energy 1990

final report

may 1976

part a

final programmatic environmental impact statement

Your Seattle City Light

Gordon Vickery, Superintendent

May 21, 1976

Honorable Wes Uhlman
Mayor of Seattle

Dear Mayor Uhlman:

I am pleased to transmit to you the Final Report on the Energy 1990 Study.

As you know, the study took 12 months to complete, cost Seattle's ratepayers approximately $600,000 and represents the combined efforts of City Light and five consulting firms with assistance from City Light's Citizens Overview Committee and the Executive Office of Policy Planning. In addition, over 12,000 Seattle citizens communicated directly with City Light, either by responding to a questionnaire or sending us letters, to make their opinions known and we have attempted to consider all of their views in developing my recommendations to you.

The Final Report comprises three volumes which supplement the seven volumes of the Initial Report released in February. The three volumes of the Final Report are:

1. Final Programmatic Environmental Impact Statement (Part A).

2. Final Programmatic Environmental Impact Statement (Part B).

3. Technical Supplement to the Consultants' Study.

The three volumes are intended to accompany and support my detailed recommendations which are being transmitted in a separate document titled, "Energy 1990 Superintendent's Recommendations."

My findings based on the study are the following:

1. Seattle's electric energy demands can be expected to grow at an annual rate of 3.24 percent between now and 1990.

2. Conservation can play a very key role in helping to reduce future demands. The potential reduction in loads for Seattle appears to be approximately 250 megawatts in the year 1990 without hav-

ing to resort to mandatory conservation measures which restrict individual freedom of choice or quality of life.

3. With respect to increasing Seattle's future energy supply, there are no generation strategies that are altogether ideal at this time and it is improbable that any single generation form can alone fully satisfy future Seattle demands. Power generation opportunities which appear most attractive at this time include nuclear, hydroelectric and combustion turbines utilizing gasified coal. Alternatives which are not available but which City Light should continue to research include solar, wind, and bioconversion.

4. With respect to the various alternative strategies for meeting Seattle's future electric energy demands, the environmental impacts within the City do not vary dramatically and are mostly beneficial. Adverse impacts would be caused outside the City and would vary depending upon the type of generation and location. Of the opportunities available, the adverse impacts from nuclear plants, hydroelectric facilities and gasified coal-fired combustion turbine facilities would be less than coal-fired thermal plants with their associated strip-mining.

5. There is a great deal of uncertainty ahead with respect to energy management. More than ever before Seattle will continually have to monitor regional and national trends and reevaluate its programs and policies accordingly in order to guarantee an adequate future supply of electric energy for the City.

Based on these findings, I have made my recommendations. I believe the recommendations to be conservative--conservative in commitment, conservative in risk to the citizens of Seattle, and conservative with respect to the use of depletable natural resources. I believe they offer a balance which is both sound and responsive to both the changes and issues of today.

The Energy 1990 Study has been the object of intense public scrutiny, debate and discussion. The open nature of the process is new to utility decision-making and I am hopeful that history will show it to result in better decisions. There is no question that the public involvement has lead to a substantially more complete and far-reaching study of the issues.

I urge you also to keep in mind that the investigations have attempted to quantify many factors and influences which have yet to be defined by future events. The loads and resources forecast is a prime example. Many of the numbers and assumptions in the report represent the subjective view of City Light and disagreements have resulted. This, of course, is a natural consequence of different attitudes toward the future.

Again, I am pleased to transmit this Final Report to you. It has been a landmark effort in open public planning and represents, I believe, a turning point in energy decision making here in Seattle.

Very sincerely,

GORDON VICKERY
Superintendent

PBH:ct

Enclosure

Energy 1990 Study

Final Report

May 1976

PART A

FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

My experience in government is that when things are non-controversial, beautifully coordinated and all the rest, it must be that there is not much going on.

John F. Kennedy

FOREWORD

This volume (Final Programmatic Environmental Impact Statement, Part A) is one of three volumes comprising the Final Report of the Energy 1990 Study and complements the seven-volume Initial Report published in February, 1976. Purpose of the study was to determine Seattle's electric energy needs and resources for the period 1976-1990 and to evaluate the various options for meeting those energy needs. Contents of the Initial Report are shown on the following page.

The other two volumes of the Final Report are:

1. Final Programmatic Environmental Impact Statement, Part B.
2. Technical Supplement to the Consultants' Study.

CONTENTS OF THE INITIAL REPORT

OF THE

ENERGY 1990 STUDY

Copies of this three-volume Final Report of the Energy 1990 Study are available for review at all Seattle Public Libraries, Seattle area university and college libraries, the Municipal Reference Library and the Seattle City Light Library. The complete distribution list can be found at the beginning of Part A of the Final Environmental Impact Statement. Additional copies of the three-volume Final Report are available for $45.00 from the Office of Environmental Affairs, Seattle City Light, 1015 Third Avenue, Seattle, WA 98104 (telephone 206--625-3151). Checks should be made payable to the Seattle City Treasurer.

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INTRODUCTION

Action Sponsor and Proposal: Sponsored by the City of Seattle, Department of Lighting, the proposed action is adoption of legislation of a City Electric Energy Program for 1976-1990. The proposed program consists of a combination of conservation and new generation, including 5 percent participation in WNP-4 and -5 nuclear plants.

Lead Agency: The lead agency for this proposal is the City of Seattle, Department of Lighting, and the responsible official is the Superintendent of Lighting Gordon Vickery. Questions and comments concerning this proposal may be sent to Mr. Peter B. Henault, Office of Environmental Affairs, the City of Seattle, Department of Lighting, City Light Building, 1015 Third Avenue, Seattle, WA 98104.

Principal Contributors: The people who contributed to the preparation of this final EIS are listed in Table 1.

Required Licenses: No licenses are required for the proposed action; however, certain projects studied in the proposed action do require the following type of permits:

a. State of Washington Site Certification pursuant to RCW 80.50
b. State of Washington Department of Natural Resources, Land Leases
c. US Nuclear Regulatory Commission, Construction Permits and Operating Licenses
d. US Army Corps of Engineers Permit for Construction in Navigable Waters (Section 10 Permit)
e. NPDES Permit from the Thermal Power Plant Site Evaluation Council of the State of Washington
f. US Federal Power Commission, Licenses

In addition, certain types of generation facilities, such as coal-fired power plants, might require a variety of authorizations from federal and state authorities.

Location of Background Data: All data used to prepare this document is available in the following reports of the Energy 1990 Study:

Initial City Light Report
Volume I — Summary and Overview

Consultants' Report
Volume II — Technology and Demand Control Options
Volume III — Loads and Resources Forecast
Volume IV — Existing Environmental Conditions
Volume V — Alternative Energy Policies
Volume VI — Calculations, Assumptions and Sources of Information

Initial City Light Report
Volume VII — Draft Programmatic Impact Statement

Cost: Copies of the Energy 1990 Final Report, including the Final EIS are available at all Seattle Public Libraries and at additional locations as specified in the distribution list. Also, limited numbers of the Final Report are available for purchase from Seattle City Light's Office of Environmental Affairs for $45.00 per set.

Date of Issue: The date of issue of this Final EIS is May 21, 1976.

Publication Milestones:

Request for Proposal	July 7, 1975
First Interim Report	Oct. 22, 1975
Preliminary (Discussion) Draft	

Volume I	Executive Summary	Jan. 16, 1976
Volume IIA	Technology and Demand Control Options	Jan. 19, 1976
Volume IIB	Technology and Demand Control Options	Jan. 19, 1976
Volume III	Loads and Resources Forecast	Dec. 10, 1975
Volume IV	Alternative Energy Policies	Dec. 30, 1975

Energy 1990 Initial Report — Feb. 27, 1976

Volume I	Summary and Overview
Volume II	Technology and Demand Control Options*
Volume III	Loads and Resources Forecast*
Volume IV	Existing Environmental Conditions*
Volume V	Alternative Energy Policies*
Volume VI	Calculations, Assumptions, Sources of Information*
Volume VII	Draft Environmental Impact Statement

* Consultants' Reports

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DISTRIBUTION LIST

This Final programmatic EIS has been sent to the following organizations, agencies, and individuals.

Citizens Overview Committee for the Energy 1990 Study (27)

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Seattle Community College
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-North Campus
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King County Executive
Seattle, Washington

President, King County Council
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Governor, State of Washington
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State Agencies

Thermal Power Plant Site Evaluation Council
State of Washington
Olympia, Washington

Washington State House and Senate Transportation
& Utilities Committee
Olympia, Washington

Washington State Energy Office
Olympia, Washington

Washington State Department of Ecology
Olympia, Washington

California State Energy Commission
Sacramento, California

Oregon State Department of Energy
Salem, Oregon

Federal Agencies

U. S. Environmental Protection Agency
Region X Office
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Federal Energy Administration
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Federal Agencies (Cont.)

Bonneville Power Administration
Portland, Oregon

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Office of Management and Budget

Office of Policy Planning

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Washington Public Utilities

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Kennewick, Washington

Chelan County PUD, No. 1
Wenatchee, Washington

Clallam County PUD, No. 1
Port Angeles, Washington

Clark County PUD, No. 1
Vancouver, Washington

Cowlitz County PUD, No. 1
Longview, Washington

Douglass County PUD, No. 1
East Wenatchee, Washington

Franklin County PUD, No. 1
Pasco, Washington

Grant County PUD, No. 1
Ephrata, Washington

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Aberdeen, Washington

Klickitat County PUD, No. 1
Goldendale, Washington

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Chehalis, Washington

Mason County PUD, NO. 3
Shelton, Washington

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Okanogan, Washington

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Skamania County PUD, No. 1
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Everett, Washington

Wahkiakum County PUD, No. 1
Cathlamet, Washington

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City of Port Angeles
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Electrical Department
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City of Tacoma
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British Columbia Hydro and Power Authority
Vancouver, B. C., Canada

Municipality of Metropolitan Seattle
Seattle, Washington

Other Organizations and Individuals (Cont.)

Puget Sound Council of Governments
Seattle, Washington

Port of Seattle
Seattle, Washington

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Portland, Oregon

American Public Power Association
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Northwest Public Power Association
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Washington Public Power Supply System
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Seattle, Washington

Oil Heat Institute
Seattle, Washington

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Sierra Club
Northwest Representative
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Media

Seattle Times
Seattle, Washington

Seattle Post-Intelligencer
Seattle, Washington

Daily Journal of Commerce
Seattle, Washington

Argus
Seattle, Washington

Seattle Sun
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The Weekly
Seattle, Washington

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KCTS/KUOW
Seattle, Washington

KTVW
Tacoma, Washington

KCPS
Tacoma, Washington

KZAM
Bellevue, Washington

SUMMARY

The Proposal

The proposal is adoption by legislation of a City Electric Energy Program for 1976-1990. The proposed program is based on an assumed load growth of 3.24 percent annually and consists of two primary elements, The first is a generation strategy calling for:

- Immediate acquisition by ordinance of an approximate 5% participation share in WNP # 4 and 5 Nuclear Plants.
- Initial studies for two 49 MW coal gasification units in Western Washington.
- Initial studies and, when appropriate, construction of Copper Creek Dam.
- Initial study of Ben Franklin Dam and additional generation units at Boundary Dam.

The Boundary and Ben Franklin projects would provide additional generation capacity after 1990.

This generation strategy assumes continued utilization of Seattle's present generating facilities, and purchased power arrangements; and development of the High Ross Project. If such development does not take place, other generation components will have to be modified or accelerated.

The second element is a conservation program calling for:

- Establishing a City Office of Energy Conservation.
- Requiring space heating conversions to be supported by heat loss calculations.
- Requiring energy use and cost records be provided to prospective buyers.
- Requiring all homes to be fully insulated by 1990.
- Requiring all new construction to meet thermal efficiency standards.
- Establishing an Office of Electric Energy Management within the Lighting Department.
- Develop a comprehensive program within the Lighting Department to promote conservation in all sectors.
- Promote use of heat pumps.

- Provide revenue to conduct consumption-oriented research.

Environmental Impacts of the Proposed Action

The proposed action will have both positive and negative environmental impacts. Due to the extended time frame and the myriad of changes possible in social, environmental and technological conditions pertinent to the study during the 15-year planning period, many of these impacts are uncertain in both nature and magnitude.

In addition, many of the proposals' impacts are secondary; that is, they occur outside of the City Light service area.

Human Environment

In terms of the human environment, the proposed action's major impacts within the City Light service area will result from the conservation program. Mandatory conservation measures will have both positive and negative economic impacts and will infringe on present privileges regarding energy inefficient structures. On the positive side, the proposed conservation measures will increase the efficiency of energy use within the City Light service area, thereby reducing the need for additional generating capacity. These conservation measures will also have long-term positive impacts on energy costs to individuals and businesses in Seattle.

The proposed generation strategy will provide ample energy for continued expansion of industry and commerce within the service area and will allow more conversions to electric energy than would otherwise be possible, although traffic congestion and noise levels in Seattle will increase. Persons living near the sites where generation facilities will be built may be adversely impacted by these projects, however.

Natural Enviroment

The proposed action should have no significant impact on Seattle's natural environment. The proposed hydro and nuclear projects will be located in areas remote from Seattle, and, although one or both of the coal units could possibly be located in or near the city, this is very unlikely. If a coal unit were constructed near Seattle, it could adversely impact the area's air quality if emissions were not adequately controlled.

The proposed generation facilities will significantly impact the natural environment near the generating sites. Negative impacts associated with these projects include:

- flooding of large land areas;
- increasing human pressure on natural areas;
- destruction of terrestrial wildlife habitat;
- destruction of the last natural Columbia River salmon spawning area

- variable degrees of air pollution, depending upon degree of emission controls installed; and
- impacts associated with mining of coal and uranium.

Positive impact to the natural environment resulting from the proposed generating facilities include:

- better regulation of Skagit River which should improve water quality in the river;
- *increased primary productivity in Ross Lake;*
- *possible decreased fish fry mortality from stranding.*

Possible Mitigating Measures

Some of the impacts of High Ross on wildlife may be mitigated by trapping out animals which would be displaced, if other suitable habitat can be found. The increased pressure on Ross Lake's pristine character can be mitigated by limiting power boat access to the lake. Coal plant impacts on air quality can be mitigated by installation of effective emission control devices and some mining impacts can be mitigated through use of careful mining techniques and proper reclamation procedures. In addition, adverse impacts at some generating sites may be mitigated to a degree by increased recreational or economic opportunities.

Unavoidable Adverse Impacts

Unavoidable adverse impacts of the proposed action include:

- noxious emissions from coal plants;
- low level radioactivity from nuclear plants;
- elimination of the last natural salmon spawning area on the Columbia River;
- destruction of existing coal and uranium resources;
- further flooding of the Skagit Valley;
- higher electrical rates;
- higher noise levels.

Alternatives to the Proposed Action

Scenario 1 - Historical:

This scenario would result in a load growth of 3.5% as projected by City Light. The generation requirements of this scenario would be met by the construction of High Ross and Copper Creek Dams as well as 10% participation in Washington Public Power Supply System Nuclear Projects (WNP) # 4 and 5. This scenario assumes no significant growth in population within the service area, although modest growth in employment and economic activity (especially non-industrial) is projected. Much of the demand expansion would be due to conversion to electricity from natural gas and oil.

Scenario 2 - Modified Historical:

This scenario is identical to Scenario 1 with regard to a 3.5% per year growth in electric energy demand. Scenario 2 differs in the supply option which will satisfy projected demands. Specifically, High Ross and Copper Creek Dams would be constructed but the nuclear plants would be foregone in favor of coal-fired thermal plants.

Scenario 3 - All-Electric:

This scenario would result in an annual electric energy demand growth rate of 7% per year through a maximum number of conversions to electricity. The demand expansion implied by this scenario would require City Light to participate in six additional thermal plants beyond the two plants called for in Scenario 1. This scenario assumes City Light would embark on an effective marketing program aimed at encouraging conversions from alternative fuels to electricity. This would include conversion in residential space heating, maximum conversions in the non-industrial sector and maximum conversions coupled with maximum growth in the industrial sector.

For purposes of analyzing environmental impacts, the six additional thermal plants are assumed to be WNP # 6, Skagit # 1 and 2, and three coal-fired plants.

Scenario 4 - Demand Management:

This scenario would result in City Light acting to reduce the annual growth in demand for electricity from 3.5% in 1976 to 1.5% per year by 1990. The smaller increase in annual growth would require the addition of one new generating facility, either High Ross Dam, WNP # 4 and 5, or a coal plant. The necessary load reduction programs would involve promotion of additional conservation techniques and would require no major long-term capital commitments.

Scenario 5 - Steady State:

In this scenario City Light would build no additional generation between 1976 and 1990, although existing commitments would be honored. All generated energy presently being sold outside the service area would be redirected for use within the service area. The growth rate would be reduced from its present assumed rate of 3.5% per year to zero percent per year by 1990 through the enactment of aggressive conservation programs and rates designed to reduce total consumption of electric energy.

Scenario 6 - Delay Action:

In this scenario, City Light would delay all decisions related to funding additional electric generation facilities for two years. In the interim, City Light would study its options and gain data on future energy growth patterns and costs for future policy options. Under this scenario, taking into account construction lead times for various central station options, a nuclear power plant could come on line no earlier than 1986 or 1987, a coal plant would be delayed until 1984 or 1985 and High Ross Dam would be delayed until 1980 or 1981. If power available to City Light from the Bonneville Power Administration were to decrease, significant shortages could develop in the service area.

Scenario 7 - No Action:

In this scenario, City Light would institute a no-action decision. No new generation facilities would be built and no conservation programs initiated. All final decisions or actions which had been established prior to this Seattle City Light decision would be honored. Contracts with Canada, BPA, WPPSS, etc., would be honored until the contract termination date and would not be renewed or renegotiated. In addition, City Light would not implement any additional action prior to 1990. Electrical shortages, with attendant economic and social costs, would be expected no later than 1986.

DESCRIPTION OF PROPOSED ACTION

The proposed action is an adoption by legislation of a City Electric Energy Program for 1976-1990, which includes immediate acquisition by Ordinance of an approximate 5 percent share in WPPSS Nuclear Projects 4 and 5.

The Draft EIS identified the following seven subjects to be detailed in this legislation:

- the means of supplying Seattle's electric energy demands
- energy conservation programs
- load forecasting methodologies
- financing agreements
- associated Bonneville Power agreements
- rate policies
- priorities for electric energy allocation during emergencies

The means of supplying Seattle's electric energy demands, financing agreements and energy conservation programs essentially comprise the final proposed action, although the other five elements identified in the draft will be discussed briefly.

Proposed method of supplying Seattle's electric energy demands: After considering alternatives presented in the Consultant's Energy 1990 Report, the Citizens' Overview Committee recommendations, public hearing testimony, and comments on the Energy 1990 study and Draft EIS, the Lighting Department proposes to meet Seattle's future electric energy demands through a combination of new generation and aggressive conservation.

The Lighting Department proposes to plan for a 3.24 percent average annual growth in Seattle's electric energy demand through 1990. Based on this growth in demand, the Department proposes as its immediate generation strategy an approximate 5 percent participation share in Nuclear Projects WNP-4 and WNP-5. These plants are scheduled to come on line in 1982 and 1984 respectively and will provide Seattle with a total of 83 MW of average energy. The proposed 5 percent participation represents a reduction from a 10 percent option agreement. Based on this reduced participation in WNP 4 and 5, the Department proposes the following:

1. Immediate initiation of environmental and other studies leading to licensing of the Copper Creek Hydro Electric Project, which could come on line in 1987-88 and would provide 63 MW of average energy. If Copper Creek is determined necessary, construction of the pro-

ject would begin in 1980. A decision to pursue Copper Creek will be made in 1979 and will be based on projected need.

2. Immediate initiation of environmental and other studies, and acquisition of necessary coal reserves for design and construction of two 70 MW capacity/49 MW energy coal units to be located somewhere in Western Washington. The first of these would come on line in 1989-90 and the second in 1990-91. Construction and mining operations for these two coal units would begin in 1982 and 1985 respectively. Decisions to proceed with these plants will be based on projected need. If a decision to construct these plants is made, the coal source chosen would largely determine their location. Local coal reserves being considered include those near Roslyn and Black Diamond. Montana, Wyoming and Alaska are also possible coal sources which will be investigated.

3. Initiate environmental and other studies of the Ben Franklin Project on the Columbia River and additional generation units of the City's Boundary Project on the Pend Oreille River. Seattle's probable one-half share of Ben Franklin would provide 214 MW of average energy and 469 MW of peaking capability, while the addition of one generator at Boundary would provide 163 MW of peaking capability only. Both projects would come on line after 1990 and the ultimate decision to proceed would be made in the mid to late 1980's.

The proposal assumes continued utilization of Seattle's existing generation facilities and purchased power arrangements and also assumes development of the High Ross project which will provide 46 MW of average energy. If this development does not take place and the energy to be provided by High Ross is not realized, other generation components will have to be modified or accelerated.

Financing agreements: Proposed financing agreements primarily are those related to the City's participation in WNP-4 and WNP-5 and are summarized in the Technical Supplement.

Conservation programs: The Lighting Department proposes the following conservation strategy as part of Seattle's overall electric energy program:

1. Establishment of a City Office of Energy Conservation, to be located outside the Lighting Department. This will formalize the City's responsibility for municipal coordination of conservation of all forms of energy.

2. Require all space heating conversions to be supported by heat loss calculations which are approved by those converted and filed with the City Office of Energy Conservation. If energy savings on conversions to electric space heating do not meet realistic goals within two years, consideration should be given to mandatory requirement for ceiling, wall and floor insulation in connection with space heating conversions.

3. A complete record of the previous 12-months' energy use and cost for a given housing unit will be provided by the owner or lessor to a prospective buyer or lessee. Records of the sale or lease shall be required to show proof that the buyer or lessee considered the energy use information.

4. Require all homes to be fully insulated by 1990. To accomplish this, installation of insulation will be required when the house is sold.

5. Assist the public in understanding the efficiency labels on appliances mandated by the new Energy Policy and Conservation Act.

6. Require all new construction to meet the newly-adopted ASHRAE 90-75 Thermal Efficiency Standards, or equivalent.

7. Emphasize conservation within the Lighting Department by establishing an Office of Electric Energy Management to coordinate present conservation efforts and establish new directions in accordance with City policy.

8. Reorganize and reorient City Light personnel presently in employ to emphasize and promote conservation and use advertising and education techniques.

   Develop a comprehensive information, education and advertising program regarding electric energy conservation. Involve schools, media and community groups.

9. Promote conservation in the commercial sector by education of, and consultation with, building owners and operators. In the government section, make efforts to install control equipment and to demonstrate supplemental energy systems such as using solar collectors to heat water whenever these can be shown to be cost effective. Highly publicize the results as examples of what can be done.

10. City Light will promote heat pumps to each customer who wishes to convert to electric heating. The projected conversion rate for electric heating is approximately 2000 units a year. A program will be established to convert at least 200 of these customers each year to heat pumps.

    Approve a policy encouraging consumption-oriented research. At least 0.25 percent of City Light total operating revenues should be provided for initiating and supporting consumption-oriented research. City Light would request approval of allocating this revenue, which would be in addition to other research. City Light's own research money would be used, where possible, as "seed money" to be augmented by national (ERDA, FEA, NSF, HUD, EPRI) and state grants.

Load forecasting methodologies: The Lighting Department proposes to refine the Econometric Model developed by Math Sciences Northwest and utilize it in future load forecasting.

Bonneville Power agreements: Under Contract No. 14-03-19300 BPA has agreed to supply all the City's electric load requirements in excess of those provided by the City's own resources. This contract was executed in 1973 and will terminate in 1993. However, the Administrator has recently indicated that in June of this year he may determine that as of 1983 the government supply shall be insufficient to provide power to Seattle in the future on such a "requirements" basis.

If such determination of insufficiency is made or transmitted, the allocation of existing Bonneville power will either be made on the basis of the "net billing" allocation formula set forth in the existing Power Sales Agreement or in the allocation method based on current load forecasts and incorporated into an Amendatory Agreement authorized by Seattle Ordinance 105280.

The Administrator has also indicated that existing industrial power sales contracts will probably not be renewed as they expire during the middle and later 1980's. The disposition of these amounts of power, other than the general "preference" accorded to public agencies under the provisions of the Bonneville Power Act, is at this time uncertain. For example, Governor Straub has indicated that the State of Oregon is exploring the establishment of a state agency which might qualify as a "preference customer" under the terms of the Bonneville Power Act.

In addition to the basic Power Sales Contract, Seattle by agreement with BPA transmits or "wheels" power that it purchases from the Priest Rapids and Box Canyon hydroelectric facilities over the main federal transmission system grid. In addition, Seattle wheels power over the federal grid from its own Boundary Project.

Although not incorporated into any long-term sales or transmission agreement, Seattle together with other Northwest generating agencies also uses the Bonneville grid for the transmission, exchange and sale of "secondary" power, that is, power produced in years of better than critical water conditions.

By letter dated April 16, 1976, the Bonneville Power Administrator indicated that, subject to compliance with the provisions of the National Environmental Policy Act, and to appropriate specific limitations PBA "expects to be able to offer" certain project-related services pertaining to Projects Nos. 4 and 5, including transmission, forced outage, scheduling and load factoring.

Rate policies: The Lighting Department proposes to continue basing customer rates on "cost to serve". Specific rate policies will be adopted by separate legislation to be adopted following the current rate policy study being conducted by the Department with the aid of a citizens committee.

Priorities for allocating electric energy during emergencies: During "energy emergencies," energy allocation would be established pursuant to CH108, Laws of 1975-1976, and extraordinary session.

The Lighting Department has developed two load shedding or reduction plans for periods of insufficient generation and/or insufficient transmission capability. The first plan was designed to make drastic short-term load curtailments automatically during periods of catastrophic loss of generation or transmission facilities, and the second was a load reduction plan for longer term periods when there is a forecasted shortage of energy or peaking capability due to adverse water conditions, as was the case in the fall of 1973.

Anticipated Future Environmental Analysis

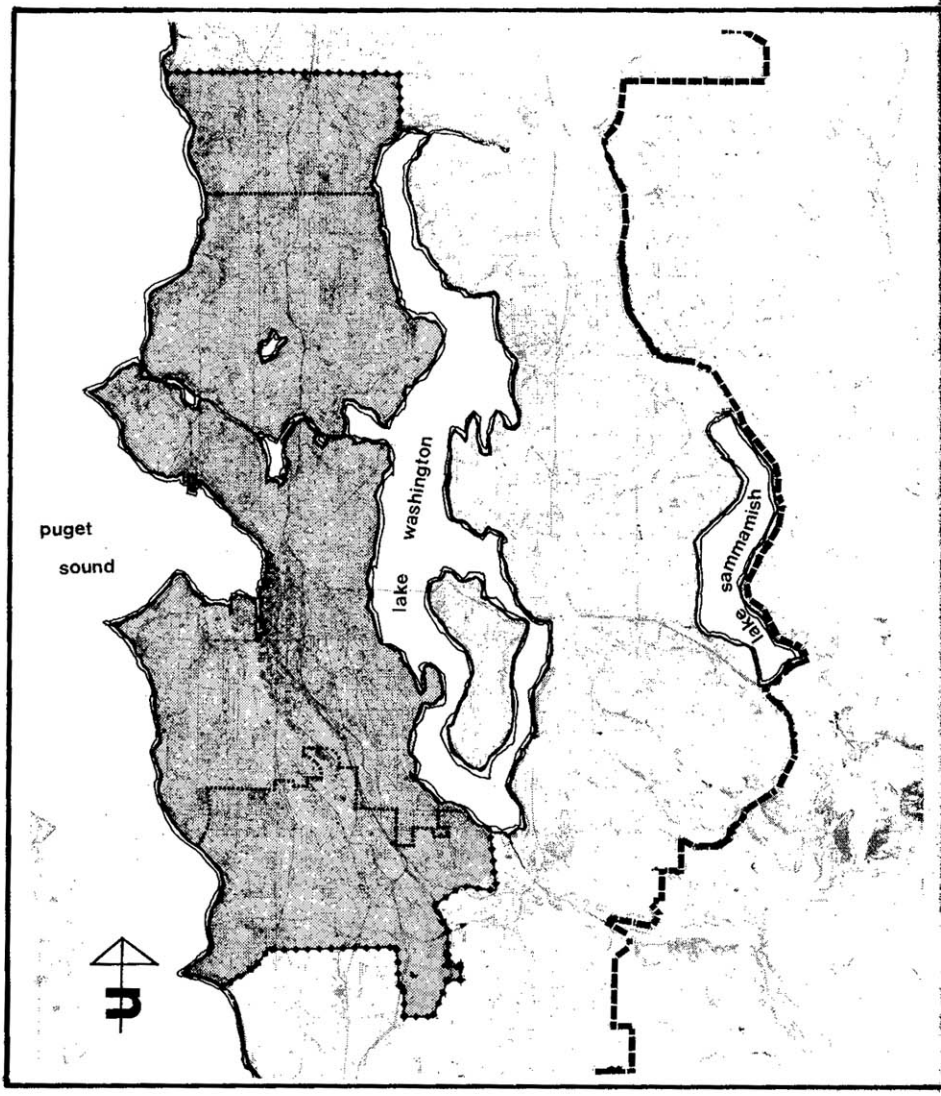
Since this is a programmatic EIS which directly involves no site specific projects, the various physical projects included in the proposed program will require environmental analysis in compliance with SEPA when specific project proposals are made.

Relationship to Existing Comprehensive Land Use Plans and Zoning Regulations

Current comprehensive land use plans and zoing regulations affecting the City Light service area do not directly relate to many of the issues presented here and therefore are not specifically discussed with regard to the environmental impacts of the seven scenarios. However, land use plans and zoning regulations may require modification for improving electric energy use efficiencies, if proposed energy conservation policies are adopted.

Area Affected by the Proposal

The Seattle City Light service area will be primarily affected by the proposal, while there will be secondary effects outside the service area. The service area, shown in Figure I, encompasses 131.31 square miles and Seattle City Light provides power for 695,000 persons according to 1972 data. The service area is located between Puget Sound and Lake Washington and extends from the King County line in the north to Renton and South 160th Street to the south. It includes the cities of Seattle, Lake Forest Park, Burien and Tukwila.



S.C.L. service area

service area

partial study area limit

city limit

fig.1

SEATTLE CITY LIGHT SERVICE AREA

Physical Environment

Earth: The geologic features of Seattle City Light's service area were formed during the retreat of the Vashon Glacier 12,000 to 14,000 years ago. This glacial retreat left a deep mantle of gravel, sand and clay in the river basins. As the ice retreated, numerous lakes and ponds developed, including Lake Washington. The glacial period smoothed the basin's relief, dammed streams and produced the rolling relief of local lakes, hills, and depressions. During the period since the glacier's retreat, small streams have incised deep valleys into the hills and larger streams have added considerable sentiments to the valleys.

The area's unique physical features are Puget Sound, Lake Washington, and the view afforded by the Olympic and Cascade Mountain ranges.

Air: Air quality in the Seattle City Light service area is a present concern. Ambient air quality standards of the Puget Sound Air Pollution Control Agency were violated in the area during 1974 for carbon monoxide, ozone, sulfur dioxide and suspended particulate concentrations. However, a review of trends for suspended particulates in the area indicates a general improvement over the last few years. During 1974 the air quality index in Seattle approached but did not reach alert stage conditions during at least one day in January, October and December. Although disagreeable odors occur locally in the Seattle City Light service area, odor is not a general concern. Intermittent disagreeable odors do occur on a larger scale in portions of the south end of the service area due to wind blown emissions from the ASARCO Smelter and other industries in Tacoma. Seattle's climate contributes to the existing air quality problems in that light winds during portions of the year tend to cause stagnant air conditions.

The most apparent evidence of current air pollution in Seattle is the brown haze that often forms over and around the City during periods of continuous clear skies and light winds, detracting from and sometimes obscuring the panoramic views of the Olympic and Cascade Mountain ranges for which Seattle is famous.

Water: Public water supplies are the only water-related subject relevant to this study within the Seattle City Light service area. Currently the vast majority of the service area's water supplies come from the reservoirs on the Upper Green Cedar and Tolt Rivers with the remainder being provided by local ground water supplies.

The Seattle Water System depends upon the Cedar River and the Tolt River as sources of supply. The Cedar River is the larger of the two with a drainage area of 143 square miles between the Dam at Landsburg, where the supply pipeline begins, to the river source near the crest of the Cascade Mountains. The main storage for the Cedar River supply is Chester Morse Lake which has a usable capacity of 40,000 acre feet. The capacity of the Cedar River supply is 220 mgd.

The Tolt River is a tributary of the Snoqualmie River, has an area of about 19 square miles, and contains a reservoir of approximately 60,000 acre feet. The capacity of the Tolt River system is 90 mgd.

Noise: A wide range of noise levels exist within the Seattle City Light service area. Generally residential areas and park areas away from traffic noise are the quietest places. Vehicular traffic noise affects nearly all of Seattle, especially during rush hour. The degree of traffic noise impact is determined by the distance and topography between the receptor and the source. Along bus routes, buses are a principal contributor to peak noise levels. In the industrial and harbor areas of Seattle noise associated with roadway vehicles is not always the dominant noise source but contributes to existing noise levels. In commercial areas traffic is generally the dominant noise source.

Railroad noise is much less extensive than roadway traffic noise. Areas experiencing the majority of railroad noise include residential areas bordering Puget Sound north of the H. M. Chittenden Locks, Richmond Beach, Carkeek and Golden Gardens Parks, the east side of Magnolia Hill and west side of Queen Anne Hill, the harbor area, and the industrial area in the Duwamish River Valley.

Aircraft is another major transportation noise source that produces a severe impact within the Seattle City Light service area. Boeing Field and Sea-Tac are the two major sources of aircraft noise.

Seattle City Light vehicles also contribute to existing noise levels within the service area. Some Seattle City Light maintenance vehicles generate significant noise both in transit and while performing maintenance functions. The amount of traffic noise from Seattle City Light vehicles is directly proportional to the ratio of City vehicles comprising a street or highway's total traffic volume.

Some receptors along most connectors, arterials, and highways are experienc ing noise levels about Federal Highway Administration (FHWA) noise standard and EPA Guidelines. The proposed City/County Noise Ordinance and the Department of Ecology noise standards (See Volume VI, Energy 1990, Consultants' Report, Appendix 2) do not regulate transportation noise from an individual vehicle.

Railroad noise is infrequent enough that in most areas it is not above EPA Guidelines to prevent hearing loss, but does result in excessive noise peaks during sleeping hours.

Jet airlines do cause noise level peaks which severely conflict with sleep ing. Noise levels from airport operations severely impact residential receptors in the airport's vicinity.

Some industrial sources exceed Department of Ecology noise standards and the proposed City/County Noise Ordinance. The City Light substation noise level complies with both regulations.

Elements of the Human Environment

Population: The Seattle City Light service area maintains the highest population density of any area in the Pacific Northwest. Densities within the service area range from 38,000 people per square mile in the multi-family areas to the east and north of the central business district to 400 people per square mile in the industrial concentrations to the south of the central business district. The service area's average density is about 6,000 people per square mile. In 1974 the service area's total population was 691,500. During the last fifteen years people in the area have tended to relocate towards the periphery of the urban centers. As a result, Seattle has had a slightly declining population within a region of population growth.

Housing: Housing in the Seattle area consists primarily of one and two story single family wood frame structures. Nearly half of this housing was built before 1940 and generally there is a considerable diversity in the quality of housing construction.

Of the 226,081 housing units in Seattle, a 1975 report prepared by the City of Seattle Office of Policy Planning (Housing Assistance Plan) indicated 33,800 units needed major repairs and an additional 86,000 needed prompt maintenance work to prevent deterioration. The worst housing is located in the downtown area, followed by the central area, Rainier Valley, and the lower Duwamish section. In addition, small clusters of poor housing occur throughout the Seattle area and deteriorating houses are often found within a block of very new, very modern homes.

With demolitions during the 1970's averaging 1,048 per year, and housing construction slowing dramatically, new construction has produced a net gain of only eight-tenths of one percent of total housing units available per year during the last five years. At this rate, it would take 125 years to replace Seattle's housing stock. To provide adequate housing for Seattle's population, either deterioration must be slowed or rate of constructions speeded up. In addition, most construction has been outside the City limits. For example, during the first three quarters of 1974 nearly 90 percent of housing construction took place in the suburbs.

Recently multi-family units have gained considerably in popularity. Apartment construction during 1970 and 1971 totaled 3,461 units but has since slowed down to a current average of 572 units per year.

During the employment and population boom of the 1960's, Seattle area housing market also boomed. During the recent recession, however, housing starts dropped dramatically and vacancy rates increased, slowing rental and purchase prices. The housing market began a recovery in 1973 and vacancy rates are now low. Construction is currently increasing although less speculative housing construction is taking place, and generally the market is more cautious.

Transportation: The transportation network of the City Light service area consists of roadway systems, waterways, railroads and air routes. The main circulation network for the Seattle City Light service area is an

interdependent highway-and-street system based upon three levels of service: freeways, expressways, and arterials.

The freeway system consists of Interstate 5, Interstate 405, and State Route 520. Interstate 5 is the main north-south facility connecting Seattle with Vancouver, British Columbia, to the north and Oregon and California to the south. It had an average daily traffic (ADT) of approximately 170,000 automobiles through the Seattle's downtown in 1975. Interstate 405 provides a bypass around the City of Seattle and also connects growing suburban areas of the East Side. The taffic counts indicate that the ADT was approximately 55,000 on I-405 through the Bellevue area in 1974. State Route 520 crossing the Evergreen Point Floating Bridge connecting the City of Seattle and East Side area is a primary commuting route between employment center and residential development. It had an ADT of approximately 47,000 in 1974.

The expressway system consists of Interstate 90, Alaskan Way Viaduct, and South Spokane Street. Interstate 90 partially completed within the City is the western terminus of the major east-west highway connecting the region with the eastern United States. Traffic counts indicated that the 1974 ADT on Interstate 90 was approximately 56,000 vehicles per day. Currently one reversible lane is being operated on a segment of Interstate 90 between 23rd Avenue South to the west and Lake Washington Boulevard on the east during peak hour periods to improve traffic flow.

Alaskan Way Viaduct is a main roadway running along the City's waterfront. It provides the direct access to and from the City's central business district from the southwestern and northwestern portions of Seattle. In 1975 the ADT was approximately 51,000 vehicles per day on the viaduct in the vicinity of the City's Central Business District.

South Spokane Street is the only main roadway connecting the West Seattle area and the employment center in the City. In 1974 a great travel intensity was observed with an ADT of approximately 65,000 vehicles per day at the Spokane Street Bridge over the Duwamish Waterway. The construction of a new bridge over the Duwamish Waterway was scheduled to begin in 1974 by the City of Seattle. Because of financial difficulties the City has not implemented the construction of the bridge.

The arterial system primarily consists of Pacific Highway South, Aurora Avenue North, 15th Avenue Northwest, First Avenue South, Montlake Boulevard Lake City Way, Rainier Avenue South, South Dearborn Street, Northwest 45th Street, Northeast 50th Street and Northeast Northgate Way. The primary arterial streets offer additional access to industrial areas, regional shopping centers and the Sea-Tac Airport. The primary arterial system feeds the other roadway system and interconnects the communities.

The majority of the roadways mentioned above show signs of severe traffic congestions during the rush hours, specifically at the locations immediate adjacent to the major employment centers.

All public transportation in the King County area is coordinated through the Municipality of Metropolitan Seattle. They are all operated on the roadway system mentioned previously. In 1971, Metro and the Puget Sound Council of Governments (PSCG) developed a comprehensive county-wide surface transit plan aimed at preserving and improving transportation systems through 1980.

The plan is a "multi-center" concept of metropolitan transit. It includes Park and Ride facilities to intercept autos and the Metro Flyer express service on freeways to provide fast and frequent bus service between major destination points in the region.

Public transportation has been improving steadily under Metro's leadership reversing the historical trend of decreased service and patronage. Revenues are increasing even though fares are lower today than they were five years ago. (Metro's twenty-cent bus fare is the second lowest city bus fare in the country.) In addition, in 1973 a Magic Carpet Zone was introduced enabling passengers to ride free of charge within the downtown area.

Energy: Seattle City Light supplies 260,000 customers with approximately 850 MW of average energy per year. Approximately eighty percent of this energy is generated by City Light hydroelectric facilities with the balance purchased from BPA and from Grant County and Pend Oreille PUD's. Two fuel oil-fired steam generation plants located in Seattle at Lake Union and Georgetown also contribute very small amounts of energy to the system.

Due to the generally wet climate of Western Washington, the generating capacity of City Light's hydroelectric facilities is highly reliable. In addition, most turbines in the City Light system are relatively new or recently rebuilt. Purchased energy, however, is less reliable due to other demands upon the agencies involved when seen in the long-term perspective.

Virtually 100% of Seattle's electric energy ultimately comes from hydroelectric sources. There is local use of oil and natural gas as heating fuel, which is supplied by privately-owned sources. There is a trend toward conversion to electric space heating. Since January, 1974, approximately 2700 conversions have taken place. The projected rate of conversions to electric heating is 2100 per year between now and 1990. Seattle industries and commercial firms are also converting to electricity and total conversions by 1985 are expected to amount to approximately 94 MW with an addition potential of 40.4 MW.