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June 28, 1982

50-522

U.S. Nuclear Regulatory Commission
Attention: Director, Division of Licensing
Washington DC 20555

To Those Concerned:

This letter transmits the comments of the Natural Resources Defense Council, the National Wildlife Federation, the Oregon Environmental Council, and the Sierra Club on the Nuclear Regulatory Commission's Draft Environmental Statement Related to the Construction of Skagit/Hanford Nuclear Project, Units 1 and 2.

We look forward to receiving your response to our comments. Questions regarding the enclosures should be directed to me.

Sincerely,

Ralph Cavanagh

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COMMENTS OF THE NATURAL RESOURCES DEFENSE COUNCIL,
THE NATIONAL WILDLIFE FEDERATION,
THE OREGON ENVIRONMENTAL COUNCIL, AND THE SIERRA CLUB ON
THE NUCLEAR REGULATORY COMMISSION'S
DRAFT ENVIRONMENTAL STATEMENT RELATED TO THE
CONSTRUCTION OF THE SKAGIT/HANFORD NUCLEAR PROJECT,
UNITS 1 AND 2

Submitted: June 28, 1982

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TABLE OF CONTENTS

These comments respond to the Nuclear Regulatory Commission's "Draft Environmental Statement Related to the Construction of Skagit/Hanford Nuclear Project, Units 1 and 2" (see 47 Fed. Reg. 20234 (1982)). This statement is submitted on behalf of the Natural Resources Defense Council (NRDC), the National Wildlife Federation (NWF), the Oregon Environmental Council (OEC), and the Sierra Club. Each is a nonprofit membership organization with an extensive history of involvement in Northwest energy issues. NRDC, NWF, OEC, and the Sierra Club have Northwest memberships of approximately 1500, 40,000, 1900, and 16,000, respectively. The national membership of the four organizations exceeds 2.3 million. NRDC, NWF, and OEC are intervenors in the Skagit/Hanford licensing proceeding now pending before the Nuclear Regulatory Commission (NRC).*

I. OVERVIEW AND SUMMARY

The Draft Environmental Statement (DES) on the Skagit/Hanford project is grossly inadequate, in part because of factors completely beyond the authors' control. As NRDC and NWF have demonstrated elsewhere, the unnecessarily expedited schedule for DES preparation guaranteed that the document's

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*In the Matter of Puget Sound Power and Light Co. (Skagit/Hanford Nuclear Project, Units 1 and 2), Docket Nos. STN 50-522, 50-523.

need-for-power analysis would be at once premature and obsolete: premature, because all parties agreed that crucial data would not become available until April of 1983; and obsolete, because no less than three comprehensive regional forecasts had supplanted -- and discredited -- the data reported in the DES by the time the document reached the public.* On need for power issues, the DES is useless as a decision-making tool. Section II below proposes procedures for remedying this glaring and fundamental deficiency; if the NRC does not heed those recommendations and extend the environmental review process, it will be sanctioning a serious violation of the National Environmental Policy Act.

Our concerns regarding the DES are not limited to procedural matters. Section III of these comments reviews mounting evidence that the Skagit/Hanford project is not needed to meet loads in the Northwest region.** Section IV

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*See "Scheduling of Further Proceedings in Light of Need for Power Uncertainties: Joint Comments and Recommendations of the Natural Resources Defense Council and the National Wildlife Federation" (May 19, 1982: submission to Atomic Safety and Licensing Board).

**The DES does not assert that the project is needed to meet loads outside the region, a contention that has been refuted elsewhere. See Supplement to Amended Petition of the Natural Resources Defense Council, Inc. for Leave to Intervene: Contentions, at pp. 12-13 (April 20, 1982: Submission to Atomic Safety and Licensing Board). Cf. DES at p. 2-23 (acknowledging that Skagit/Hanford can displace oil and gas-fired generation "only if markets and transmission capability exists for California and Southwestern areas"; sources cited in the NRDC submission indicate that neither condition holds).

demonstrates that the DES's treatment of alternatives to Skagit/Hanford is cursory, incomplete, and seriously flawed in concept. Section V identifies significant environmental impacts that the DES ignores, involving changes in the operation of the Columbia River hydropower system that would be directly traceable to integration of the Skagit/Hanford Units into the Northwest power system. Section VI explains the inadequacy of the treatment of uranium fuel cycle impacts, in light of a recent decision by the District of Columbia Circuit Court of Appeals. Section VII questions key assumptions underlying the cost-benefit analysis presented in the DES. Three appendices to the comments document further our objections to the DES's treatment of need for power from, and alternatives to, the Skagit/Hanford facilities.

II. THE COMMENT PERIOD FOR THE DRAFT ENVIRONMENTAL STATEMENT SHOULD BE EXTENDED THROUGH AT LEAST APRIL OF 1983.

The Skagit/Hanford project sponsors (hereafter "Applicants") have proposed deferral of the NRC's evidentiary hearings on environmental issues until the spring of 1983.* The same evolving uncertainties on need-for-power issues that counsel deferral of the hearings also mandate delay in issuing

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*Letter from F. Theodore Thomsen, Attorney for Applicants, to Judge John F. Wolf, Atomic Safety and Licensing Board, and Nicholas D. Lewis, Chairman, Washington Energy Facility Site Evaluation Council (April 26, 1982) (hereinafter cited as "App. Letter").

the Final Environmental Statement (FES), and extension of the comment period on the Draft Statement. This would preserve the participatory opportunities that federal law guarantees to the public, and permit the FES to contribute to an informed decision by the Licensing Board.

A. THE STAFF HAS DISCRETION TO EXTEND THE COMMENT PERIOD.

While nothing in the National Environment Policy Act (NEPA) or the NRC regulations dictates scheduling criteria, the Commission* has the discretion to extend the usual 45-day comment period to "such longer period as the Commission may specify." 10 C.F.R. § 51.25. The "paramount consideration" in scheduling is the public interest. In re Potomac Electric Power Co. (Douglas Point Nuclear Generating Station, Units 1 and 2), ALAB-277, 1 NRC 539, 552 (1975); In re Offshore Power Systems, supra, at 208. In this instance, the public interest clearly lies in extending the comment period.

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*NRDC has previously presented its views on the scheduling of this proceeding to the Licensing Board. See "Scheduling of Further Proceedings in Light of Need for Power Uncertainties: Joint Comments and Recommendations of NRDC and the National Wildlife Federation" (May 19, 1982). Since there is some question as to whether the Board may specify when the staff is to issue an FES, see In Re Offshore Power Systems (Floating Nuclear Power Plants), ALAB-489, 8 NRC 194 (1978), aff'd on other grounds, CLI-79-9, 10 NRC 257 (1979); these comments are presented to the Commission and its staff in order to ensure that all potentially responsible decision-makers have been put on notice of the problem and given an opportunity to respond.

B. ISSUANCE OF AN FES ON THE CURRENT SCHEDULE WOULD PRECLUDE ADEQUATE COST-BENEFIT AND OTHER ANALYSES THAT ARE ESSENTIAL TO AN INFORMED DECISION.

"Need-for-power" is a short-hand expression for the "benefit" side of the cost-benefit balance that both NEPA and NRC regulations require. "A nuclear plant's principal 'benefit' is of course the electric power it generates. Hence, absent some 'need for power,' justification for building a facility is problematical." Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-355, 4 NRC 397, 405 (1976). See 10 C.F.R. § 51.23(c). Likewise, the need-for-power question bears directly on the "no action" alternative which the staff is also required to consider. See Regulations of the Council on Environmental Quality, 40 C.F.R.§ 1502.14(d); Natural Resources Defense Council v. Hughes, 437 F.Supp. 981, 990 (D.D.C. 1977)("no action" is "the most significant alternative"). Applicants take the position that "the facts are simply not in yet," on both the demand and resource side of the need-for-power question. App. Letter at 3. If "the facts are simply not in yet" from Applicants' perspective, the same is surely true for the NRC, and its staff is left incapable of performing a cost-benefit analysis or considering the alternative of "no action," as NEPA requires.*

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*Cf., e.g., the table that presents a "Benefit-Cost Summary" in the DES (p. 6-7). The table's characterization of energy and capacity benefits as "large" presupposes that need-for-power issues can be resolved favorably to Applicants on the present record.

NRC regulations also require an evaluation of uranium fuel cycle environmental data. 10 C.F.R. § 51.23(c). A recent D.C. Circuit decision held the Commission's "Table S-3 Rule" inadequate under NEPA. Natural Resources Defense Council v. Nuclear Regulatory Commission, Civil Action No. 74-1586 (D.C. Cir., April 27, 1982). The current schedule would preclude the Commission from responding to the Court's objections in a generic proceeding or in the site-specific DES for Skagit/Hanford.

The significance of leaving these inadequacies uncorrected in the FES is best understood by recalling why the Staff is required to produce an Environmental Statement. The Statement serves two purposes. First, it permits decision-makers to fully examine and consider environmental factors before acting; and second, it provides the public with information on the environmental impact of the proposed project, and encourages participation in the development of that information. See Trout Unlimited v. Morton, 509 F.2d 1276, 1283 (9th Cir. 1974). If the crucial need-for-power and waste disposal issues are not adequately addressed in the FES, these purposes will be frustrated. As the Appeal Board has stated:

> The role played by the FES as the Licensing Process moves forward is a crucial one .... [T]he FES stands as the product of the study made by that segment of the agency which has the specific function of ferreting out the baseline

> facts upon which the final environmental judgments required by NEPA must be made. That being so, it necessarily is a prime ingredient in the ultimate fashioning of the agency's NEPA determinations ...." Texas Utilities Generating Co. (Comanche Peak Steam Electric Station, Units 1 and 2), ALAB-260, 1 NRC 51, 55 (1975).

In order to assure that NEPA is not thwarted, the NRC and the courts have set forth procedural guidelines for FES preparation. These duties are not inherently flexible; they must be complied with "to the fullest extent." Calvert Cliffs' Coordinating Committee, Inc. v. United States Atomic Energy Commission, 449 F.2d 1109, 1115 (D.C. Cir. 1971).

NEPA requires "a detailed statement" on the environmental impact of and the alternatives to a proposed action. 42 U.S.C. § 4332(2)(C). "[T]o satisfy NEPA, an agency must go beyond mere assertions. At a minimum, it must provide a detailed, thoughtful analysis drawn from adequate data ...." In re Boston Edison Co. (Pilgrim Nuclear Generating Station, Unit 2) ALAB-479, 7 NRC 774, 779 (1978). See also Silva v. Lynn, 482 F.2d 1282, 1287 (1st Cir. 1973). Furthermore, the draft statement "must fulfill and satisfy to the fullest extent possible the requirements established for final statements." Regulations of the Council on Environmental Quality, 40 C.F.R. § 1502.9(a).

The grounds cited by Applicants for deferring evidentiary hearings preclude compliance with these requirements. By Applicants' own admission, "an informed decision on the

need-for-power issues ... would be difficult at best" pending "the outcome ... the WPPSS bond election and the findings of the Regional Council." App. Letter at 3. In analogous situations, the judicial branch has counseled that "unavailability of information might require delays in filing draft statements or extensions of time in which to comment upon the statements, if the procedures of NEPA are to be conducted in a meaningful way." Jicarilla Apache Tribe of Indians v. Morton, 471 F.2d 1275, 1281 (9th Cir. 1973). Factors that "must be considered in addition to the possibility of obtaining more complete information" are "the consequences of delay, the present state of information concerning the environmental factors, and the degree of probative value and relevance of the information which may be gained by delay." Id.

All these criteria mandate delay in issuing the FES for Skagit/Hanford, as Applicants' letter itself effectively recognizes. Thus, Applicants argue that more complete information will be forthcoming with the April 1983 release of the Regional Council's electric power and conservation plan, and emphasize both the inadequacy of "the present state of information" and the "probative value and relevance" of anticipated data.* Also, Applicants have provided no reason

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*Applicants characterize the Regional plan as "[p]robably the most significant need-for-power development still to come in the near term." App. Letter at 3.

for concluding that adverse consequences will attend delay. In fact, they argue that efforts to address need-for-power issues now would be "premature and probably fruitless." App. Letter at 3.

Under the circumstances, the NRC's obligations under NEPA to both the decision-makers and the public are clear. "Simply put, the agency may not evade its duty. It must either assess the impact of the decision, or, if the factual situation will not permit that assessment (thus preventing the agency from performing its NEPA duties) the decision must be deferred until the agency has a sufficient factual basis to perform its environmental analysis." California v. Bergland, 483 F.Supp. 465, 480 (E.D. Cal. 1980). Cf. In re Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), CLI-77-8, 5 NRC 503, 525 (1977) ("[I]f the staff believes that inadequate data about environmental considerations is available or that reasonable alternatives have not been adequately explored, it can and should decline to issue a DES."); Regulations of the Council on Environmental Quality, 40 C.F.R.§ 1502.22(a) ("If the information relevant to adverse impacts is essential to a reasoned choice among alternatives and is not known and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.")

C. PUBLICATION OF AN FES ON THE CURRENT SCHEDULE WOULD DENY THE PUBLIC PARTICIPATORY RIGHTS THAT ARE GUARANTEED BY NEPA.

The opportunity for public comment on Environmental Statements is a crucial element in the NEPA process. See Trout Unlimited v. Morton, supra at 1282. As a result, the NRC staff may not lawfully close the comment period now, and simply incorporate additional information on need-for-power and waste disposal in the FES. To do so would deny the public and concerned governmental agencies the right to comment on critical factors in the environmental analysis of the license application. At the very least, given the considerations reviewed above, the Staff will have to issue a revised DES with updated cost-benefit and waste disposal analyses, and circulate it for public comment. See, e.g., Natural Resources Defense Council v. Hughes, supra, 437 F.Supp. at 990-91. See also Regulations of the Council on Environmental Quality, 40 C.F.R. § 1502.9(a) (revised draft required "if the draft is so inadequate as to preclude meaningful analysis"); id. at § 1502.9(c)(1)(ii) (Agencies must prepare, circulate and file supplements to draft statements if "[t]here are significant new circumstances, or information relevant to environmental concerns and bearing on the proposed action or its impacts.") Publication of a document purporting to be an FES on the current schedule will in no way respond to or reduce these obligations. There is no way to avoid extensive revision and

recirculation of this pervasively flawed and incomplete DES; no purpose would be served by attempting to press ahead now with a final statement.

D. CONCLUSION

Applicants have admitted that "the [forthcoming] regional plan will play a major role in determining what new generating resources will be constructed in the region." App. Letter at 3. Likewise, the courts have underscored the importance of a sound analysis of long-term nuclear waste disposal. Publication of the FES for Skagit/Hanford without adequate information and analyses of these crucial issues -- and accompanying public comment -- will subvert the mandate of NEPA. It will prevent both the Licensing Board and the public from making an informed decision, and thus invalidate any construction permit ultimately granted. By formally extending the comment period on this DES through at least April of 1983, the NRC will be acting in the best interests of the public and all the parties involved. Following publication of the Regional Council's plan and the other near-term developments cited in Applicants' submission to the Licensing Board, preparation of an extensively revised DES can begin--unless, as seems increasingly likely, Applicants abandon this project in the interim. See "Scheduling of Further Proceedings in Light of Need for Power Uncertainties: Joint Comments and

Recommendations of the Natural Resources Defense Council and the National Wildlife Federation," at pp. 3-7, 13-15 (May 19, 1982: Submission to Atomic Safety and Licensing Board).

III. THE ANALYSIS OF NEED FOR POWER ISSUES IS OBSOLETE, INCOMPLETE, AND INCORRECT.

Applicants characterize the Skagit/Hanford Nuclear Project as "a regional resource," which "will be operated as a baseload facility." (ASC/ER, p. 1.0-2).* It follows that assessments of need for the facility must be based on long-term, regional forecasts of firm energy requirements in the Pacific Northwest region.** At least three such forecasts have been released in 1982; each is substantially lower than those relied on by the DES authors, and each refutes the need-for-power rationale that the DES presents. Yet the DES ignores one of these forecasts (prepared by NRDC for the Northwest Conservation Act Coalition) and grants the other two only passing mention.

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*Here and elsewhere in these comments, citations to Applicants' Application for Site Certification/Environmental Report will be in the form "ASC/ER."

**Thus, forecasts of regional peaking needs are largely irrelevant to the need for power questions confronting the DES draftsmen. If Skagit/Hanford is not needed to provide energy, there obviously are cheaper and more reliable peaking alternatives that -- unlike nuclear plants -- need not be operated continuously. See, e.g., Bonneville Power Administration, The Role of the Bonneville Power Administration in the Pacific Northwest Power Supply System, at IV-36 to IV-37 (1980).

A. WASHINGTON STATE FORECAST [Independent Review of Washington Public Power Supply System Nuclear Plants 4 and 5: Final Report to the Washington State Legislature, Washington Energy Research Center, Washington State University/University of Washington (March 1982)]

In April of 1981, the Washington Legislature directed the joint Washington Energy Research Center of the University of Washington and Washington State University to determine, inter alia, long-term electricity needs in the Pacific Northwest Region (§ 2, Senate Bill No. 3972, passed by the House and Senate on April 28, 1981). The Steering Committee and Liaison Representatives for the study included distinguished members of the Northwest utility, industrial, and academic communities. As a state-sponsored need-for-power analysis prepared by individuals who "can be expected to possess considerable familiarity with the primary factors bearing upon present and future [electricity] demand," the Washington State forecast is entitled to substantial deference from the Nuclear Regulatory Commission. In re Rochester Gas and Electric Co. (Sterling Power Project, Nuclear Unit No. 1), ALAB-502, 8 NRC 383, 389 (1978).

The Washington forecast "indicate[s] that the most likely rate of load growth, as measured by total regional electricity retail sales, over the period 1980 to 2000 is about 1.5 percent/year." (p. 4). Under this "most likely" scenario, no new thermal resources of any kind beyond six plants now under

construction (WPPSS Units 1, 2, and 3, Colstrip Units 3 and 4, Valmy Unit 2) would be needed before 1995, assuming "moderate levels of conservation" (pp. 4-5; see also pp. 85-86). The need for additional baseload generation is delayed "beyond the end of this century" if "moderate levels of conservation savings" are supplemented by "moderate levels of renewable resource development" plus "more use of combustion turbines and/or imports." (p. 4) These findings contemplate deferral or cancellation not only of the Skagit/Hanford Nuclear Project, but also of two other nuclear plants and four coal plants now slated to come on line at the same time or sooner (WPPSS Units 4 and 5; Creston Units 1, 2, 3, and 4). These six plants have a total capacity in excess of 4500 Megawatts.

The DES conceded the existence of this study (p. 2-19), but cited none of its conclusions and recommendations. The DES merely speculated that the baseline forecast of 1.5 percent annual growth might be revised upward prior to final publication (*id.*). In fact, the forecast has been revised downward. The final report, which slashed projections for future years by 250-650 MW, urged "that more emphasis should be given" to the document's initial recommendation, "which call[s] for reducing plans for new power plants." Walter R. Butcher, Deputy Project Director, "Independent Review of WNP-4 and WNP-5: Adjustment to Load Forecasts and the Need for Power."

B. DRAFT BPA REGIONAL FORECAST, AND RELATED BPA DOCUMENTS [Bonneville Power Administration, Forecasts of Electricity Consumption in the Pacific Northwest (April 1982)]

As the DES went to press, BPA was preparing its own forecast of regional needs. The DES speculated that a 2% annual rate of growth would emerge (p. 2-20). No lower growth rate is analyzed anywhere in the DES. The DES authors were poor prophets; the BPA forecast's "baseline case" shows regional loads growing at an average rate of 1.6% from 1980-1990, and 1.7% from 1990-2000 (p. 5). These figures are comparable to those in the Washington State forecast, discussed above. The BPA forecast does not include "savings which might be achieved through future conservation programs budgeted by BPA, by local and state governments, or by utilities." (p. 3). Also excluded are the effects of building and appliance efficiency "standards which may be proposed by the Northwest Power Planning Council, federal, state or local governments .... " (p. 35). However, "[t]his conservation potential is to be analyzed ... in a separate conservation assessment." (pp. 3, 35). That document has not yet been published.

In reliance upon this forecast, Bonneville Administrator Peter Johnson has recommended -- and WPPSS has imposed -- a suspension of construction for up to five years on WPPSS Unit 1, which had been scheduled to commence operations in 1986. See Bonneville Power Administration, Analysis of Resource Alternatives (April 19, 1982).

In addition to its demand forecast, Bonneville also has released projections of potential contributions from alternatives to large-scale nuclear plants such as wind machines, industrial cogeneration, biomass facilities, geothermal resources, and small hydropower projects. In October 1981, BPA submitted to Congress the following "preliminary estimate" for those resource categories:

Preliminary Estimate of Practical Potential for Commercial Electrical Generation by Resource (Average Energy in MW)

	1990	1995	2000
Large Wind	175	420	700
Industrial Cogeneration	455	520	520
Biomass/MSW	240	319	370
Geothermal	150	400	550
Small Hydro	550 - 850	1050 - 1550	1750 - 2550

Source: Bonneville Power Administration, "Answers to Questions Posed by Chairmen Dingell and Ottinger in Their Letter of October 13, 1981," at 13 (undated).

Under the Pacific Northwest Electric Power Planning and Conservation Act, all of these resources have priority over Skagit/Hanford and other nuclear projects if they are as or less costly to develop. 16 U.S.C. § 839b(e)(1).

Despite its obvious omissions, particularly in the conservation area, the BPA forecast is significantly lower than the regional forecast upon which the DES primarily relies. In fact, the BPA projection of regional loads for the year <u>2000</u> is lower than that estimated for <u>1990-91</u> by the Pacific Northwest Utilities Conference Committee (PNUCC) (23,333 average Megawatts vs. 23,834 average Megawatts). Compare BPA forecast at 5 with PNUCC, <u>Northwest Regional Forecast of Power Loads and Resources</u>, at I-14 (1981). The BPA baseline forecast of electricity needs in 1991-1992 -- 20,129 average megawatts -- could be met without <u>any</u> contribution from WPPSS Units 4 and 5, Creston Units 2, 3, and 4, Skagit/Hanford Units 1 and 2, <u>or</u> any additional renewable energy, cogeneration, or conservation resources. Compare BPA forecast at 117 with PNUCC, <u>supra</u> at I-17.

C. NRDC FORECAST [<u>A Model Electric Power and Conservation Plan for the Pacific Northwest</u> (Drafts, January and May 1982)]

At the request of the Northwest Conservation Act Coalition, NRDC has prepared a "Model Electric Power and Conservation Plan for the Pacific Northwest." This "Model Plan"

projects the results of the implementation of the Pacific Northwest Electric Power Planning and Conservation Act, which became law in December of 1980. A summary is attached to these comments as Appendix 1; Appendix 2 reviews the Model Plan's underlying assumptions in greater detail, and responds to questions about the document raised by PNUCC.

One of the Model Plan's objectives was to determine whether new nuclear or coal-fired power plants would be required to meet the Northwest's energy needs over the next two decades, if -- as the Act expressly contemplates -- vigorous efforts were made to increase the efficiency of electricity use and utilize cost-effective renewable energy resources. The Model Plan develops "high demand" and "low demand" estimates through the year 2000; the "high" scenario assumes somewhat smaller efficiency increases, less rapid "penetration" of conservation measures, and higher industrial growth than the "low" scenario. Even under the Model Plan's high demand scenario, generous surpluses result from 1985-2000, assuming indefinite deferral of the Skagit/Hanford Nuclear Project plus the following plants, most of which precede Skagit/Hanford in the region's construction pipeline: Colstrip Unit 4; Creston Units 1, 2, 3, and 4; WPPSS Units 1, 3, 4, and 5; and Pebble Springs Units 1 and 2. And these surpluses were calculated without assuming any reliance on wind-generated electricity; electricity surcharges or "curtailment purchases" in times of

threatened supply insufficiency; environmentally acceptable small-scale hydropower projects; geothermal resources; photovoltaics; or financial incentives to prevent net growth in irrigated agriculture (and accompanying losses in hydropower generation). The only new generating resources needed to meet the Model Plan's "high demand" loads are Valmy Unit 2, WPPSS Unit 2, and Colstrip Unit 3.

D. FORECASTS RELIED UPON BY APPLICANTS AND THE DES

Applicants concede that "the electric utilities of the Pacific Northwest form, in effect, a single regional system" and that the Skagit/Hanford Nuclear Project is planned as a "regional resource." ASC/ER at 1.0-4, 1.0-2. Therefore, forecasts limited to the service territories of individual utility systems are largely irrelevant (but cf. ASC/ER at 1.1-2 to 1.1-20; DES at 2-3 to 2-9), although the Applicants' summary is enlightening in its revelation of glaring inconsistencies in individual utilities' methodologies.* The crux of Applicants' need-for-power case is the regional forecast prepared annually by the Pacific Northwest Utilities Conference Committee (ASC/ER

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*Without any justification cited in the ASC/ER, the four utilities employ significantly different assumptions about conservation, price elasticity, and end-use needs in the major consumption sectors. The participants also differ in their choice of basic forecasting methodologies, employing idiosyncratic mixes of trend extrapolation, econometric projections, and end-use analysis.

1.1-20 to 1.1-24; DES at 2-9 to 2-16). The following considerations demonstrate that the PNUCC projections should be accorded little or no weight in the DES:

(1) Although the DES nowhere alludes to the fact, PNUCC forecasts have failed conspicuously (a) to accurately project actual regional loads and (b) to provide a stable indicator of future needs. On the former point, as the Washington State forecast notes:

> [T]he difference between the February 15, 1969 [PNUCC] forecast for the 1979-80 water year energy load and the actual 1979-80 energy load is larger than the energy output of three 1200 megawatt nuclear power plants. The difference between the February 5, 1979 forecast for the 1979-80 water year energy load and the actual 1979-80 water year load is about the same as the output of a 1200 megawatt nuclear power plant.

Washington Energy Research Center, _supra_, at 76-78.

Projections of future loads have exhibited still greater variance. Between 1974 and 1981, PNUCC's annual estimates of regional loads in 1990 _dropped_ seven consecutive times, by a total of more than 8700 average megawatts -- the reliable output of more than twelve 1200 megawatt nuclear plants operating at 60% capacity. Between 1980 and 1981 alone, the decline in projected 1990 loads equalled the reliable output of three such plants (2127 average megawatts). Public Power Council, _Power Planning Primer: An Introduction to Pacific Northwest Electric Power Planning Issues and the Role of Public Power_ 26 (1981).

(2) The PNUCC projections cited in the DES are far higher than those of the Washington State and BPA forecasts, discussed earlier. The 1.5-1.7 percent annual growth rates derived in those comprehensive assessments refute Applicants' contentions that average annual growth will be "2.9 percent with a 90 percent confidence interval ranging from 2.0 percent to 3.7 percent," and that "between 1981 and 1991-92 [there is] a 99% chance of at least one four-month period of insufficient resources to meet firm load." DES at 2-16. In fact, in anticipation of extended regional surpluses, BPA has forced a two- to five-year construction delay for a nuclear unit that is more than 60% complete (WPPSS Unit 1) and has refused repeated requests by the sponsors of WPPSS Units 4 and 5 to acquire the capability of those plants.

(3) The PNUCC load and resource balances are based on the assumption that every future year is part of a "critical water" period in which the output of the regional hydropower system is constrained by droughts that produce the lowest water flows ever recorded. The difference in annual energy production by the region's dams between an extremely wet year and a critical water year is more than 7000 average megawatts. PNUCC, supra at Table IX-14. The Washington State forecast recommended that the region's utilities "change planning criteria to permit increased Pacific Northwest utilization of secondary hydropower in combination with combustion turbines,

imports, and/or exchange agreements." Washington Energy Reserch Center, supra, at 7. The DES totally ignores that recommendation and its supporting analysis.

(4) Further inconsistencies and errors in Applicants' presentation reinforce the conclusion that their need for power case is totally implausible. For example, Table 1.1-5 (ASC/ER) projects a one-year regional energy consumption growth rate of 14.6% for 1981-82. This adjustment, positing an unprecedented one-time surge of demand during a year of deep recession, was obviously made necessary by the failure of recent loads to keep pace with PNUCC's expectations. This strained effort to override uncomfortable realities with patently unrealistic assumptions speaks volumes about the credibility of Applicants' analysis. In its projection of loads for Applicants' service territories, the DES assumes a somewhat more modest -- but still fanciful -- one-year increase of 8.2%; compare Table 2.2 (reporting 1980-1981 loads of 6510.5 average megawatts) with Table 2.3 (projecting 1981-1982 loads of 7047 average megawatts).

Any forecaster's tools are at best imperfect, but the deficiencies of the PNUCC forecast are overwhelming and more reliable alternative analyses are available (see pp. 13-19 above). The DES should place no reliance on a forecast whose sponsors manifestly cannot meet their "burden of showing that [their] projections of demand are reasonable." In re Duke

Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-355, 4 NRC 397, 405 (1976). Here, as in many other NEPA contexts, a federal agency has been led to the brink of serious error by forgetting "the potential, if not the likelihood, that the applicant's statement will be based upon self-serving assumptions." Greene County Planning Board v. Federal Power Commission, 455 F.2d 412, 420 (2d Cir. 1972).

E. NRC STAFF CONCLUSIONS ON NEED FOR POWER

The DES observes (p. 2-21) that a total average regional load growth of 2.0% would reduce firm load deficits* to "nearly zero" in 1991-92, even "if WNP-4 and -5 were not built." The BPA and Washington State forecasts project substantially lower growth rates, and even PNUCC recently has cut its annual growth estimate to 2.1%, using an econometric model.** These developments totally undermine the DES conclusion that "the S/HNP will be needed by its projected completion dates to alleviate electricity deficits as projected under the critical water assumption" (p. 2-23), putting aside -- as the DES may not -- the question whether "critical water" planning is

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*As the NRC presumably recognizes, nonfirm loads -- which constitute regional reserves -- are completely out of place in forecasts used for resource planning purposes. See, e.g., 16 U.S.C. § 839c(d); H. Rep. No. 96-976, Part II, at 48 (1980); H. Rep. No. 96-976, Part I, at 61-62 (1980).

**See PNUCC, Northwest Regional Forecast of Power Loads and Resources 3 (1982).

appropriate in any case. Cf. pages 21-22 above. The sole support for the DES finding on need for power is a discredited and obsolete forecast, which has been supplanted by independent assessments to which NRC precedents command deference.

IV. THE ANALYSIS OF ALTERNATIVES TO THE SKAGIT/HANFORD PROJECT IS TOTALLY INADEQUATE.

In a cursory discussion spanning some eight pages, the DES dismisses all alternatives to the Skagit/Hanford project. No effort is made to "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." Regulations of the Council on Environmental Quality, 40 C.F.R. § 1502.14. The "linchpin of the entire impact statement"* overlooks a number of obvious alternatives and treats those actually discussed with sketchy dismissals that make a mockery of NEPA. The Appendices to these comments point the way toward the comprehensive analyses that this environmental review must undertake to remedy these deficiencies. The discussion that follows identifies a number of specific omissions and errors in the DES itself.

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*Monroe County Conservation Council, Inc. v. Volpe, 472 F.2d 693, 697-98 (2d Cir. 1972).

One point should be emphasized at the outset, however. In considering alternatives to Skagit/Hanford, inquiry cannot be limited to whether any single option by itself can substitute for Skagit/Hanford. Also needed is a discussion of whether a mix of environmentally preferable alternatives, working in combination, would be adequate for that purpose. The DES at one point (p. 3-8) concedes as much, but declines to undertake such an assessment -- although acknowledging that, if performed, it might "justify a delay for the S/HNP." The DES is, of course, incorrect in its assertion that the only "combined analysis" is "the PNUCC regional area forecast" (id.); see pages 13-14 and 17-19 above, and Appendix 1 below.

A. CONSERVATION: The DES concedes that conservation could affect "the need for the proposed project" (p. 3-3), and acknowledges that Applicants' forecasts do not include a substantial conservation resource (p. 3-4). The DES omits any discussion whatever of the extensive treatment of conservation potential in the Washington State forecast, which relies in part on anticipated conservation savings for its conclusion that the region needs no new thermal generation for the rest of this century. See Washington Energy Research Center, supra, at 85-91. See also Appendices 1 and 2 to these comments (reviewing NRDC's findings). Also missing from the DES is any comparison of the environmental impacts of conservation and nuclear generation. Cf. NRDC, Quantifying Environmental Costs

and Benefits: A Methodology for Electric Power Planners (1981: submission to Bonneville Power Administration).

The DES gives no reason for concluding that conservation cannot substitute entirely for the Skagit/Hanford project. Unless the NRC can produce some persuasive ground for rejecting the Washington State and NRDC findings, the staff's refusal to acknowledge any "viable alternative to the project" (p. 3-9) amounts to an arbitrary and capricious decision.

B. SOLAR APPLICATIONS: The DES devotes four sentences to all solar technologies (p. 3-7). This subsection, which includes no cited authorities or studies, advances the self-contradictory propositions that (1) "solar energy appears to show promise as a significant energy source for the near future;" (2) solar energy lacks the "technical feasibility ... to serve as an alternative to a large baseload plant"; (3) passive solar systems "will ... supplement as an energy source"; and (4) passive solar systems "cannot be considered as an alternative to [Skagit/Hanford]," because "their development is based on an individual application."

Proposition (1) is plainly correct. Proposition (2) is clearly inapplicable to -- at the very least -- solar water heaters (ignored in the DES) and passive solar systems, which are mentioned in proposition (3) without any reference to the extensive Northwest-specific literature on performance and cost-effectiveness. See, *e.g.*, A. Kiphut *et al.*, "Oregon's

Solar Tax Credit Program: Actual Cost and Estimated Performance of Passive Solar Installations," in Proceedings of the Third National Passive Solar Conference, Vol. 3, pp. 73-77 (January 1979); U.S. Department of Energy and U.S. Environmental Protection Agency, Solar Energy for Pacific Northwest Residential Heating (May 1978) (relatively simple passive designs are capable of supplying 59 to 71 percent of home heating needs in the Northwest); City of Eugene, The Eugene-Springfield Solar Report (April 1982)(solar potential in Eugene/Springfield residential sector).

Finally, to rule out passive solar as an alternative to Skagit/Hanford because it is "based on an individual application " (p. 3-7) is ludicrous. The same tortured logic could be used to dismiss most, if not all, conservation measures. Utilities can invest in passive solar -- and conservation -- by providing incentives for construction of high-efficiency structures and retrofits of existing buildings. See, e.g., Appendix I to these comments at pp. 18-20. Small-scale, dispersed resources have distinct advantages over large bas..oad plants in terms of flexibility and reliability. See, e.g., Appendix 2 to these comments at pp. 5 and 8.

C. COGENERATION: The DES acknowledges the enormous gap between the cogeneration included in the PNUCC forecast (44 MWe) and the potential identified elsewhere (erroneously cited

as 1430 MWe -- the actual figure is 1645 MWe*). The DES also concedes the "environmental advantages" of these resources (p. 3-5). Why these findings had no impact on the DES endorsement of Skagit/Hanford remains a mystery. The DES does observe that a stagnant economy will reduce cogeneration output -- but a stagnant economy also reduces regional electricity needs, as the DES concedes (p. 3-5).

D. WIND-GENERATED ELECTRICITY: The DES dismisses wind resources in one paragraph, which includes an unidentified and almost certainly erroneous citation to a BPA estimate that the total regional potential is 60 MWe (p. 3-8). The most recent published BPA estimates (175 average MW in 1990, 700 average MW in 2000) are cited above at page 16. Appendix 3 to these comments reviews the extensive literature on Northwest wind energy potential, and concludes that 170 and 984 average megawatts can be realized from wind energy conversion systems by 1990 and 2000, respectively. The unsubstantiated suggestion that development must wait until "the mid 1990s" (DES, p. 3-8) is refuted by these sources and Puget Sound Power and Light's 1981 Annual Report, which states: "we are <u>presently</u> working with other electric utilities in the region to site a wind

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*Rocket Research Co., <u>Industrial Electrical Cogeneration Potential in the BPA Service Area, Phases III and IV: Economic Analysis</u> 9 (February 29, 1980).

farm project capable of producing 50,000 kilowatts .... " (emphasis added).*

E. INCREASES IN THE EFFICIENCY OF THE ELECTRICITY DELIVERY SYSTEM: The DES totally ignores this promising option. The Washington State forecast projects savings in excess of 200 average megawatts by the year 2000 from "a reduction in transmission and distribution line losses which is accomplished by upgrading and thereby increasing the efficiency of the electricity delivery system." Washington Energy Research Center, supra at 86.

F. ADJUSTMENTS IN WHOLESALE AND RETAIL RATE STRUCTURES: Price-induced changes in electricity consumption are only partly a function of a consumer's total bill; also significant is the rate structure through which the bill is calculated. A recent Washington State Senate study concluded:

> A baseline inverted rate structure would result in a more efficient (e.g., less wasteful) use of electricity. A baseline inverted rate structure would price the initial or "base block" of electrical energy at the cost of inexpensive hydroelectric power to the utility. Electric energy consumed in excess of the base block would be priced at a level more closely approximating the marginal cost of electric energy; that is, the cost of power from new thermal plants. Such a rate structure would provide the vast majority of consumers with more accurate price signals by pricing energy consumption over the base block closer to its marginal cost and closer to the cost of alternate fuels.

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*Puget Sound Power & Light Co., Annual Report 1981: Meeting the Challenge of Change 12 (1981).

Watson et al., Residential Baseline Inverted Rates: Analysis of Their Application in Washington State 2 (Washington State Senate Committee on Energy and Utilities, 1981). That study further notes that "inverted" retail rate structures are now appearing for the first time throughout the Northwest. Id. at 2-3. Neither the PNUCC forecast nor the DES makes any attempt to analyze the extent to which such rates may be expected to increase consumers' demand elasticities. The Washington Senate study notes that at least two utilities have discerned significant reductions in space heating and other electricity-intensive uses following adoption of inverted rates. Id. at 54 and 56 (Pacific Gas and Electric Co., Central Vermont Public Service Corp.).

G. ABANDONMENT OR MODIFICATION OF CRITICAL WATER YEAR PLANNING: This issue was discussed at pages 21-22 above. Options for "firming" Northwest hydropower include, in addition to combustion turbines, reliance on spot market purchases from other regions, "buybacks" of electricity from Northwest industrial customers, and temporary surcharges. The DES should assess the cost-effectiveness of all these options, which are reviewed in J. Lazar, "Does it Still Make Sense to Build for Critical Water?" (mimeo, 1981); NRDC's Model Plan; and Washington Energy Research Center, supra, at 4, 96 and 118.

H. CONCLUSION: There are abundant environmentally preferable and cost-effective alternatives to the Skagit/

Hanford Nuclear Project, which cannot fail to emerge from a competent and objective NEPA analysis. The NRC has yet to undertake such an analysis; until it does so, any construction permit for the Skagit/Hanford Nuclear Project will not survive judicial scrutiny.

V. THE DES FAILS TO ASSESS FULLY THE ENVIRONMENTAL IMPACTS OF THE SKAGIT/HANFORD PROJECT ON COLUMBIA RIVER FISH AND WILDLIFE RESOURCES.

Applicants state in their Environmental Report that "[t]he region foresees even greater usage of hydro resources for peaking, with thermal resources, such as the proposed Skagit/Hanford Nuclear Project, operating as baseload units at high plant factors ...." ASC/ER at 1.0-3. Nowhere, however, does the DES assess the environmental impacts of pushing the system in this direction.

The use of regional hydro projects for peaking is of two types. First, reservoir storage permits use of hydropower to serve seasonal winter peak demands, while thermal projects, such as Skagit/Hanford, operate to serve annual baseloads. Second, daily reservoir fluctuations permit the hydrosystem to provide power for daily peak loads. In either case, the fish and wildlife impacts are significant. In the first instance, demands for reservoir drawdown in the winter months may limit the water available to provide the high spring flows necessary for juvenile anadromous fish migration. And in both cases, the

rapid or increased reservoir and streamflow fluctuations required for peaking can lead to losses of riparian habitat and dependent wildlife. See Final EIS, The Role of the Bonneville Power Administration in the Pacific Northwest Power Supply System, at IV-22 - IV-23 (1980). The Bonneville Power Administration has generally described the impacts of increased hydro-peaking when thermal power is used as a baseload resource, citing "reduced anadromous fish runs, decreased wildlife habitat on islands and riverbanks, conflicts with recreational activities and increased navigational hazards." Id. at IV-283.

Significantly, resource alternatives that are inadequately assessed in the DES -- conservation and certain renewable energy applications -- would have far more benign effects on fish and wildlife. Use of conservation to decrease winter peak demands, for instance, would diminish the need to draw down reservoirs to serve peak loads, and thus assist markedly in retaining sufficient water in the reservoirs to provide adequate spring fish flows. See Romer Associates, Draft Report, Northwest Electric Load Shaping for Fish Enhancement, Appendix A-A of [Agency and Tribal] Recommendations for Fish and Wildlife Program Under the Pacific Northwest Electric Power Planning and Conservation Act, submitted to Northwest Power Planning Council, November 15, 1981.

Bonneville's general review of hydro-peaking impacts does not, of course, excuse the NRC from a more focused analysis in the DES. Only issues "fully addressed in a program statement" can be excluded from the analysis provided in subsequent EISs on smaller components of the larger program. United States Energy Research and Development Administration Project Management Corporation Tennessee Valley Authority (Clinch River Breeder Reactor Plant), CLI-76-13, 4 NRC 67, 80 (1976) (emphasis supplied). Further, as the District Court for the District of Columbia has noted:

> As a general rule, the preparation of a [program EIS] does not obviate the necessity of preparing a particularized impact statement for individual major federal actions that are components of a subject program. Because programmatic statements are primarily concerned with analyzing the cumulative or synergistic environmental impacts of a program as a whole, they generally are unable to reflect a considered analysis of the particularized aspects of individual federal actions.
>
> * * *
>
> Accordingly, in order to determine whether [a decision not to prepare a component-specific EIS] is consistent with NEPA, it is necessary to consider the adequacy of the [program EIS] . . . as applied to the individual construction projects . . . .

Natural Resources Defense Council v. Administrator, U.S. Energy Research and Development Administration, 451 F. Supp. 1245, 1258, 1259-60 (D.D.C. 1978).

The programmatic BPA analysis clearly is no substitute for the particularized assessment that NEPA demands in this proceeding, for the following reasons:

1. The BPA Role EIS discusses the impacts of hydro-peaking in the most general of terms. It does not endeavor to decide with exactitude how much increased hydro-peaking will occur and when, or what the specific, as opposed to general, impacts of a particular change in the power system might be. Thus, the Role EIS itself cautions that it

> is regarded as a "tiered" EIS designed to discuss policy, planning, and programming matters and is not intended to present the level of detail of a project or action-specific EIS. Project or action-specific proposals will be assessed individually as they are formulated.

Final Role EIS at I-20. The Role EIS simply was not designed to provide sufficient detail to describe the particular hydro-peaking impacts of operation of Skagit/Hanford in comparison to alternative power sources.

2. Much of the discussion of hydro-peaking in the Final Role EIS is based on, or specifically references, Appendix A to the Draft Role EIS published by Bonneville in 1977. The analysis in Appendix A assumed load and resource conditions that are now vastly changed. See, e.g., Appendix A at III-16. Thus, those attempts in the Appendix to quantify expected future hydro-peaking are badly out of date, if not entirely irrelevant to the Region's current and future load-resource balance.

3. In numerous instances, Appendix A admits to a dramatic lack of information or study of hydro-peaking impacts. See, e.g., Appendix A, Draft Role EIS at III-156, III-158, III-170. Since 1977 there has been continued study of the impacts of hydro-peaking by, among others, Battelle Laboratories for the Department of Energy and by the City of Seattle on the Skagit River in Washington State. Appendix A, and thus the Final Role EIS, did not incorporate the results of those investigations and neither, on that ground as well, is adequate as a treatment of hydro-peaking environmental impacts.

For all these reasons, the Commission may not rely on the BPA Final Role EIS as a justification for refusing to consider the hydro-peaking impacts of operation of the Skagit/Hanford Project. That BPA may be the agency primarily vested with control of hydro-peaking does not permit the NRC to ignore the issue in the Skagit/Hanford DES. The National Environmental Policy Act requires the Commission to consider all direct and indirect impacts, as well as the cumulative effects, of its actions. City of Davis v. Coleman, 521 F.2d 661, 676 (9th Cir. 1975); Natural Resources Defense Council v. Callaway, 524 F.2d 79, 88 (2nd Cir. 1975). And it must investigate the environmental consequences of alternatives to the proposal before it, so that here, for example, it can determine the comparative hydro-peaking fish and wildlife impacts of conservation and other resource alternatives versus thermal

generation. See Monroe County Conservation Council v. Volpe, 472 F.2d 693, 697-98 (2nd Cir. 1972); Natural Resources Defense Council v. Morton, 458 F.2d 827, 833 (D.C. Cir. 1972). Finally, alternatives may not be rejected for consideration simply because implementation is dependent upon action by another agency. NRDC v. Morton, supra, 458 F.2d at 834. If the Commission refuses to consider the hydro-peaking impacts of its decision in this proceeding, it will have violated these NEPA obligations.

VI. THE DES DOES NOT ADEQUATELY ASSESS THE ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE.

On April 27, 1982, the District of Columbia Circuit Court of Appeals released its decision in Natural Resources Defense Council v. Nuclear Regulatory Commission, Civil Action No. 74-1586 (D.C. Cir., April 27, 1982). In that case, the Court held invalid the Commission's "Table S-3 Rule," and, in particular, rejected that Rule's analysis of the environmental impacts of long-term nuclear waste disposal. According to the Court, the Rule is inadequate under the National Environmental Policy Act because it fails, inter alia, to assess and describe the "uncertainties concerning the long-term isolation of high-level and transuranic wastes ...." NRDC v. NRC, supra, Slip Op. at 11.

The DES relies exclusively on Table S-3 and its explanatory narrative to assess the fuel-cycle impact of the

Skagit/Hanford Project, and does nothing to illumine the uncertainties with which the Court in NRDC v. NRC was concerned. The DES is thus inadequate on its face. Either the Commission must respond to the Court's objections to Table S-3 in another generic proceeding, or it must comply with the Court's interpretation of the requirements of NEPA in the site-specific DES and FES for Skagit/Hanford. If the NRC does not conduct an uncertainty analysis for Skagit/Hanford waste disposal, any decision to proceed with a Skagit/Hanford license will violate NEPA.

VII. THE COST-BENEFIT ANALYSIS FOR THE PROJECT IS INCOMPLETE, AND REFLECTS UNSUPPORTED AND ERRONEOUS ESTIMATES OF LIFE-CYCLE COSTS AND BENEFITS.

The Pacific Northwest Electric Power Planning and Conservation Act sets out criteria for a minimally adequate cost-benefit analysis of new generating facilities. See 16 U.S.C. § 839a(4)(B) ("[T]he term 'system cost' means an estimate of all direct costs of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer and, among other factors, waste disposal costs, end-of-cycle costs, and fuel costs (including projected increases), and such quantifiable environmental costs as ... are directly attributable to such measure or resource.")

The DES ignores distribution and transmission costs, including line losses, completely. Decommissioning costs are calculated at .4-.6 mills/kWh, following the totally unsupported application of a 12% discount rate (p. 4-230). Cf. Natural Resources Defense Council v. Nuclear Regulatory Commission, No. 74-1586 (D.C. Cir., April 27, 1982), slip op. at 65 (questioning use of 10% discount rate, and indicating that 0-2% discount rates are more appropriate for NRC cost-benefit analyses).

Elsewhere, the DES's uncritical reliance on the applicant's cost estimates (p. 6-7) ignores the disparity between those estimates and the cost of other nuclear plants in which applicants have an interest. For example, Pacific Power and Light Co. has projected the cost of its share of Washington Public Power Supply System Unit 3 at 191.4 mills per kilowatt-hour. See Letter from James F. Pienovi, PP&L Controller, to William Kramer, Public Utility Commission of Oregon (December 22, 1981). The DES inexplicably provides no estimate of costs per kilowatt-hour for Skagit/Hanford output (see p. 6-7); when that omission is remedied, the DES must reject Applicants' unrealistic assumptions. For example, Applicants' calculations rely on a 10.67% average cost of money for financing the project. ASC/ER at Table 8.2-2. Comparable figures for WPPSS Unit 3, compiled by Pacific Power & Light, are 15% (long-term debt), 15.5% (preferred stock), and 16.25% (common equity). Letter from James F. Pienovi, supra, Attachment C, p. 4.

Also, for no reason cited in the document, the DES assumes a 70% capacity factor for Skagit/Hanford in calculating both benefits and costs (p. 6-7). However, as noted in an earlier filing in this proceeding:

> The cumulative average performance of large (approximately 1100 megawatts) Boiling Water Reactors through mid-1981 was 58%. Historical capacity factors for BWR's of approximately 800 megawatts is 56%. Significantly, the Bonneville Power Administration is required by law when calculating resource costs to rely upon "appropriate historical experience with similar ... resources." Pacific Northwest Electric Power Planning and Conservation Act, § 3(4)(C), 16 U.S.C. § 839a(4)(C).

Second Supplement to Petition to Intervene of National Wildlife Federation and Oregon Environmental Council, at p. 2 (May 21, 1982: submission to Atomic Safety and Licensing Board).

In what may be a tacit concession that the 70% figure is an exercise in wishful thinking, the DES retreats to a 60% capacity factor elsewhere in the document (p. 4-230).

In sum, the cost-benefit analysis requires at least the following revisions:

(1) An accounting for transmission costs and line losses associated with operation of the facility;

(2) Use of a reasonable real discount rate (0-2%) in calculating decommissioning costs; and

(3) Independent derivation of capital costs, busbar costs, and capacity factors that reflect historical experience, rather than applicants' self-interested and implausible projections.

The cost-benefit analysis also needs a "bottom line;" nowhere does the DES weigh cumulative costs against cumulative benefits. In the course of remedying that glaring deficiency, the DES authors should explain why they characterize capital charges of $7.8 billion as a "moderate" cost, while property tax revenues of $8.7 million per year are termed a "large" benefit (p. 6-7).

VIII. CONCLUSION

The NEPA process may well afford the best hope for dissuading the Applicants and NRC decision-makers from proceeding with this misconceived project. Skagit/Hanford is one of the lingering remnants of a tragic chapter in Northwest power planning, when inflated forecasts let utilities into costly errors that produced such monuments to futility as the abandoned shells of WPPSS Units 4 and 5. These comments are submitted in an effort to prevent history from repeating itself at the proposed Skagit/Hanford site.

APPENDIX 1

NORTHWEST CONSERVATION ACT COALITION,
A MODEL ELECTRIC POWER AND CONSERVATION PLAN
FOR THE PACIFIC NORTHWEST (Summary: May 1982)

A MODEL ELECTRIC POWER AND CONSERVATION PLAN

FOR THE PACIFIC NORTHWEST

-- Summary --

Northwest Conservation
Act Coalition

May 5, 1982

NORTHWEST CONSERVATION ACT COALITION

Member Organizations

Alternative Energy Resources Organization, Montana
Center for Renewable Resources
Citizens for a Solar Washington
Clark County PUD Owner's Association, Washington
Columbia River Citizens Compact
Communication Workers of America, #9103, Washington
Environmental Information Center, Montana
Eugene Future Power Committee, Oregon
Fair Electric Rates Now, Washington
Fair Use of Snohomish Energy, Washington
Friends of the Earth
Human Resources Council, Montana
Idaho Conservation League
Idaho Wildlife Federation
International Longshoremen's and Warehousemen's Union, #21, Washington
League of Women Voters, Idaho
League of Women Voters, Montana
League of Women Voters, Oregon
League of Women Voters, Washington
Light Brigade, Washington
Natural Resources Defense Council
Northern Plains Resource Council, Montana
Oregon Environmental Council
Oregon Fair Share
Oregon Federation of Teachers
Oregon Solar Energy Industries Association
Peoples' Organization for Washington's Energy Resources
Rose City Ratepayers Association, Oregon
Service Employees International Union, Northwest States Council
Sierra Club
Solar Energy Association of Oregon
Solar Oregon Lobby
Southwest Oregon Community Action Committee
United Food and Commercial Workers, #1092, Oregon
United Food and Commercial Workers, #1001, Washington
Washington Environmental Council
Whatcom County Opportunity Council, Washington

PREFACE

The passage of the Pacific Northwest Electric Power Planning and Conservation Act (PL 96-501) signalled a new era in Northwest power planning. It was said to have marked an end to the region's utilities' decade-long search for "planning certainty" and to have satisfied their desire for a "stable framework for resource development." Few of those involved in the implementation of the Act would describe the current situation as either stable or certain. But all will admit to the Act's extraordinary new energy planning and development tools now being applied in the region.

Those tools reflect the work and demands of citizen groups during the legislative evolution of the Act:

* All power planning is being carried out by an independent agency, the Northwest Power Planning Council;

* The primary criterion for that planning is "cost-effectiveness" -- that is, every resource acquired by the Bonneville Power Administration must be the cheapest available;

* Priority shall be given to conservation and renewable resources;

* The Bonneville Power Administration has the financial and other authorities necessary to implement the full range of resources sponsored by any entity; and

* The fish and wildlife resources of the Columbia River System must be "preserved, mitigated and enhanced."

The implementation of the Power Act and, specifically, the utilization of these key new authorities is what prompted the formation of the Northwest Conservation Act Coalition. After observing and criticizing the Bonneville Power Administration and the region's utilities and large power-consuming industries for years, the thirty-

seven environmental, labor, ratepayer and other citizen organizations determined that, together, they must enter the regional energy planning debate and put forward a comprehensive proposal for future power development. This "Model Conservation and Power Plan for the Pacific Northwest" is that proposal. It outlines what the region could do to stabilize rate increases, mitigate environmental impacts, make energy development and decisionmaking more responsive to local communities and promote economic development by examining the financial impacts of our energy policies before, not after, setting those policies.

Beyond a simple theoretical suggestion, the Model Plan is offerred as a challenge, a challenge to the utilities, the industries, the Bonneville Power Administration and, most importantly, to the Northwest Power Planning Council. This is a picture of what the region could do, how aggressive we could be in applying the new authorities and tools of the Northwest Power Act. The Model Plan is not a forecast of what the future will be; it is a blueprint of what the future could be. That future will come about only if the region decides to choose its energy future, rather than awaiting that future to befall us.

In presenting the Model Plan, the Coalition owes a tremendous debt to the staff of the Natural Resources Defense Council, one of our founding members. Without their technical and programmatic expertise, the Model Plan would be a substantially less valuable document. In addition, the generosity of The Abelard Foundation, A Territory Resource, The Bydale Foundation, The Youth Project and The Northwest Fund for the Environment has, in part, made our work possible.

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TABLE OF CONTENTS

This Model Plan is a blueprint for securing a cheaper, cleaner, and less unsettled electrical energy future in the Pacific Northwest. Its provisions are governed by seven principles in the by-laws of the Northwest Conservation Act Coalition:

> Specifically, the Coalition will advocate that the implementation of the Pacific Northwest Electric Power Planning and Conservation Act:
>
> -- maximize the use of environmentally acceptable and cost-effective energy conservation and renewable resources;
>
> -- avoid unnecessary thermal power development;
>
> -- optimize regional economic development through the promotion of labor-intensive energy resources and local financing;
>
> -- assure that the financial assistance and local development provisions of the Act be made available on an accelerated basis to those most in need of such provisions -- the low income and elderly;
>
> -- promote equitable and resource-conservative rate structures;
>
> -- protect the natural environment, including the fish and wildlife resources, of the region;
>
> -- maximize the use and development of community-based resources and structures in implementation of the Act.

At its April 1982 meeting, the Coalition added an eighth principle to this list:

> -- Ensure the preservation of democratically controlled local public power systems in the Pacific Northwest (i.e., public utility districts, cooperatives, and municipals).

The sections that follow explain how the Model Plan advances each of these goals. The body of the Plan consists of chapters and appendices that explain in detail the technical and policy justifications for the Plan's recommendations. The bulk of that work was submitted to the Coalition on January 22, 1982, and is now being revised in response to comments. This summary, which was endorsed unanimously by the Coalition at its April 1982 meeting, describes the final product that is emerging from that process. It also suggests ways that citizens, Coalition members, and other groups can make the Model Plan work for them. Among other things, the Plan offers a way to control increasingly unmanageable residential utility bills; expand job opportunities, and stimulate a depressed regional economy; decentralize control of energy resources and increase local self-sufficiency; and convince local utilities to reject involvement in high-risk, high-cost efforts to build new coal and nuclear power plants.

A theme that dominates the Model Plan is the importance of public participation in regional energy planning, with particular reference to the implementation of the Pacific Northwest Electric Power Planning and Conservation Act ("the Regional Act"). The ultimate beneficiaries of the Model Plan can and must assume a leading role in its implementation; the Regional Act expressly declares Congress's determination "to insure widespread public involvement in the formulation of

regional power policies." True to that spirit, the Model Plan itself already has undergone extensive review and comment, and will continue to evolve as that process continues.

I. Maximizing the Use of Environmentally Acceptable and Cost-Effective Conservation and Renewable Resources

In passing the Regional Act, Congress made clear its view that no new coal or nuclear power plants should be built in the Pacific Northwest until all options had been exhausted for developing cost-effective conservation and renewable resources. The economic and environmental justifications for this decision are obvious. Nonetheless, the region's utilities are still attempting to secure construction permits for eight new coal and nuclear ("thermal") plants in Oregon and Washington alone, while seeking to retain the option of completing two recently "terminated" plants, WPPSS Nuclear Units 4 and 5.

The Model Plan assembles an extensive -- although by no means exhaustive -- inventory of conservation and renewable energy measures that would cost less than, and eliminate the need for, new thermal plants. This analysis begins with an estimate of the economic and environmental costs of additional coal and nuclear generation. Discussion then turns to the nature and potential of less expensive conservation and renewable energy alternatives.

A. The Cost-Effectiveness Threshold: Economic and Environmental Costs of New Thermal Plants

The Model Plan develops separate estimates for the economic costs of new coal and nuclear plants, taking into account -- as the Regional Act requires -- construction and maintenance, transmission, waste disposal, end-of-cycle costs, and fuel costs. The Plan then addresses environmental costs, and argues -- based on a detailed analysis of the different impacts of various measures -- that the quantifiable environmental damage (including destruction of human life and property) associated with coal and nuclear facilities is significantly greater than that accompanying wind machines, solar heating systems, and most conservation measures. Projected dollar costs of coal and nuclear facilities are based on Creston Unit 1, the next coal-fired plant scheduled for construction in the region, and WPPSS Units 4 and 5, the nuclear units now under construction that are furthest from completion.* The results of the calculation are presented below.

*Although nominally "terminated," these plants are being maintained in a status that will permit construction to resume if the necessary financing arrangements can be made.

	Creston Unit 1	WPPSS Units 4 & 5
Construction, maintenance waste disposal, end-of-cycle costs, fuel costs	7¢/kWh	8.2¢/kWh
Line losses and transmission costs	1.4¢/kWh	1.6¢/kWh
Quantifiable environmental costs	2¢/kWh (minimum)	2¢/kWh (minimum)
Total	10.4¢/kWh	11.8¢/kWh

These costs are given in 1982 dollars. Actual costs to consumers in future years would be higher, reflecting the impact of inflation.

These results mean, concretely, that the region is better off investing in measures that cost less than 10.4 cents/kWh than purchasing Creston or a comparable coal plant, and that this "cost-effectiveness threshold" increases to 11.8 cents/kWh if the alternative is WPPSS Units 4 and 5 or a comparable nuclear plant.* The Model Plan identifies many such alternatives, which are described below; what bears emphasis here is that the list should not be considered exclusive. Additions can and will be made continually by Coalition members and others.

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*Under the Regional Act, conservation measures would have priority over these plants even if their costs per kilowatt-hour saved were up to 10% higher than the figures cited in the text. Pub. L. No. 96-501, § 3(4)(D).

B. Conservation and Renewable Energy Measures

The Model Plan's discussion of measures is intended to serve two purposes. First, it shows how to determine whether a particular conservation or renewable energy option is cost-effective. The same methods can be applied to any measure that is not discussed specifically in the Plan. Second, the Plan projects the likely impact of widespread adoption of certain readily available and well-understood measures, for which costs and savings could be documented and quantified.

Thus, the Plan assembles packages of cost-effective conservation and renewable energy measures for "retrofitting" existing homes, commercial buildings, industrial processes, and irrigation systems. It also identifies ways of ensuring that such measures are included in new buildings, processes, and systems. The next four subsections give details on the Plan's recommendations for each major category of electricity use.

These recommendations focus on buildings and equipment, because efficiency improvements in "hardware" are capable of producing reliable energy savings or production at no sacrifice in comfort or convenience. Changes in energy-related behaviors are and should remain the choices of each individual. However, innovative education programs, which increase people's understanding of the energy-related impacts of their activities, show promise of inducing substantial amounts of low-cost conservation and increasing the energy savings

realized from Model Plan measures. Programs that increase the energy management skills of Northwest citizens should be implemented on an experimental basis, and the resulting benefits should be evaluated in field-test settings. Since the Model Plan does not assume energy savings from such programs, the Plan's assumptions regarding future energy needs are conservatively high.

1. Residential Sector

Conservation measures are identified for all of the dozen or so major end uses that account for residential electricity consumption. Conservation "packages," for existing homes, include:

- -- high levels of ceiling, floor, wall, and water heater insulation (generally up to R-49, R-38, R-11, and R-19 respectively), where structurally feasible;
- -- leak-sealing to reduce air infiltration, accompanied by caulking and weatherstripping around doors and windows;
- -- low-flow showerheads and plumbing;
- -- substitution of high-efficiency heat pumps for resistance space heaters;
- -- substitution of solar units or high-efficiency heat pumps for resistance water heaters;
- -- reducing heat loss from windows through additional panes, thermal shutters, and surface treatments;
- -- air-to-air heat exchangers, where needed to ensure high indoor air quality;
- -- passive solar retrofits, including greenhouse or sunspace additions, Trombe wall conversions in existing masonry walls, and thermosiphon panels;

-- high efficiency electric appliances; and

-- high efficiency lights.

It should be noted here that nearly all these measures, raised in some instances to still higher levels, were included in a conservation proposal recently submitted to the Bonneville Power Administration by the Pacific Power and Light Company ("The Hood River Pilot Conservation Project," February 24, 1982).

The Model Plan recognizes that not all measures are appropriate or practicable candidates for installation in all existing homes. Thus, in projecting the impact of retrofits on regional energy needs, provision is made for the inability of many houses to accommodate certain measures, due to structural or other constraints. Moreover, although conservation measures are discussed on a region-wide average basis, implementation strategies are tailored to the needs of individual houses and climate zones. Each house would be visited by an energy auditor, who would produce a list of conservation and renewable energy measures appropriate for that house. This list would generally include some or all of the measures described above, although in climates east of the Cascades still more extensive retrofits often will be cost-effective. In many cases, special family characteristics will lead auditors to broaden the scope of their recommendations. For example, a large family with

above-average hot water needs might benefit by installing both a solar water heater and a heat pump back-up system, along with a super-low-flow showerhead.

We assume that retrofits will be phased in gradually, and that some households will decline to participate in all or part of the retrofit programs. Also, recognizing the uncertainties inherent in predictions of this kind, we identify a range of likely outcomes bounded by "high conservation" and "low conservation" scenarios. The table below illustrates this procedure, listing assumptions used to project residential needs for space heating in future years.

Percentage of Total "Achievable Savings"* From Space Heating Retrofits Realized Between 1980 and 2000

	Low Conservation Case	High Conservation Case
1985	9%	25%
1990	39%	70%
1995	54%	90%
2000	60%	95%

*The target for "achievable savings" is substantially less than 100% of the technical potential for retrofits; it assumes nonparticipation rates for each measure ranging from 10-30%, and incorporates an allowance for weatherization already completed.

These and comparable assumptions provide specific targets for use by Coalition members and others in monitoring the progress of retrofit programs at the local level. On average, households participating in the Model Plan program should realize reductions in electricity needs of about 50%; in some instances, savings will exceed 75%. The calculation of energy savings assumes higher thermostat settings in the aftermath of retrofits, as a conservatism. The average cost of residential sector savings is less than 3.5 cents per kilowatt-hour, in 1982 dollars.

For new houses, the Model Plan recommends enactment of building codes calculated to minimize the life-cycle cost of housing to occupants (purchase price plus utility bills). The proposed codes incorporate substantial flexibility in choice of design, and allow trade-offs between different measures as long as an overall target for energy consumption per square foot is reached. This "energy budget" is based on a prototype house incorporating passive solar heating, a high-efficiency heat pump, and cost-minimizing insulation levels. Actual houses need not resemble the prototype; they can substitute more of some measures for less of others.

Energy budgets will need to be adjusted to reflect differences in regional climate zones. The Model Plan uses the zone west of the Cascades to illustrate the methodology and results. Solar and conservation measures, working together,

typically will reduce space heating needs per square foot of housing by 90% compared with current practice. The proposed building codes will encourage, in addition to measures discussed for existing homes, the widespread incorporation of passive solar design principles in new housing, and the accelerated development of solar-assisted heat pumps and ground water-based heat pumps. These codes would be preceded and supplemented by financial incentives based on the energy performance of new housing construction, which would override the increase in purchase prices and help more people qualify for home ownership.

The Model Plan does not seek to encourage installation of electric heat in new housing, but neither does it view as an acceptable "conservation" alternative the construction of inefficient structures that are heated with fossil fuels. Building codes and financial incentives for upgrading the construction of housing shells should not discriminate among heating sources. However, hook-up charges for new electric resistance-heated houses are an appropriate means of recovering the true costs such heating systems impose on the region, unless -- in accordance with the Model Plan's recommendations -- the building codes applicable to such houses have been revised to reduce space heating needs to trivial levels.

The Model Plan also describes regulatory and incentive approaches for increasing the efficiency of appliances. The

table below lists savings over current average consumption for the major appliance categories that will result if these recommendations are adopted.

Appliance Category	Low Conservation Case	High Conservation Case
	Savings Realized by New Appliances, Compared to Current Average Consumption, After 1985	
Refrigerators	46%	70% (after 1987)
Freezers	31%	73% (after 1987)
Cooking Equipment	17%	40% (after 1990)
Televisions	55%	55%
Central Air Conditioners	35%	51%
Room Air Conditioners	28%	56%
Clothes Dryers	10%	10%

2. Commercial Sector

In the commercial sector, where variation in building types and uses is much greater than that found in the residential sector, the Model Plan relies on a combined program of audits and incentives to reduce electricity needs of existing buildings. Generic measures recommended for retrofits include:

Lighting

-- use daylighting to replace artificial lighting

-- reduce excessive general or background lighting intensities

-- focus high illumination levels exclusively on work surfaces

-- use more efficient bulbs and fixtures

Cooling

-- reduce cooling loads through lighting conservation

-- reduce solar heat gains by shading windows

-- use outside air for cooling whenever possible

Space Heating

-- increase insulation and seal leaks

-- install high-efficiency heat pumps

-- cut back ventilation to code standards

-- recover heat from ventilation air

Water Heating

-- increase heating efficiency by installing solar water heaters or heat pumps

-- reduce hot water needs by installing more efficient dishwashing appliances or low-flow plumbing units

Based on these and related measures, we assume that 15% savings can be achieved, on average, through measures that will pay for themselves in reduced electricity bills in two years or less. That figure increases to 40%, again on average, if incentives are in place to induce building owners to take

advantage of the full potential of cost-effective efficiency improvements. The table below gives the Model Plan's targets for implementation of the 15% and 40% retrofits, respectively.

Percentage of Buildings Retrofitted for 15% or 40% savings (based on surviving mid-1982 stock)

	Low Conservation Case		High Conservation Case	
	15% savings	40% savings	15% savings	40% savings
1985	6%	10%	7%	13%
1990	8%	40%	9%	51%
1995	14%	50%	10%	66%
2000	17%	52%	18%	67%

Savings realized through this program would cost ratepayers less than 40% as much as an equivalent amount of output from a new coal or nuclear power plant. In addition to retrofits, the Model Plan recommends adoption of lighting standards for existing commercial buildings, to promote de-lamping, upgrading of efficiency, and lighting system redesign.

For new all-electric buildings, the Model Plan proposes building codes based on energy consumption targets averaging 6 kWh per square foot, a reduction of more than 50% from levels typical of current new construction. As in the residential sector, flexibility will be the cornerstone of the new codes.

Lower lighting energy needs, which would result from systems emphasizing daylighting and automatic switch-offs, could be used to displace heavy insulation; higher lighting consumption could be compensated by extra-efficient cooling systems and active solar units. Factor-of-three or greater variation in lighting and insulation levels would be within reach of designers willing to employ these or other innovative approaches. Passive solar design principles will play an increasingly important role, particularly in reducing energy needs for cooling through adroit use of thermal mass.

3. Industrial Sector

In the postwar era, declining real prices for electricity have been a mainstay of industrial growth in the Pacific Northwest. However, recent developments have eliminated the prospect of expansion fueled by cheap energy. The region is now experiencing reduced industrial electricity consumption through production cutbacks and business failures. Forecasters and utilities need to recognize what plant managers understand all too well: business as usual, in the form of a return to robust growth in electricity consumption, is not an option. The region's industries will cut back on electricity consumption -- either through curtailment or through efficiency improvements. The Model Plan seeks to promote the latter course, as the only viable route to expanded production and employment in the industrial sector.

The Model Plan's "high demand scenario" for industry assumes that growth in industrial production will soon resume at the high rates featured in conventional utility forecasts. The "low demand scenario" is based on somewhat lower -- and more plausible -- growth rates. Both scenarios assume that Northwest industries will take advantage of some -- but by no means all -- opportunities for increasing the efficiency of four major processes: mechanical drive, production of process heat, electrolysis, and lighting. Together, these broad end use categories account for almost all of the industrial sector's electricity consumption.

In addition to process efficiency improvements, we assume that Northwest industries will expand substantially their use of waste heat for the production of electricity, through cogeneration. The Model Plan derives its estimate of cogeneration potential from a recent regional survey commissioned by the Bonneville Power Administration (BPA).

The results of the analysis are highly encouraging. The industrial sector can maintain the highest twenty-year growth rates envisioned in the most optimistic current utility forecasts and still reduce total electricity needs by 14%, compared with 1980 levels. The measures needed to sustain these efficiency increases all pass the cost-effectiveness test outlined in the Model Plan.

4. Irrigation Sector

The Model Plan's irrigation sector analysis is based on a comprehensive study prepared recently for the Bonneville Power Administration.* That study identifies extensive cost-effective opportunities for improving the efficiency of water application and pumping, and describes likely changes in crop patterns and irrigation systems. It also provides a basis for projecting future increases in acreage under irrigation, which affect electricity consumption in two ways. Such increases lead to withdrawals of additional river water, which otherwise could be used to generate electricity, and boost electricity consumption for irrigation itself.

The Model Plan presents "high" and "low" demand scenarios for irrigation, based on differing assumptions about implementation rates for conservation and growth in irrigated acreage.** Thanks to extensive efficiency improvements, electricity needs under even the high demand scenario constitute a 17% reduction from levels recorded in 1980; the low demand scenario produces a 30% reduction.

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*Norman Whittlesey et al., Demand for Electricity by Pacific Northwest Irrigated Agriculture (January 1982).

**The two scenarios assume that, by 2005, lands under irrigation will expand by 729,000 acreas and 600,500 acres, respectively.

The expansions in irrigated acreage constitute our best estimate of "business as usual," if current subsidies and other policies encouraging new irrigation are retained. However, because these expansions would cost the hydropower system dearly (up to 197 average megawatts in the year 2000), the region may well want to adopt policies that would stem growth in irrigated acreage. We will return to this option in the next section.

C. The Regional Council's Model Conservation Standards

The Model Plan's recommendations for utility-financed incentives and regulatory reform should find a powerful ally in the Northwest Power Planning Council. The Regional Act charges the Council with developing "model conservation standards" by April of 1983; these standards must "include, but not be limited to, standards applicable to (A) new and existing structures, (B) utility, customer, and governmental conservation programs, and (C) other consumer actions for achieving conservation." Moreover, the standards "shall be designed to produce all power savings that are cost-effective for the region and economically feasible for consumers, taking into account financial assistance made available to consumers [by the Bonneville Power Administration]." Every regulation, code, and financial incentive program mentioned in the earlier part of this section is a strong candidate for Council

adoption, pursuant to these statutory requirements. These include:

1. Residential and commercial building codes, and accompanying utility financing;

2. Utility-financed audit and retrofit programs for existing residential and commercial buildings;

3. Lighting codes for existing commercial buildings;

4. Utility investment in cost-effective process efficiency improvements and cogeneration in the industrial sector; and

5. Regulatory and incentive programs targeted at low-income consumers (see Section IV below).

Jurisdictions that fail to adopt the Council's recommendations will face substantial rate penalties. In addition, the Council will be developing estimates regarding the amount of energy that BPA should plan to acquire from renewable resources.

These regulatory and financial incentives constitute an indispensable part of a sound regional energy program. Rate increases (price signals) by themselves are an inequitable and inefficient spur to development of Model Plan measures, because those most adversely affected are least able to respond without assistance. As noted above and in Section VII below, the Plan recommends a diversity of approaches emphasizing education, audits, improved price signals, and incentives/regulations working in tandem. To the extent practicable, audits and incentives should be offered <u>in advance</u> of new price signals, to minimize hardship for those most vulnerable to rate increases.

In sum, a key goal of the Model Plan is to provide Coalition members and others with a comprehensive set of proposals to put before the Council during a series of region-wide hearings that will precede enactment of model conservation standards. If the Council is receptive, its actions will help ensure that the benefits of the Model Plan are fully realized.

II. Avoiding Unnecessary Thermal Power Development

One of the Coalition's objectives in preparing the Model Plan was to determine whether new nuclear or coal-fired power plants would be required to meet the Northwest's energy needs over the next two decades, if vigorous efforts were made to increase the efficiency of electricity use and utilize cost-effective renewable energy resources. We conclude that no new thermal plants are needed; indeed, under the Model Plan, it would be possible to defer at least five plants that are now under construction.

This section summarizes our forecast of regional electricity needs through the year 2000 if the Model Plan is implemented. To reflect uncertainties about future policy decisions and regional growth, the forecast is expressed as a range, reflecting both "high demand" and "low demand" estimates. The "high" scenario assumes that policy decisions and economic trends produce somewhat smaller efficiency

increases, less rapid "penetration" of conservation measures, and higher industrial growth, compared with the "low" scenario. Regional requirements under the Model Plan are compared in Table 1 with those predicted in three other recent studies: the official forecast of the Pacific Northwest Utilities Conference Committee (PNUCC); the Washington State University (WSU) forecast, which was commissioned by the state legislature in 1981; and the draft forecast published in April 1982 by the Bonneville Power Administration (BPA). The "high demand" scenario in the Model Plan projects electricity needs for 1990 that are 15%, 21%, and 35% below the lowest WSU estimate, the BPA estimate, and the PNUCC estimate, respectively. Comparable figures for the "low demand" scenario are 23%, 28%, and 41%. The discrepancies are attributable primarily to the Model Plan's greater emphasis on cost-effective ways to reduce electricity needs.*

Table 2 compares energy requirements under the Model Plan's "high demand" forecast with energy resources available to the Northwest now and in the future. Generous margins of safety result, despite the following assumptions:

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*Thus, for example, the BPA forecast does not include "savings which might be achieved through future conservation programs budgeted by BPA, by local and state governments, or by utilities"; also excluded are the effects of building and appliance efficiency "standards which may be proposed by the Northwest Power Planning Council, federal, state or local government, or by public and private utilities."

- o every year of the forecast is part of a "critical water" period in which droughts drastically reduce hydropower availability;
- o only three of the eight large-scale plants now under construction in the region are completed (Valmy Unit 2, Colstrip Unit 3, and WPPSS Unit 2);
- o the two nuclear plants in operation during most of the forecast period, Trojan and WPPSS Unit 2, produce only 56% of their rated capacity (PNUCC assumes 71% and 75% capacity factors, respectively)
- o Colstrip Unit 3 operates at only 64% of its rated capacity (PNUCC assumes a 75% capacity factor); and
- o PNUCC's assumptions regarding the future energy contribution of the hydropower system are reduced by 900 average megawatts to allow increased fish protection (with a net loss of 600 average megawatts, as explained in section VI below).

In other words, under the Model Plan, the following thermal plants could be deferred indefinitely without creating a danger of electricity shortages:

1. Colstrip Unit 4 (Coal, Montana)
2. Creston Unit 1 (Coal, Washington)
3. Creston Unit 2 (Coal, Washington)
4. Creston Unit 3 (Coal, Washington)

5. Creston Unit 4 (Coal, Washington)
6. WPPSS Unit 1 (Nuclear, Washington)
7. WPPSS Unit 3 (Nuclear, Washington)
8. WPPSS Unit 4 (Nuclear, Washington)
9. WPPSS Unit 5 (Nuclear, Washington)
10. Pebble Springs Unit 1 (Nuclear, Oregon)
11. Pebble Springs Unit 2 (Nuclear, Oregon)
12. Skagit/Hanford Unit 1 (Nuclear, Washington)
13. Skagit/Hanford Unit 2 (Nuclear, Washington)

The Model Plan also identifies a number of options, preferable to thermal plants on cost, reliability, and flexibility grounds, which provide an additional margin of safety in case demand growth outstrips expectations or the region must prematurely retire some of its coal, nuclear, or hydro plants. These include:

o Wind-generated electricity: The Model Plan provides a survey of cost-effective, environmentally acceptable wind energy potential, which reaches 170 average megawatts by 1990 and 984 average megawatts by the year 2000. Wind units lend themselves well to a flexible power planning strategy, since they can be added to the system in small increments (unit sizes range from 50 kilowatts or less to 6 megawatts) and require only one to two years for site preparation and installation.

- Electricity surcharges or "curtailment purchases" in times of threatened supply insufficiency: The Northwest Power Planning Council has expressed considerable interest in readjusting economic incentives to minimize disruptions in response to unexpected supply insufficiencies. Rather than paying to stockpile expensive power plant capacity to meet such emergencies, ratepayers would benefit from less costly alternatives that include temporary surcharges and "buy-backs" of electricity from large industries, in the event that appeals for voluntary short-term cutbacks are insufficient.
- Environmentally acceptable small-scale hydropower projects: Unfortunately, the current surge of interest in "small hydro" projects has produced many proposals that could seriously harm the region's fish and wildlife resources. However, such damage can be minimized where facilities are installed at existing dams and irrigation systems. If properly managed and sited, these resources offer an additional alternative to thermal power for meeting future electrical energy needs in the Northwest.
- Geothermal district heating: Both Klamath Falls, Oregon and Boise, Idaho now make direct use of hot water geothermal resources. Applications include pavement de-icing and heating of residential and industrial buildings, commercial buildings, and pools. Many other

communities may be able to take advantage of the Northwest's ample endowment of low temperature geothermal resources, for district heating and other purposes.

- Financial incentives to prevent net growth in irrigated acreage: If irrigated acreage can be stabilized at current levels, instead of growing as the Model Plan assumes, up to 200 average megawatts could be restored to the Northwest's hydropower system by the year 2000. Our preliminary calculations indicate that irrigation subsidies so distort the market that the region could actually save money by buying land targeted for irrigation, instead of replacing the electricity generation lost through additional water withdrawals. Less expensive strategies almost certainly can be found for correcting the skewed incentives that create this anomalous situation.
- Photovoltaics: At some point within the period of the forecast, electricity from photovoltaics cells probably will become less expensive than the output of new coal and nuclear plants in at least some areas of the region. Quantifying this potential is difficult at present, but photovoltaics can be expected to make a significant contribution in decentralized agricultural and residential applications.*

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*See, e.g., Natural Resources Defense Council, Choosing an Electrical Energy Future for the Pacific Northwest: An Alternative Scenario 104 (1980).

These options, and the other Model Plan measures, permit far more flexible power planning than large scale thermal power plants with ten to fourteen year lead-times. As a report recently prepared for the Northwest Power Planning Council observed*:

> When comparing projects that are equally costly to the region, those available on short notice should be given priority over those with long lead-times; small projects should be preferred to large ones, and programs that can be slowed, halted, or reversed should be more useful than those entailing inflexible commitments.

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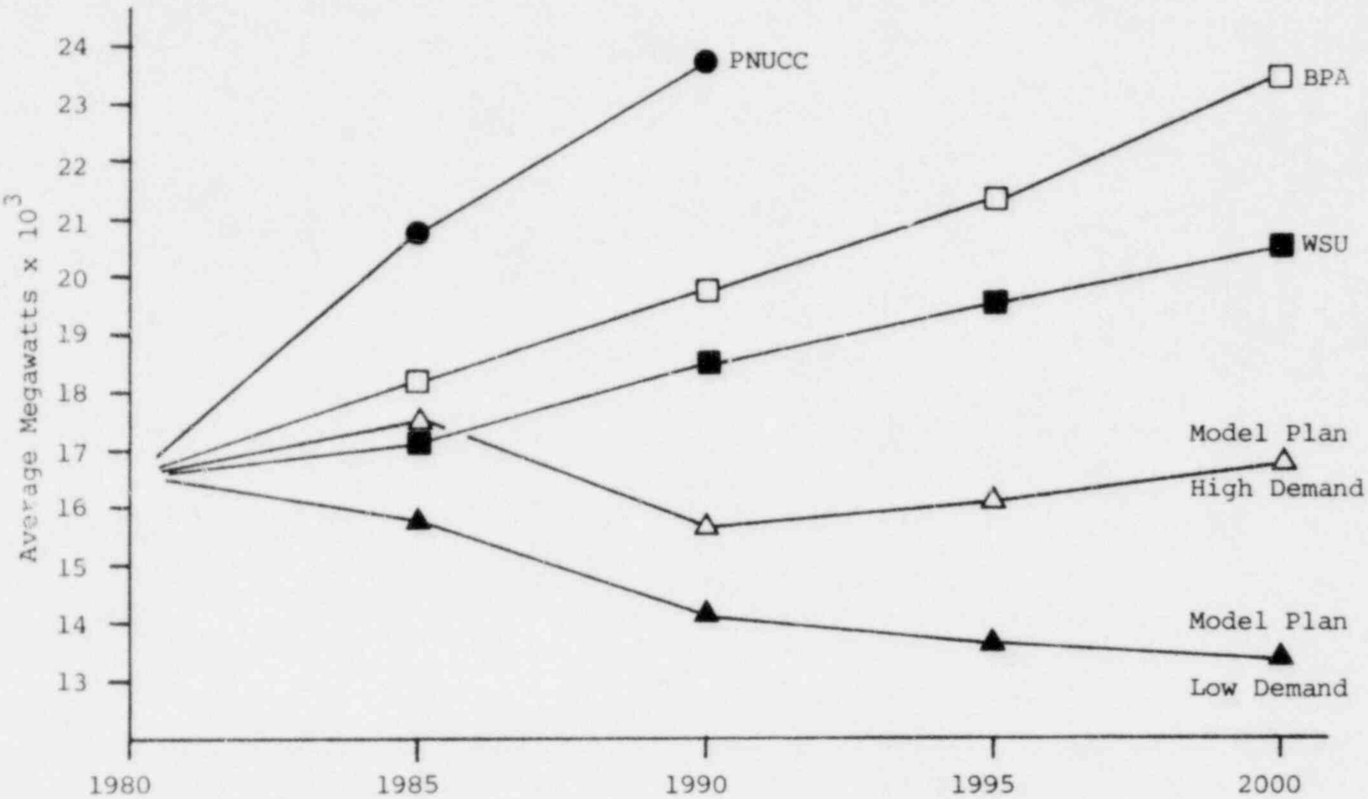
*K. Lee, "The Path Along the Ridge: Regional Planning in the Face of Uncertainty," at p. 5 (March 1982).

Table 1: Comparison of PNUCC, BPA, WSU, and Model Plan Forecasts



	PNUCC[a]	BPA[b]	WSU[c]	Model Plan: High Demand Scenario	Model Plan: Low Demand Scenario
1985	20,765	18,120	17,120	17,300	15,700
1990	23,834	19,624	18,410	15,600	14,100
1995	not available	21,350	19,510	16,100	13,600
2000	not available	23,333	20,490	16,800	13,400

a. From Pacific Northwest Utilities Conference Committee, Northwest Regional Forecast of Power Loads and Resources: July 1981-June 1992.

b. From Bonneville Power Administration, Forecasts of Electricity Consumption in the Pacific Northwest (April 1982).

c. From Washington Energy Research Center/Washington State University, Final Report to the Washington State Legislature, Independent Review of WNP-4 and 5 (1982) (Table A-15) (Projected loads, assuming termination of WPPSS Units 4 and 5, "moderate demand growth," and "moderate conservation and renewables").

Table 2: Comparison of Projected Loads and Resources Under the Model Plan

(In Average Megawatts)

(All resource estimates are taken from Pacific Northwest Utilities Conference Committee, Northwest Regional Forecast of Power Loads and Resources (1981).)

1980		1985		1990		1995		2000	
Loads	Resources	Loads	Resources	Loads	Resources	Loads	Resources	Loads	Resources
17200	17595[a]	15700 to 17300	17878[b]	14100 to 15600	17335[c]	13600 to 16100	17285[c]	13400 to 16800	17238[c]
Reserve in future years under the High Demand Scenario:		578		1735		1185		438	

a. Reflects resources available in a "critical water" (drought) year.

b. Reflects resources available in a critical water year; assumes retirement of Hanford N-Reactor and operation of Valmy Unit 2, Colstrip Unit 3, and WPPSS Unit 2. Hydropower contributions have been reduced for fish protection and irrigation, as explained in the text.

c. Same assumptions as note be except that contributions from combustion turbines are reduced 50% (adopting PNUCC's assumption).

III. Optimizing Regional Economic Development Through the Promotion of Labor-Intensive Energy Resources

The Northwest's grim unemployment statistics afford one of the strongest reasons for supporting the Model Plan. Coal and nuclear plants cost the regional economy dearly in terms of job creation, by siphoning funds from more job-intensive uses both within and outside the energy sector. The Model Plan, by contrast, would (1) produce more jobs per dollar invested in energy services than the thermal power alternative and (2) free up billions of dollars for use in sectors that are more job-intensive than power plant construction.

Several findings from recent studies dramatize these points. A 1981 report to the Washington Environmental Council identified the utility industry as one of the economy's least promising in terms of jobs produced per dollar of investment.* Compared with an average job-creation cost for the entire manufacturing sector of $18,000 per employee (in 1977 dollars), an investment of $105,000 is needed to create a new job in the public utility sector. Thus, "money saved on energy is almost certain to create more jobs when it is invested in other parts of the economy."**

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*D. Smolewicz, "Energy and Jobs," May/June 1981 Solar Washington 11.

**Id.

By the same token, a dollar used within the energy sector for conservation and solar applications will yield more labor years than a dollar diverted to a new large-scale power plant. In fact, the ratio is almost three to one, according to New York's Council on Economic Priorities.* Additional features of the tradeoff are described in the WEC report:

> Jobs in conservation and solar will have a more decentralized character than jobs produced by power plant construction. While the manufacturing of components will probably pass largely into the hands of large corporations, the construction and installation of conservation/solar technologies will be done almost entirely by small neighborhood firms. In contrast, mining and power plant construction often require workers to move to remote job sites.

Finally, through efficiency improvements that will enable Northwest industries to compete more successfully in national markets (see section I above), the Model Plan provides a way to reverse current trends toward plant shut-downs and production cutbacks. Model Plan measures also offer local governments a way to reduce energy costs substantially without cutting back other functions, which will help preserve jobs and essential public services.

The Coalition staff is now working to quantify the various employment-related benefits that would emerge under the Model

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*Council on Economic Priorities, Jobs and Energy, at p. 12 (1979). See also Mid-Peninsula Conversion Project, Creating Solar Jobs: Options for Military Workers and Communities 12 (1978).

Plan. What bears emphasis here is that those benefits are threatened by any move to expand the Northwest's inventory of thermal power plants. The dollar drain for plants already under construction reached unprecedented levels in 1981, and five of the investor-owned utilities serving the region each intend to spend more than $300 million for construction during 1982.* Over the same period, the Washington Public Power Supply System plans to borrow at least $1.4 billion, of which $850 million is already committed. These are ominous trends for anyone seeking ways to put an end to rising unemployment in the Pacific Northwest; the Model Plan offers an urgently needed change of course.

IV. Assuring that the Financial Assistance and Local Development Provisions of the Act are Made Available on an Accelerated Basis to Those Most in Need of Such Provisions

The percentage of household budgets that low-income families must allocate to energy is up to three times what middle-income families pay. Conservation and renewable energy measures offer a way to cut these increasingly unmanageable utility bills dramatically, but neither the "free market" nor conventional incentive programs will speed these measures to those who need them most urgently. The indigent suffer under a

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*"Utilities Will Increase Construction Spending," Seattle Daily Journal of Commerce, March 11, 1981.

dual handicap: they lack funds to invest even in partially-subsidized measures with substantial initial costs, and they live disproportionately in rental housing, whose owners control decisions on whether retrofits should be undertaken. The Model Plan offers a comprehensive response to these barriers, involving new regulatory and financial inducements coupled with aggressive outreach and marketing programs. Key recommendations include:

- o Phased-in, mandatory weatherization of rental housing, drawing on precedents already established in Portland, Seattle, Eugene, and elsewhere. The Bonneville Power Administration, acting through the region's utilities, would provide financing calculated to ensure that no building owner was asked to shoulder costs disproportionate to benefits realized upon sale of the weatherized units. Criminal penalties would play no part in the enforcement process, which would center on preventing sales of unweatherized units until funds had been deposited in an escrow account to meet the seller's share of retrofit costs. Alternatively, owners who failed to comply within a specified period could simply be required to pay the extra electricity costs they were imposing on their tenants and on the region.
- o Substantial expansion of existing financial and rate incentives for adopting the Model Plan measures described

in Section I above, to help ensure that no family is denied the opportunity to retrofit its residence for lack of funds. These incentives would be structured to ensure that no family's monthly costs for financing a retrofit and paying subsequent utility bills would exceed current utility bills.

- For families near or below the Federal Poverty Guidelines (less than $10,000 for a family of four), a prerequisite for participation is Bonneville's agreement to pay 100% of the costs. From a regional standpoint, these payments are not "handouts," but purchases of a cost-effective energy resource. Accordingly, a number of Northwest Conservation Act Coalition members already are working to establish a BPA-funded program using the federal low-income weatherization delivery system of state governments and Community Action Agencies. Prompt BPA action is urgently needed; direct federal support for low-income weatherization was cut 50% in fiscal year 1982, and is slated for still further reductions in FY 1983.
- In general, aggressive outreach -- including door-to-door solicitation and neighborhood-based demonstrations -- is essential to build the broadest possible base of participation in the Model Plan's residential programs. Media advertisements and mass mailings are not sufficient. A recent Pacific Power & Light proposal for a path-breaking demonstration program in Hood River, Oregon -- designed to

"assess the degree to which the universal weatherization of a community's structural stock can be achieved"* -- is built around a door-to-door marketing effort.

Some utility officials have expressed resistance to the concept of special incentives for low-income participation, arguing the Bonneville "is not a social welfare agency." But it is precisely because Bonneville is an agency charged with acquiring all cost-effective conservation that it should be concerned about targeting financial assistance at the indigent. The region has at least 100,000 unweatherized, electrically-heated low-income residences.** As of May 1982, Bonneville was prepared to offer the occupants no more than partial financing for some of the residential measures identified in the Model Plan. Without a significantly expanded commitment, BPA will be abandoning a substantial, cost-effective conservation resource that is waiting to be extracted from low-income households. The agency will then have to spend still more money on higher-cost resources, which will worsen the plight of indigent and middle income ratepayers alike. BPA does not need to become a social welfare agency in order to reject this fiscally imprudent course.

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*Pacific Power & Light Co., "The Hood River Pilot Conservation Project," at 17 (February 24, 1982).

**Figures compiled by Spokane Legal Services Center in attachment to January 26, 1982 letter from James A. Bamberger to Steve Hickok.

V. Promoting Equitable and Resource-Conservative Rate Structures

In order to remove significant barriers to the development of cost-effective conservation and decentralized renewable resources, the Model Plan proposes numerous changes in current electric rate design policies. Virtually all of these policies have been adopted by at least one electric utility in the Pacific Northwest, but no utility has fully implemented the overall program we propose.

Rates should encourage people to use additional electricity only when the value of doing so exceeds the cost of generating the necessary kilowatt-hours. Economists generally agree that this goal is best served when goods are sold at a price equal to the marginal cost -- the cost of producing the last unit of goods. In theory, a consumer's willingness to buy at that price justifies the allocation of resources needed to produce additional units. But utility rates typically reflect only the average cost of all electricity produced. This has the effect of temporarily disguising the high cost of adding new supplies to the existing base, which is dominated in the Northwest by relatively inexpensive electricity from hydroelectric dams.

While consumers benefit from average cost pricing at the outset, it quickly takes a substantial toll on family and business budgets. Distorted prices lead inexorably to an unnecessarily expensive electrical energy system, as increased

demand spurred by deceptively low prices leads utilities to develop costly new sources of supply. The WPPSS fiasco provides a classic illustration of this problem.

In recent years, a number of remedial proposals have surfaced. One innovative approach, suggested by the Pacific Power and Light Company during rate hearings before the Oregon Public Utility Commissioner, was to increase rates to consumers to the level of marginal costs, with state and local governments using the increased revenues to reduce sales, property, and other taxes. Ratepayers as a whole would be no worse off (higher rates are offset by lower taxes), and electricity would be consumed only where cost-effective. However, such a drastic change in electricity prices would harm consumers who have made major investments based upon current conditions. This policy cannot be considered seriously unless mechanisms are found for assisting such consumers in altering their usage patterns.

The Model Plan proposes a number of less radical changes in rate design, which are all candidates for adoption by the Regional Council as model conservation standards. Alterations are needed at both the wholesale (BPA) and retail (utility) levels, in order to signal to consumers the actual costs and benefits they impose on the region through decisions to use more or less electricity. These proposals call for redesign of rates, involving offsetting increases and decreases in

particular rate schedules, to improve the reward system that electricity bills create.

At the wholesale level, the Model Plan calls for eliminating "demand charges," which serve no useful function in the region's mixed hydro-thermal system and provide unjustified benefits to certain large industrial customers. Also, for electricity used to serve residential sector needs, "tiered" wholesale rates are recommended. These rates would encourage utility and consumer investment in cost-effective solar and conservation measures, by increasing the rewards earned through reduced consumption. Finally, although wholesale rate discounts for utilities with low system densities would be retained, they would be delivered differently. Current policies have caused utilities qualifying for the discount to set retail rates and service charges that reward electricity waste, and do not ensure that the benefits of the discount are shared equitably among rural consumers -- whose unusually high distribution costs provide the justification for granting the discount in the first place. To correct these problems, the Model Plan would substitute uniform per-consumer discounts for the percentage discounts per-kilowatt-hour of sales that BPA now awards.

At the retail level, the Model Plan envisions seasonal shifts in pricing, to reflect differences in costs of providing electricity during peak and slack demand periods, and the

elimination of service charges. Residential rates would be tiered, for the reasons explained above, and would guarantee each customer a supply of low-cost electricity sufficient to meet essential needs. Existing electric heat customers would receive a larger low-cost allowance than those who heated with oil or gas. As a result, low-consumption households -- which include disproportionate numbers of indigent families -- would pay significantly reduced rates. Rates for large commercial and industrial customers would incorporate interruptible and time-of-day features.

Utilities that elected to go beyond the model conservation standards would qualify for BPA payments, in the form of "billing credits," for the additional energy saved as a result. The Model Plan provides examples of innovative rate designs that could meet this test, such as tiered retail rates for industrial and commercial consumers.

Finally, the Model Plan recommends that all costs of BPA conservation programs should be recovered through the agency's rates, and that all BPA customers that realize benefits from these programs should help defray their costs. Efforts to recover part of the costs of these programs through direct fees to participants, or to exempt some beneficiaries -- such as large industrial consumers -- from rate impacts, are inconsistent with both the Model Plan and the Regional Act.

If the recommendations of this section are adopted, many of the economic obstacles to cost-effective conservation and solar applications will disappear. Of course, other barriers will remain; experience elsewhere in the United States indicates that even extremely high electricity rates do not guarantee rapid implementation of cost-effective conservation and solar measures. Thus, in addition to rate reform, the Model Plan calls for regulatory action (see sections I and IV above), mechanisms to help consumers and businesses obtain initial financing for Model Plan measures (see section VII below), and special programs targeted at low income ratepayers (see section IV above). However, more equitable and resource-conservative rates clearly will play an important role in delivering the economic and environmental benefits of the Model Plan, by encouraging individual consumers and businesses to take responsibility for careful management of the region's electricity resources.

VI. Protecting the Natural Environment, Including the Fish and Wildlife Resources of the Region

The Model Plan advances this goal in several significant ways. Most obviously, it avoids the many severe environmental consequences that inevitably would attend construction of new coal and nuclear plants. Such facilities would bring, among other things, increased contamination of the air and impairment of visibility in both urban and rural areas of Idaho, Montana,

Oregon, and Washington, caused by the emission of hazardous particulates and gasses from coal-fired power plants; possible serious loss of aquatic life because of thermal and chemical pollution from nuclear power plants; increased fish mortality, decreased recreational safety, and disruption of commerce on the Columbia River due to increased use of hydro-generators for peaking power; increased risks of a catastrophic accident and routine release of hazardous radioactive materials at nuclear power plants and their supporting facilities; disruption of wildlife habitat and removal of thousands of acres of land from agricultural and recreational uses during and after the construction of transmission lines; and destruction of thousands of acres of other agricultural, grazing, and recreational lands by the surface mining of coal and uranium. Of course, the Model Plan's measures have environmental implications too, not all of them negligible. However, the Plan demonstrates that the negative impacts of its recommendations would be substantially less severe than those of the power plants that the recommendations would displace. Also addressed are mitigation measures for conservation (e.g., measures to ensure high indoor air quality) and renewables (e.g., siting plans for wind machines that minimize adverse aesthetic impacts).

The Model Plan also assumes regulation of the hydroelectric system to enhance fish migration and provide maximum protection

for fish and wildlife resources. Downstream migration of juvenile salmon requires high river flows during the months of April, May, and June; hydropower facilities currently are operated to maximize power production (and hence river flows) during the peak demand months of December, January, and February. There is extensive debate among fisheries agencies and advocacy groups concerning the amount of hydroelectric generation that must be foregone in order to ensure adequate spring river flows. The Model Plan doubles the 450 average megawatt estimate of the National Marine Fisheries Service, which has been criticized widely as inadequate. We then assume, conservatively, that one-third of the resulting 900 average megawatts of "shifted" hydropower can be recouped through mutually beneficial exchange agreements with California. Other analysts sensitive to the problem believe that the resulting estimate of net energy losses (600 average megawatts) is excessive,* but we have decided to opt for a margin of safety.

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*See, e.g., Romer Associates, Northwest Electric Load Shaping for Fish Enhancement (November 9, 1981).

VII. Maximizing the Use and Development of Community-Based Resources and Structures in Implementing the Act

The Model Plan lays out a path to increased local self-sufficiency and self-determination. It calls upon citizens and businesses to take their electrical energy futures into their own hands, and offers urgently-needed relief to local economies and ratepayers. But no one should assume that these goals will be realized automatically through the implementation of the Regional Act. This section suggests ways that local organizations and individuals can make the Act -- and the Model Plan -- work for them.

To ensure that utilities, local governments, organizations, and individuals can be effective actors, there should be a major emphasis on education and infrastructure development. It is not enough to offer financial incentives: the Model Plan also provides for education on energy use; on the design and implementation of conservation/renewables measures; and on the urgently needed infrastructure improvements described below.

In the past, the Pacific Northwest relied almost exclusively on utilities to produce and market electrical energy services. They developed systems for generating electricity at large-scale power plants, delivering the product to local customers, and convincing those customers to increase consumption steadily. By the late 1970s, this led to a paradoxical situation: utilities had developed a sophisticated

marketing system for selling an abundant and inexpensive commodity that was now both oversubscribed and costly. At the same time, efforts by conservation and renewable energy firms to offer alternative ways of meeting electrical energy needs were hampered by pricing and institutional barriers that constituted the legacy of this obsolete system.

The Regional Act marked an overdue recognition that the Northwest's future energy acquisitions must emphasize conservation and direct solar applications. This requires, in turn, a shift of emphasis toward the role of community-based resources and institutions. Acquiring energy through conservation and solar measures is fundamentally different, in concept and application, from earlier approaches based on large-scale generating units. The former strategy is built around millions of widely dispersed decisions and actions; the latter concentrates dollars and centralized management on a relative handful of energy resources. Also, solar and conservation expertise generally has been developed outside the utility sector, by small businesses, architects, engineers, contractors, and developers.

These considerations mean that the delivery systems for conservation and renewable energy systems must rely on local entities outside the traditional utility sector. These delivery systems are not yet in a position to meet the demands contemplated in the Model Plan; remedying that condition is a

crucial and immediate priority. For example, despite the rhetorical support that BPA and others have given the measures described in the Model Plan, many small businesses in a position to provide conservation and renewable energy services are currently failing as a result of cash flow problems. Forecasts of the major contributions that such measures can make must be backed by provision for commensurate programs.

In developing strategies for making sure this happens, it is useful to keep in mind that the Act sets up a region-wide competition among towns, cities, and states to develop cost-effective conservation and renewables. Communities that lag behind will find themselves paying part of the costs of programs initiated by communities that forge ahead. Of course, everyone ultimately benefits from this "race," because the resulting actions all work to reduce regional needs for expensive thermal power. But this is a competition in which no district that is solicitous of ratepayer interests can afford to fall far behind.

In all end use sectors -- residential, commercial, industrial, and irrigation -- implementation of Model Plan measures will require major contributions from diverse community actors and institutions. For example, housing services are delivered through a fairly well-defined "shelter industry" system, which involves consumers, home builders/ designers, realtors, appraisers, primary mortgage lenders, and

secondary mortgage lenders. Outside this system, various specialized small businesses have sprung up to deliver conservation and solar services to the residential market. To ensure widespread penetration of conservation and solar in the residential sector, the entire shelter industry system -- in conjunction with conservation and solar delivery mechanisms -- must be "primed." Prerequisites -- which apply also to the other end use sectors -- include:

(1) Education of consumers on the benefits of conservation and solar measures (*e.g.*, by community energy groups and energy extension services*);

(2) Access to capital for installation of conservation and solar measures (BPA is the Regional Act's primary financing mechanism, as explained below, but innovative approaches for improving and broadening access to these funds are urgently needed. Illustrative proposals appear at pages 47-50 below); and

(3) Quality assurance to ensure that measures perform as predicted (*e.g.*, major training programs for auditors and solar/conservation industry personnel are urgently needed).

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*The marketing agent for conservation programs must be credible (expert and trustworthy) in the eyes of the public. Several studies document, and rapidly rising rates will exacerbate, the credibility problems that traditional energy suppliers face in marketing conservation. Consumer-oriented, community-based organizations must play a substantially enhanced role in order to market conservation programs effectively.

Also important is a strengthened role for local government, both in policy formulation (e.g., building codes and development standards) and enforcement (where, among other things, training of building code inspectors assumes special importance). Local governments also possess many unexploited energy resource options, such as recovery of electricity by conservation in public facilities and encouragement of solar energy development with solar access ordinances. Through these and other means, the Model Plan calls on local government to become a significant supplier of new energy resources.

An obvious question immediately arises as to the availability of financing for these initiatives. Under the Regional Act, BPA becomes a major conduit for funds to back conservation and renewables at the local level. The Act repeatedly emphasizes BPA's obligation to acquire all cost-effective renewable energy resources needed to meet anticipated load growth, and adds still stronger guarantees for conservation: such measures get a 10% "bonus" in cost-effectiveness calculations, and the statute "prohibits BPA from letting up on conservation even if BPA has a power surplus on its hands."* BPA funds can reach the local level in at least four ways:

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*Eric Redman, "The Northwest Regional Power Act: Conservation and Resource Opportunities for Municipalities", at p. 7 (1981). See Pub. L. No. 96-501, §§ 3(4)(D) & 6 (b)(5).

(1) as payments for participation in BPA conservation programs, which already or soon will cover many residential and commercial retrofit measures;

(2) as payments to local banks and lending institutions, enabling them to lower interest rates for loans used by individuals and businesses to finance Model Plan measures;

(3) as outright purchases of the "capability" of conservation measures and renewable energy resources, through which BPA assumes the risk that the measures and resources may not perform as planned;

(4) as "billing credits," or reductions in the BPA wholesale electricity rates paid by utilities, in districts where conservation measures not covered by a BPA program are implemented, or where renewable resources are developed but not offered to BPA as described in item (3) above.

These funding mechanisms create the following illustrative options for implementing the Model Plan at the local level:

o In collaboration with citizens' groups and businesses, local utilities develop plans to finance installation of Model Plan measures by local contractors, and subsequently explore all possible ways to speed installations in residential and commercial buildings (Pacific Power & Light's proposed Hood River project is the best example

that has emerged to date; it includes most of the Model Plan's retrofit measures and calls for a door-to-door marketing campaign). As part of this effort, experienced citizens' groups run a series of workshops covering weatherization, home energy management, renewable energy retrofits, and consumer protection. Note that it does not matter whether individual measures are covered expressly by a BPA conservation program; all Model Plan measures not yet in that category will qualify for billing credits, which BPA must award once savings have been demonstrated.

- Instead of relying exclusively on utilities as conduits for its investments in residential conservation, BPA develops new approaches to work directly with local boards of realtors, local lenders, and local conservation and solar businesses to prime the conservation delivery pump. For example, realtors are given financial incentives to identify homes that are energy-inefficient at times of sale; local conservation businesses, working in conjunction with the realtors, are brought in to retrofit the properties; and the local utilities conduct follow-up inspections to ensure high-quality work.
- Citizens' groups convince their local government to adopt the Model Plan's recommendations for upgrading building codes and eliminating over-lighting in existing commercial buildings. The resulting electricity savings earn billing

credits,* which are used to defray costs associated with the new regulations and to reduce local utility bills.

- Local businesses or individuals form a corporation equipped to audit commercial buildings and install Model Plan measures. The corporation sells the energy savings it produces to its local utility, which recoups the purchase price from BPA through conservation program payments and billing credits. Alternatively, the corporation sells BPA the "capability" of its proposed program of efficiency improvements and renewable energy measures; BPA assumes all risks of the enterprise and guarantees payment for projected savings at a mutually agreed price.
- Local solar industries arrange for low interest bank loans to customers installing their products, made possible by BPA payments to the lender.**
- A local industrial plant installs efficiency improvements that permit it to maintain production with less electricity. It also discovers that its waste heat could be used, through cost-effective cogeneration, to produce

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*Billing credits would be earned until, and unless, the Regional Council called for equally stringent codes in its "model conservation standards"; after that date, the local code would still yield substantial rate benefits, by shielding residents from surcharges prescribed in the Regional Act.

**BPA has not yet established such a program, but the agency and the Regional Council are giving the option serious consideration.

substantial amounts of electricity. BPA pays for the efficiency improvements through billing credits, which are passed through to the plant by its utility. BPA also signs an advance guarantee to purchase the output from the cogeneration unit, lowering financing costs and ensuring a market for the energy.

- Local entities develop plans to build a small-scale, environmentally acceptable renewable energy generating resource. BPA funds the investigation and pre-construction expenses and agrees in advance to pay for anticipated output, ensuring the availability of favorable financing.

In working to ensure that their communities take advantage of these and related opportunities, Northwest citizens will find the Model Plan useful in still another respect: it affords specific targets against which to measure the adequacy of local efforts. Where Model Plan recommendations are omitted or diluted by a proposed utility program or building code, local groups can and should point out that the result is to squander opportunities for additional rate relief -- opportunities that other communities are unlikely to ignore. To preempt such problems, and promote its other goals, the Model Plan calls for initiation of county energy planning throughout the Northwest. County energy plans, to be developed with the broadest possible community involvement, should focus on present community energy

use; conservation and renewable resource potentials; the jobs and capital flow impacts of alternative community-based solutions to energy problems; and -- most important -- the development of community-wide strategies to meet county conservation and renewable resource goals.

The discussion of BPA's conservation and solar financing requires one significant qualification. BPA takes the position that such financing is tied to the execution of long-term power sales contracts by local utilities. The deadline for signatures is on or about September 1, 1982. Although most Northwest utilities are expected to accept the contracts, few had acted as of May 1982. A utility that lets the deadline pass is saying, in effect, that it intends to meet the long-term electrical energy needs of its customers without help from Bonneville. The response of local groups should be that such utilities must be prepared to replace BPA as the primary financing mechanism for conservation and solar programs in their service territories. Refusals to do so would provide a strong basis for campaigns opposing efforts by the abdicating utilities to burden ratepayers with new large-scale power plants.

Any utility that is contemplating a coal or nuclear power project should be asked by its ratepayers to answer one highly specific question: Would the plant be needed to serve the utility's loads if the measures described in the Model Plan

were installed throughout the utility's service territory at rates specified in the Plan? No Northwest utility lacks the capacity to adjust its demand forecasts in response to that question, and no utility that is leaning toward purchase of all or part of a new coal or nuclear plant is justified in refusing to address the alternatives offered by the Model Plan.

VIII. Ensure the Preservation of Democratically Controlled Local Public Power Systems in the Northwest (i.e., Public Utility Districts, Cooperatives, and Municipals)

Democratically controlled public power systems have an important role to play in the implementation of the Model Plan. This role includes, but is not limited to, assisting in the development of the broadly-based community energy plans described in section VII above, and working with other local groups and institutions to ensure that community conservation and renewable energy goals are realized. The thrust of the Model Plan is toward decentralized strategies for meeting energy needs, guided by public participation; involvement in that effort will both revitalize local utility systems and reaffirm the highest traditions of the public power movement.

One crucial point should be reemphasized in closing: the Model Plan will not succeed without broad support in Northwest communities. Extensive citizen involvement in program development and delivery of services under the Plan is essential to overcome political and institutional barriers that

otherwise could delay or defeat the effort. We repeat here a point made at the outset: the ultimate beneficiaries of the Model Plan can and must assume the leading role in its implementation. The primary goal of the materials summarized above is to provide assistance in doing just that.

APPENDIX 2

NRDC RESPONSE TO PNUCC COMMENTS ON THE DRAFT
MODEL ELECTRIC POWER AND CONSERVATION PLAN
FOR THE PACIFIC NORTHWEST (June 14, 1982)

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NRDC RESPONSE TO PNUCC COMMENTS ON THE DRAFT MODEL ELECTRIC POWER AND CONSERVATION PLAN FOR THE PACIFIC NORTHWEST

Ralph Cavanagh
Margie Gardner
David Goldstein

June 14, 1982

NRDC RESPONSE TO PNUCC COMMENTS ON THE DRAFT MODEL ELECTRIC POWER AND CONSERVATION PLAN FOR THE PACIFIC NORTHWEST

Introduction and Overview

On May 13, 1982, the Pacific Northwest Utilities Conference Committee (PNUCC) circulated a preliminary analysis of the Northwest Conservation Act Coalition's draft Model Electric Power and Conservation Plan for the Pacific Northwest. The draft "Model Plan" had been forwarded to PNUCC with a request for comments by the Natural Resources Defense Council, Inc. (NRDC), whose staff were the Coalition's primary technical consultants. PNUCC concluded that there were "numerous weaknesses in NRDC's analysis" and implicitly rejected the Model Plan's conclusion "that aggressive conservation programs can eliminate the need for most thermal plants planned or under construction in the Northwest." PNUCC found particularly questionable the Model Plan's "heavy" reliance on "(1) very optimistic (95-100%) penetration rates for conservation measures, (2) a variety of mandatory programs, (3) assumptions of very low future economic growth, and (4) artificially high avoided cost numbers (e.g., 100-120 mills)."*

As the body of this response makes clear, these assertions misconstrue the Model Plan. Penetration rates for retrofit cases never even approach 95-100%; several new "mandatory" programs are recommended, but the only ones "relied upon" in the forecast are building and appliance efficiency standards; economic growth rate assumptions are actually higher than those used by PNUCC forecasters; and avoided cost numbers substantially lower than 100 mills will validate the Model Plan's assumptions.

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*Memorandum from Randall W. Hardy to PNUCC Executive & Policy Committees (May 13, 1982).

We are convinced that misunderstandings on these and other points have led PNUCC to overstate its differences with the Coalition's analysis. We hope, accordingly, that these comments will promote consensus on many of the issues addressed in the Model Plan, while sharpening the debate in those areas where disagreement persists. Where PNUCC staff find our comments persuasive, we urge them to make appropriate revisions in their initial comments. We also hope that this dialogue will continue; PNUCC staff have made a number of constructive suggestions, and we appreciate the extensive effort that went into preparation of the PNUCC response.

At the outset, it is important to summarize areas where PNUCC and the Coalition do not disagree. The Model Plan incorporates both extensive policy recommendations and a forecast of future electricity needs; PNUCC's objections are almost exclusively centered on the forecast. It appears that there is agreement on the need for:

(1) improved efficiency standards governing the construction of new buildings and appliances;

(2) inclusion of such measures in the Regional Council's plan, as enforceable "model conservation standards;" and

(3) immediate BPA financing for Pacific Power and Light's wide-ranging pilot conservation program in Hood River, Oregon, which should help resolve many outstanding disputes about realistically achievable performance and penetration of cost-effective conservation measures.

PNUCC also has raised no objections to the Model Plan's advocacy of the use and development of community-based resources and structures in implementation of the Regional Act, and PNUCC has not contested the Plan's proposals to make use of the Act's incentives for rate structure reform. Nor does PNUCC

dispute the need for significantly expanded financial assistance to indigent consumers as a prerequisite to extracting cost-effective conservation resources from low-income households. Finally, PNUCC has not questioned that the Model Plan "would (1) produce more jobs per dollar invested in energy services than the thermal power alternative and (2) free up billions of dollars for use in sectors that are more job-intensive than power plant construction." If we may at least infer lack of opposition from this silence -- and we invite any further clarification that PNUCC may wish to make -- it appears that the Coalition and PNUCC are not nearly as far apart on key questions as the PNUCC comments might suggest. Compared with the scope of this apparent potential for consensus, the issues reviewed below are in most cases of lesser consequence.

The discussion that follows is keyed to the 36-page PNUCC document entitled "PNUCC Comments on NRDC Draft Model Plan;" unless otherwise indicated, page references are taken from that document. Citations to "MPDr" refer to the draft Model Plan circulated for comment in January 1982; citations to "MPSumm" refer to the Model Plan Summary, which was circulated in March 1982 and revised in May 1982.

1. GENERAL OBSERVATIONS (pp. 1-2)

<u>PNUCC Comment</u>: NRDC inaccurately casts the debate over the region's energy future as a "choice between two mutually exclusive options -- conservation and renewables on the one hand, and conventional powerplants on the other."

<u>NRDC Response</u>: The Pacific Northwest Electric Power Planning and Conservation Act ("the Regional Act") authoritatively grants cost-effective conservation and renewables priority over new conventional power plants. If the higher priority resources can meet the region's needs, no new

conventional plants should be built. It is within this straightforward framework, which emerges directly from the mandates of the Act, that the analysis of the Model Plan proceeds. New conventional plants are excluded not because NRDC deems them objectionable, but because the Model Plan forecast indicates that they are superfluous once less costly alternatives have been developed.

2. COST-EFFECTIVENESS (p. 2)

PNUCC Comment: NRDC oversimplifies cost-effectiveness analysis, which cannot be performed "through resource-by-resource comparisons. Rather, [cost-effectiveness] must be determined through long-term (20-year) analyses of alternative plans for resources."

NRDC Response: NRDC's analysis is certainly adequate for its primary purpose, which is to determine the electricity needs of a system in which realistically achievable conservation less expensive than new thermal resources is developed. Once such plants have been definitively excluded from long-range resource plans, further "fine-tuning" to develop a least-cost resource mix may well be appropriate. If, for example, PNUCC thinks there are inexpensive conservation resources that the Model Plan has overlooked, we hope the agency will identify them. We do not see how PNUCC can dispute the use of a cost-effective "threshold" attuned to the cost of new thermal generation, however, at a time when its members have applications pending to commence construction on four coal-fired and four nuclear power plants.
"Resource-by-resource comparisons" are clearly appropriate when deciding whether less costly, higher priority alternatives are available to meet the needs that these thermal plants are designed to serve.

a. QUESTIONABLE RELIABILITY ASSUMPTIONS (p. 3)

PNUCC Comment: NRDC does not quantify and compare "degrees of reliability of all competing technologies on a uniform basis," nor does NRDC acknowledge "the consumer benefits of moderate levels of 'excess capacity.'"

NRDC Response: PNUCC makes no specific challenge to the reliability of any conservation measures discussed in the Model Plan. In general, in reliability assessments, conservation measures consistently outperform large thermal plants, by virtue of their short lead-times, wide dispersion, and the extremely modest contribution of each individual "unit" to overall system requirements. Cf., e.g., MPDr at p. 5, MPSumm at p. 26. PNUCC does not explain how "small-scale outages" can possibly "be just as important as large-scale shortfalls;" there is no plausible reason to assume that the equivalent of a 1000-MW plant's worth of dispersed conservation resources (heat pumps, insulation, high-efficiency lights, or whatever) might fail simultaneously. In sum, PNUCC provides no reason for assuming that the detailed reliability analysis it proposes would alter any of the Model Plan's conclusions.

The relevance of PNUCC's observations on excess capacity is unclear. If it makes sense to "overbuild" thermal generation, it makes sense to "overbuild" higher priority resources first; in any case, the Model Plan forecast provides for comfortable margins of safety, in terms of generation availability, throughout the remainder of this century. See MPSumm at p. 28.

b. WNP 4/5 AS AVOIDED COST THRESHOLD (p. 3)

PNUCC Comment: WNP 4/5 have been terminated, and are no longer appropriate for purposes of cost-effectiveness analysis. "True avoided cost" is lower, whether or not new coal and nuclear plants would be cheaper than WNP 4/5.

NRDC Response: Taken at face value, this amounts to an extraordinary about-face by PNUCC. To argue that "true avoided cost" in fact will never reach the cost of coal and nuclear generation is to assume that no such generation would be needed over the next two decades even if no alternative resources -- including conservation -- were developed. However -- except in this paragraph -- PNUCC has never hinted at such a possibility, and all its forecasts and resource plans assume the contrary.

We do not believe, and PNUCC does not suggest, that new nuclear generation can be constructed for less than our cost projections for WNP 4/5, which include -- as the Act requires -- transmission and quantifiable environmental costs. We also submitted to PNUCC projected costs for new coal-fired generation (MPSumm at p. 5). Of course, most of the Model Plan's conservation resource is cost-effective under substantially lower "avoided cost" estimates,* but until PNUCC's members abandon their proposed coal and nuclear projects, the accompanying costs are not rendered irrelevant by PNUCC's protestations that they are "simply too high."

c. INAPPROPRIATE ECONOMIC CRITERION (pp. 3-4)

PNUCC Comment: NRDC ignores amortization, interest charges, and return on equity in its analysis of resource costs.

NRDC Response: PNUCC is simply incorrect. We account for all these factors; PNUCC's confusion apparently stems from our use of real rather than nominal dollars. See MPDr at pp. 32-54. Conversion to nominal dollars would not affect the Model Plan analysis, as long as the conversion was consistently applied. Current borrowing rates are not in conflict with our assumptions regarding real (as opposed to nominal) rates of discount; interest rates on long-term securities are high at present because investors assume that inflation will revive in

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*See, e.g., MPSumm at pp. 10, 14.

the relatively near future. Interest rates include an inflation factor; people want assurance that their investment of today's dollars will be recovered, even after anticipated inflation of the future dollars used to repay interest and principal. Over the last seven decades, interest rates on low-risk, long-term securities have never exceeded 3-4% real for more than 5 years; the only time they remained at current levels (net of inflation) for a prolonged period was 1929-1932, at the outset of the Great Depression. See MPDr at pp. 26-32. Thus, the high real rates of return cited by PNUCC are likely to prove transient, and should not be incorporated in long-range cost projections. Conservation programs financed by government borrowings should not require long-term interest payments in excess of 2% real. Id. at pp. 28-31.

d. INAPPROPRIATE USE OF RISK PREMIUM (p. 4)

PNUCC Comment: NRDC's assumption of a 0-2% social discount rate is unsupported and not consistent with other analyses.

NRDC Response: NRDC's discount rate assumptions are supported extensively, with historical data. See MPDr at pp. 28-32. See also Natural Resources Defense Council v. U.S. Nuclear Regulatory Commission, No. 74-1586, slip op. at 65 (D.C. Cir., April 27, 1982) (discount rates of zero to two percent have been used by both the NRC and New York State to analyze the long-run costs of nuclear waste disposal).

PNUCC Comment: NRDC unjustifiably uses different discount rates for conservation and conventional power plants, and the latter option is penalized as a result. From investors' perspective, "central-station powerplants are proven technologies with a 20-to-30 year record of performance;" conservation measures are more speculative.

NRDC Response: We have already referred to our reasons for assigning higher risk to large-scale thermal plants.* Whether that is done analytically by adjusting the discount rate or by using more elaborate techniques is largely irrelevant if the results do not diverge significantly. We await some indication from PNUCC that it has in fact identified a distinction that makes a difference. As to investors' view of central-station power plants, recent developments suggest that it is anything but sanguine. After all, the touted "20-to-30 year record of performance" encompasses WPPSS Units 4 and 5, Three Mile Island Units 1 and 2, Diablo Canyon, Zimmer, Ginna, and TVA's eight cancelled/deferred units, to pick only a few items out of a much longer list of expensive catastrophes. This might well justify a higher discount rate than that used in the Model Plan, which equates risks of thermal plant investment with those characteristic of stocks in general. See MPDr at pp. 39-40. PNUCC does not specify "the relatively unproven conservation and renewable options" it finds in the Model Plan, nor does PNUCC explain why investors will not respond to the inherent advantages of conservation in terms of scale, lead-time, and dispersion. See p. 5 above.

e. CONSERVATION RISKS (p. 4)

PNUCC Comment: Urea-formaldehyde insulation is not a low-risk conservation option. In general, NRDC underestimates the risks associated with conservation -- including equipment failure, penetration rates, and performance at less than anticipated levels -- and overestimates the lifetime of conservation measures.

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*Utilities implicitly take the same position when they seek, in rate proceedings, real returns on investment substantially in excess of 1-2% real.

NRDC Response: A number of commentators echoed PNUCC's objections to urea-formaldehyde insulation, despite the stringent installation safeguards that NRDC recommended, and it has been removed from the Model Plan. Substitutes are, of course, readily available.

Space-heating heat pumps are now a well-established technology, and the transitory growing pains cited by PNUCC (p. 5) were just that. See MPDr at pp. 134-38. Heat exchangers have been used extensively and successfully in Japan (MPDr at p. 131), and the laws of physics do not respect international borders. Water-heater heat pumps are now being tested extensively in the Northwest; Puget Sound Power & Light reports that virtually all observed failures were attributable to improper installation -- a problem readily remedied with experience -- and not mechanical flaws.* Penetration rates are indeed hard to predict -- which is one reason why both NRDC and PNUCC support the Hood River project -- but it is crucial to note here that this uncertainty does not constitute an investment risk. Lower-than-anticipated penetration results in lower investment -- it does not affect the risk to investors associated with conservation measures actually installed. Penetration rates are important for resource planning purposes, and in the absence of good data we used highly conservative retrofit assumptions (see Appendix 1).

Whether estimated savings will exceed actual savings hinges on the quality and conservatism of the estimates. NRDC's methodologies and assumptions are explicitly stated in the Model Plan; we would be glad to respond to specific criticism or questions.

NRDC does not generally "assume 40-year lives for conservation measures;" we do assume that certain shorter-lived

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*From data submitted to NRDC by Nancy Wenke, Puget Sound Power & Light Co. (May 26, 1982).

measures are periodically replaced or refurbished, and include all associated expenses in our cost-effectiveness analysis. Thus, for example, we include in the costs of space heat pumps the purchase price, installation (including ductwork where necessary), annual maintenance, and compressor replacements every ten years. Appendix 2 gives further details on assumptions regarding lifetimes of measures. The only measures assigned 40-year average lifetimes, with no provision for periodic replacement or repair, are home insulation and glazing; in response to PNUCC inquiries, we contacted independent sources at insulation manufacturers and Bonneville, who confirmed that this assumption was consistent with their own analyses and expectations.*

f. SENSITIVITY OF DISCOUNT RATES (p. 5)

PNUCC Comment: NRDC incorrectly asserts that cost-effectiveness calculations are not sensitive to the choice of discount rate.

NRDC Response: The quotation PNUCC cites is taken out of context; NRDC was simply observing that choice of discount rate does not significantly affect cost comparisons between conservation measures and thermal plants with high initial capital costs and relatively low running costs. Since both cost and benefit streams are "shaped" similarly for the conservation and thermal alternatives -- in terms of their distribution over present and future time -- cost-effectiveness comparisons are not very sensitive to choice of discount rate.

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*Telephone interviews with Tom Campbell, Owens Corning Inc., San Jose, California (June 2, 1982); John Smith, Johns-Manville, Inc., Denver, Colorado (June 2, 1982); Phil Thor, Bonneville Power Administration (June 7, 1982).

g. QUESTIONABLE ECONOMIC ASSUMPTIONS (p. 5)

PNUCC Comment: NRDC assumes unrealistically low lon,-term rates of economic growth, and relies exclusively for that proposition on an unreliable Solar Energy Research Institute (SERI) study.

NRDC Response: This is a fundamental misinterpretation of the Model Plan. The Plan's "high demand" industrial scenario uses SIC Sector growth projections that reflect the highest estimates developed by either PNUCC or the Northwest Energy Policy Project (NEPP). See MPDr at pp. 262-66. None of these estimates bear any relationship to the SERI study, which was cited primarily to demonstrate the conservati n of the Model Plan's assumptions. See MPDr at p. 271. In addition, it played a subsidiary role in our calculation of more plausible industrial growth rates for a "low demand" scenario. But the Model Plan does not use the low demand scenario, here or in any other sector, for resource planning purposes. As we hope PNUCC will acknowledge in its response to these comments, the Model Plan's high demand scenario envisions a Northwest economy even more robust than that reflected in PNUCC's own forecasts.

PNUCC Comment: NRDC's analysis of the economics of conventional power plants is based on flawed work by Charles Komanoff. Particularly questionable are assumptions of 10% real annual construction cost escalation and capacity factors of 55% for new nuclear plants.

NRDC Response: The challenges to Komanoff have come primarily from those with an economic or ideological stake in rejecting his findings; he has yet to admit error, and the Idaho PUC ruled for Komanoff, not his critics, during hotly contested rate proceedings in late 1981. In any case, PNUCC overstates NRDC's reliance on Komanoff; most of the nuclear plant construction cost analysis relies on budgets published by the Washington Public Power Supply System. The 55% capacity

factor assumption has been validated by numerous independent surveys (see, e.g., Nucleonics Week, April 29, 1982, at p. 5), and draws -- as the Regional Act requires -- on actual historical experience, not promotional literature. We have yet to see a documented defense of a higher figure from PNUCC or any of its members. Finally, we never assume 10% real annual cost escalation -- or anything close to that figure -- as the pages cited by PNUCC itself make clear. We merely note that such escalation actually occurred over the last decade.

PNUCC Comment: NRDC incorrectly assumes that the gap between BPA avoided cost and wholesale rates will remain constant. In fact, wholesale rates will rise more rapidly than avoided costs over the next several years.

NRDC Response: The gap between a low number and a high number remains constant over time when the low number increases at a faster rate than the high number. Consider the following illustrative table; all figures are net of inflation, and the rates of increase are given in parentheses. These figures are hypothetical and do not constitute predictions; they are merely used to illustrate the point at issue.

	BPA Wholesale Rate	BPA Avoided Cost	Gap
Year 1	2¢	8¢	6¢
Year 2	3¢ (50%)	9¢ (12.5%)	6¢
Year 3	4¢ (33%)	10¢ (11.1%)	6¢
Year 4	5¢ (25%)	11¢ (10%)	6¢
Year 5	6¢ (20%)	12¢ (9.1%)	6¢

Under the Model Plan, BPA wholesale rates would stabilize over the long term, in real dollars, at a level well below the cost of new thermal generation; if real thermal power costs continue to escalate to any extent thereafter, the gap between wholesale rates and avoided costs will actually widen.

3. ENVIRONMENTAL COSTS (pp. 7-10)

PNUCC Comment: NRDC seeks to incorporate coal and nuclear impacts that are not "priceable," misconstruing the mandate of the Regional Act.

NRDC Response: PNUCC draws a distinction between "quantifiable" and "priceable" impacts (pp. 7, 8) -- and certain and uncertain costs (p. 9) -- that is nowhere to be found in the Regional Act. Cf. Pub. L. No. 96-501, § 3(B) ("direct costs" of a measure, for purposes of cost-effectiveness analysis, must include "quantifiable environmental costs and benefits ... directly attributable to such measure or resource.") The NRDC calculations that PNUCC contests are based on human deaths and injuries attributable to carbon dioxide releases (from coal-fired plants) and increased risks of nuclear weapons proliferation, catastrophic accidents, and radon releases (associated with nuclear plants and their support systems).

PNUCC does not deny that a price can and must be assigned to human life as part of an environmental cost methodology -- the alternative is to grant the most devastating form of "environmental costs" no economic weight in resource comparisons. What PNUCC argues instead is that costs subject to substantial uncertainty "are not quantifiable." (p. 9) Thus, trivial but certain costs are counted while potentially enormous costs that vary over a wide range are excluded from the economic calculus. This is bad law and worse policy. NRDC uses an extremely conservative conversion factor to translate broad cost ranges into discrete values for cost-effectiveness calculations (MPDr at pp. 100-101). It should be noted that PNUCC never directly confronts NRDC's "bottom line" on generic environmental costs of coal and nuclear plants: does the agency think two cents per kilowatt-hour is unreasonable? If so, what alternative estimate does PNUCC propose?

PNUCC Comment: NRDC ignores the environmental costs of conservation measures, and "implies that environmental impacts are only characteristic of two technologies -- nuclear and coal" (p. 9).

NRDC Response: Environmental impacts of conservation, wind-generated electricity, and solar collectors are in fact addressed extensively. See MPDr at pp. 102-07, 130-34. We are aware of no reputable analysis that disputes the Model Plan's conclusion that environmental impacts associated with these technologies are substantially less destructive than those accompanying development of coal and nuclear generation. PNUCC's characterization of NRDC's discussion of indoor air quality (p. 9) misses the point completely: far from dismissing the problem, we outline an extensive program for improving indoor air quality, and include its costs in our cost-effectiveness analysis. See MPDr at 130-34. PNUCC's concerns about urea-formaldehyde insulation (p. 9) have been accommodated by removal of this measure from the list of Model Plan recommendations.

PNUCC Comment: NRDC arbitrarily uses a 1% discount rate for environmental damages.

NRDC Response: The Model Plan uses 1% as a social rate of discount, reflecting the time value of money (with no allowance for risk). The empirical basis for this assumption is presented at MPDr, pp. 28-31. In addition, the Model Plan uses a 2% "low-risk-plus-time-preference" discount rate to evaluate small-scale, proven technologies, and a 3.5% "high-risk-plus- time-preference" discount rate for less reliable measures. See MPDr at 32. These assumptions are neither "arbitrary" nor "buried" (cf. PNUCC Comments, p. 9); for our response to PNUCC's objection to use of varying discount rates, see pages 5 and 8 above.

PNUCC Comment: "NRDC's environmental cost work relies almost exclusively on a single source," a paper by John P. Holdren, and avoids reference to a "wide range" of other research.

NRDC Response: The Model Plan's 66-page environmental analysis relies on more than 50 sources, including the work cited by Holdren (whose extensive credentials and international reputation are not, understandably, challenged by PNUCC). We invite PNUCC to submit citations to the "wide range" of sources that NRDC allegedly has "avoided."

PNUCC Comment: NRDC has inadequately and inconsistently accounted for "internalized" environmental costs.

NRDC Response: PNUCC gives three specific examples, none persuasive. First, PNUCC argues that coal-miner fatalities and injuries are fully "internalized," but does not respond to NRDC's contrary arguments. See MPDr at pp. 67-68. In most states, for example, the maximum workmen's compensation benefit for death or injury is less than the poverty level for a family of four. MPDr at p. 68. Because NRDC puts a substantially higher price on human life (p. 84), we do not deem such payments full compensation, for purposes of cost analysis. PNUCC implies that it would assign a much lower dollar value to human life; if so, the argument should be cast in those terms.

Second, PNUCC contends that NRDC does "internalize" all environmental costs associated with solar and wind. This is incorrect; see MPDr at pp. 102-107. Whether or not aesthetic damages are reflected in increased land costs is debatable, but what PNUCC fails to recognize is that this assumption is applied uniformly to all technologies, including coal and nuclear plants and their attendant transmission lines.

Third, PNUCC contends that environmental costs of coal and nuclear plants are partially captured in the cost of mitigation measures. The Model Plan acknowledges as much

(e.g., MPDr at p. 86). But the costs that dominate the NRDC analysis (e.g., those associated with climate change from carbon dioxide releases) are not reduced by such measures. See MPDr at pp. 87-101.

4. CONSERVATION (p. 10)

a. DOUBLE COUNTING (p. 10)

PNUCC Comment: NRDC subtracts conservation savings from "baseline" forecasts of sectoral demand that are well below forecasts prepared by PNUCC and others. The result is extensive "double counting" of conservation benefits.

NRDC Response: Only in the industrial sector does NRDC subtract savings from a "baseline" forecast, and -- as already noted -- the industrial "baseline" is higher than that used by PNUCC. The residential and commercial analyses employ an end use approach, which calculates the energy needs of a growing inventory of buildings and appliances that is drawn directly from data and projections prepared by BPA.* Since there is no forecast of "no-conservation" sectoral electricity needs from which savings are subtracted, there is no possibility of "double counting." Only in the industrial sector is double counting potentially a problem, and it is minimized by

(1) selection of a conservatively high baseline forecast, keyed to energy intensities observed in 1977 -- before the recent upward trend in Northwest electricity prices; and

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*Percentage savings anticipated from commercial sector retrofits, compared to current end use averages, are noted illustratively; see the discussion at pp. 19-20 below. But as that discussion indicates, the plausibility of the Model Plan forecast hinges on the post-retrofit consumption assumed, not the magnitude of "savings." The payment mechanism for commercial sector retrofits ensures that utilities will pay only for savings actually realized. See MPDr at pp. 240-45.

(2) elimination of all "double counting" potential from the primary aluminum sector, through the assumption that full contractual entitlements are consumed regardless of the extent of efficiency improvements (i.e., all efficiency increases are offset by production increases).

PNUCC Comment: "[NRDC] begins with assumptions of very low economic growth; then compounds those assumptions by imputing slow growth to each sector; and incorporates exaggerated shifts in composition of the regional economic base toward non-industrial activity, assuming a high level of technological change that results in significant energy-savings." (p. 10)

NRDC Response: The author of this sentence is referring to some document other than the Model Plan. A more plausible critique would read "NRDC begins with assumptions of unrealistically high economic growth, then compounds those assumptions by accepting BPA's optimistic projections of end-use additions in each sector; while failing to incorporate any shifts in composition of the regional economic base toward non-industrial activity."

Technological change plays a role only in a few portions of the industrial sector forecast, where its contribution is quite modest. See MPDr at 283-93 (note that process improvements for the aluminum sector are not assumed to reduce total electricity consumption in the "high demand" case). PNUCC argues that the Model Plan fails to accommodate increasing electrification, without noting the massive expansion contemplated for the residential and commercial sectors (e.g., virtually all new households and commercial buildings are assumed to have electric heat*). Our reasons for

*The final draft probably will adopt somewhat more realistic, but still conservative, estimates.

not assuming a trend toward increased electrification in the industrial sector are outlined at MPDr, pp. 269-70. No industrial reviewer has contested this analysis; BPA has actually identified a potential for "switches" away from electricity in certain industries. See MPDr at p. 270.

b. ACTUAL SAVINGS vs THEORETICAL ESTIMATES (p. 11)

PNUCC Comment: NRDC takes insufficient account of the stimulative effect on consumption of reduced energy costs resulting from efficiency improvements.

NRDC Response: PNUCC has raised an important issue, which the Model Plan does not overlook. See, e.g., MPDr at p. 193 (residential retrofits are assumed to result in higher thermostat settings); MPSumm at pp. 6-7 (importance of educational programs that increase the energy management skills of Northwest citizens). The PNUCC comments refer to "a recent study by Hausman" on air conditioners, but give no title or publisher -- we would appreciate receiving a copy. This study provides the only data cited in support of PNUCC's argument, and the end use covered -- air conditioning -- is trivial for purposes of Northwest forecasting. Significantly, PNUCC can produce no empirical support for the existence of "substantial usage elasticities" in other areas, and we are aware of none. Data reported to NRDC by Larry Palmiter suggest, on the other hand, that thermostat settings tend to be reduced in retrofitted housing (the reverse of what PNUCC -- and NRDC -- would predict). Note that the incentive program for commercial retrofits in the Model Plan contains safeguards against "back-sliding." MPDr at pp. 242-43.

PNUCC Comment: NRDC relies on engineering estimates of conservation savings, which may differ from actual savings.

NRDC Response: This contention, and the examples cited to support it, simply confirm that poor engineering estimates

will not be validated by performance in the field. A defense of NRDC's engineering estimates does not hinge on the accuracy of estimates made by others using different methodologies. In the case of PP&L, we have determined -- and informed the utility -- that its estimates were based on flawed assumptions that tended to over-predict savings by a substantial margin.

PNUCC observes that NRDC predicts greater residential savings than those obtained through existing utility programs. This is not surprising; the Model Plan retrofit program is much more comprehensive than those now administered by Northwest utilities.

PNUCC also contests NRDC's estimate regarding savings from water heater wraps, citing a lower figure allegedly "developed through utility experience in the region." We request copies of the studies and data underlying this otherwise unsubstantiated contention. Larry Palmiter contends, based on a survey of water heaters in the Seattle area, that the NRDC savings estimates are actually too low.

Finally, PNUCC incorrectly contends that NRDC uses a space heating heat pump coefficient of performance of 3.0; the actual figure is 2.2.* See MPDr at pp. 135, 193. Certainly there are, as PNUCC points out, heat pumps that perform at lower efficiencies, but the Model Plan does not recommend their use. See MPDr at pp. 137-138.

PNUCC Comment: "In the commercial sector, actual utility experience indicates savings closer to 10%-15% per building than the 20%-30% assumed by NRDC."

NRDC Response: The source of the "20-30%" figure is unclear. The Model Plan forecast is based on two commercial retrofit "packages" -- a "rapid-payback" retrofit, analogous to

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*Heat pumps with efficiencies in excess of 2.2 appear only in the "low demand" case, which -- as noted earlier -- is not used for resource planning purposes. See MPDr at p. 193.

those now resulting from utility audits, and a more extensive and capital-intensive version calculated to minimize life-cycle costs. The savings assumed in the former case are 15%, which is consistent with the PNUCC estimate. Cf. Southern California Edison Co., Annual Report: Nonresidential Load Management 10 (1981) (participants in pilot commercial conservation program are expected to realize a net 24% reduction in 1979 consumption levels). The more extensive retrofits, made possible through sophisticated audits and utility incentive payments, are assumed to elicit 40% savings, on average. The plausibility of the "bottom line" is best assessed on an end-use basis: on average, in the Model Plan forecast, retrofitted commercial buildings as a group consume 10.3 kWh per square foot in 1990.* For closely comparable projections, see California Energy Commission, Electricity Tomorrow 180 (1981). It is this figure, and not "percentage savings" from a baseline, that is critical for purposes of analyzing the plausibility of the Model Plan forecast.

PNUCC Comment: While NRDC's estimate for new commercial construction "may be plausible," it "seems extremely optimistic ... since it is about 30-40% lower than the most efficient new buildings now under construction in the Northwest."

NRDC Response: Here, as elsewhere, current practice cannot be deemed to set the outer boundaries of what is achievable. Moreover, the 30-40% disparity cited by PNUCC could almost certainly be eliminated if the new buildings in question incorporated lighting designs that met Model Plan specifications. For citations to buildings and designs that conform to the Model Plan's assumptions, see MPDr at p. 238; California Energy Commission, Electricity Tomorrow 180-82 (1981). PNUCC is, of course, correct that occupancy rates and

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*Figures taken from the high demand case.

other factors differ across the stock of commercial buildings; the Model Plan explains its rationale for deriving a sectoral average at MPDr, pp. 235-39. From a resource planning standpoint, what is crucial is whether this average is accurate; consumption by individual buildings will vary.

c. INSTITUTIONAL BARRIERS (p. 12)

PNUCC Comment: Many cost-effective conservation measures will be adopted as a result of market forces. NRDC's suggested regulatory and incentive levels may prove excessive, "particularly now that the Region is entering a period of probable energy surplus."

NRDC Response: No brief response will do justice to this point, and we refer the reader to our extensive discussion in "Comments of the Natural Resources Defense Council on the Bonneville Power Administration's Draft Regional Forecast of Electricity Consumption in the Pacific Northwest," (June 2, 1982) at pp. 2-18; copies have been forwarded to PNUCC and the Regional Council. Compared to reliance on price-induced responses, which are largely unknown and unpredictable, the Model Plan recommendations offer (1) far more certainty about future end use needs and (2) a way to render many more end uses much more efficient. Some consumers may invest in cheap conservation without encouragement, but in a world of distorted prices and institutional barriers it is highly unlikely that they will invest to cost-effective limits. That, presumably, is one reason why -- despite its comments here -- PNUCC's members continue to press forward with efforts to construct thermal power plants; they do not believe that price signals alone will elicit the cost-effective conservation investments identified in the Model Plan.

d. TVA EXPERIENCE (p. 12)

PNUCC Comment: TVA is scaling back its investments in conservation; the TVA experience suggests that the Model Plan's financial assistance provisions are excessive and likely to provoke distortions or abuses.

NRDC Response: It is certainly possible to design payment pro ams poorly; the one specific example noted by PNUCC is discussed in the Model Plan, along with straightforward solutions to the problem TVA experienced. See MPDr at pp. 149-150; 158-62. TVA's cutbacks in overall conservation expenditures can scarcely be cited as binding precedent for the Northwest; for one thing, unlike Northwest utilities, TVA is not currently seeking to expand its inventory of thermal generation.

e. DATA/END-USE ASSUMPTIONS (p. 13)

PNUCC Comment: NRDC provides no rationale for its recommendation that "BPA should finance lighting conversion up to 40 percent of the wattage in place as observed by the auditor."

NRDC Response: Fluorescents deliver equal illumination at substantially lower wattages, compared with incandescents. As the Model Plan explains, "fluorescent lighting will work as a conservation measure only if bulbs are replaced on the basis of equal light output." MPDr at p. 183. In the final draft, we will be sure to juxtapose this observation with the quotation taken by PNUCC from p. 190.

PNUCC Comment: Specific end use assumptions in the Model Plan appear to be inconsistent with those in other available studies. "We are not necessarily suggesting that these assumptions are incorrect, but only that they appear to conflict with other sources and thus warrant further examination."

NRDC Response: We invite PNUCC to produce the other sources, and identify the inconsistencies. The sixth and seventh items on the PNUCC list are confusingly phrased; we assume that "passive solar systems" refers to "solar hot water heaters," and that "the commercial sector" should read "the residential sector."

f. PENETRATION RATES (p. 14)

PNUCC Comment: NRDC ignores much of the literature on penetration rates, cost, and performance for conservation and renewables.

NRDC Response: Again, we entreat PNUCC to submit a bibliography of ignored literature; the Model Plan is replete with citations to the generic sources cited by PNUCC. Our retrofit penetration rates are more modest than those PNUCC identifies as reasonable on page 15 of its comments. See Appendix 1.

(1) PUBLIC ACCEPTANCE OF PROGRAMS (p. 14)

PNUCC Comment: Many customers will not participate in retrofit programs, no matter what the level of benefits is.

NRDC Response: The Model Plan forecast assumes as much. See Appendix 1.

(2) OPTIMISTIC PENETRATION RATES (p. 14)

PNUCC Comment: NRDC's penetration rates for conservation measures are too optimistic. For example, NRDC assumes 95% of its housing retrofit package is installed by the year 2000 in the High Conservation Case; Low Case assumes 60%.

NRDC Response: These numbers do not reflect the percentage of households that participate; they reflect the fraction of a "realistically achievable" conservation resource that is assumed to be in place by the year 2000. In

calculating the "realistically achievable" potential, we assumed substantial nonparticipation due to structural constraints and simple lack of interest on the part of residents. Net penetration rates for individual measures are presented in Appendix 1.

PNUCC Comment: Heat pumps and triple-glazing are not cost-effective at levels of 60-70 mills.

NRDC Response: PNUCC received Appendix II to the Model Plan, "Cost-Effectiveness of Residential Sector Retrofit Conservation Measures," which presents our calculations of the cost of those measures. Including installation, maintenance, and replacement, heat pump savings cost between 29 and 52 mills/kWh, depending on whether ductwork is needed. Savings from the glazing retrofit are estimated in the Appendix at 15 mills/kWh; recent BPA data indicate that the figure must be revised upward (using the methodology described in Appendix II) to 16 mills/kWh.

PNUCC Comment: Retrofits are unlikely to occur in renter units, "except [under] a mandatory program of dubious political feasibility."

NRDC Response: Such mandatory programs have been adopted in Portland, Eugene, Seattle, San Francisco, Santa Clara County (California), Davis (California), and Minnesota. The Regional Council is in a position to see that these precedents are followed throughout the Northwest region. See MPSumm at pp. 18-20; MPDr at 153-57 (outlining ways to defuse opposition to phased-in, mandatory retrofit legislation).

PNUCC Comment: "A more probable/realistic estimate would involve 70-75% penetration of a lower mix package (*e.g.*, R-38 ceiling/existing walls/R-19 floors/double-glazing) plus a lesser penetration (say 25%) of space heat pumps" (p. 15).

NRDC Response: Why should a "lower mix" achieve greater penetration than a package incorporating higher levels of *the*

same generic measures, which promises the homeowner more relief from rising utility bills? Note, also, that the penetration rate for heat pumps under the Model Plan Forecast reaches only 19.9% in 1990 and 30.6% in the year 2000 (see Appendix 1). No measures approach 70-75% penetration in the Low Conservation Case; if PNUCC is prepared to go that high, it should not be difficult to reach consensus on reasonable retrofit penetration assumptions for all end uses.

PNUCC Comment: NRDC's recommended building code will be watered down by state legislatures, and compliance with the resulting regulations will not be uniform.

NRDC Response: Our assumption that, on average, houses will conform to a code implicitly accommodates the possibility that some houses will do better while others will do worse. The Model Plan provides financial incentives for beating the code, and outlines mechanisms for ensuring that minimum standards are met uniformly. MPDr at p. 171. PNUCC's members are themselves in a position to ensure compliance by inspecting new houses prior to hook-ups, as Seattle now does.*

New codes will be resisted to the extent that they increase the purchase price of houses, but the Model Plan uses utility financing to override such increases. Builders get more marketable houses, consumers get a price break, and utilities get a cheap energy resource. The political calculus looks uniquely favorable; what is the source of PNUCC's concern? PNUCC objects specifically to "the 10% non-south facing window requirement" as "too highly regulatory," forgetting that the Model Plan standard is performance-based and that the cited "requirement" is simply one component of an illustrative package that would meet the standard. See MPDr at pp. 163-68. We note that -- notwithstanding PNUCC's

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*See NRDC, Choosing an Electrical Energy Future for the Pacific Northwest: An Alternative Scenario 218, 223-24 (1980).

discouraging political assessment concerning window requirements -- specifications comparable to those cited in the Model Plan have been incorporated in California's new residential building code. No builder or consumer organization, to our knowledge, has complained.

(3) NONPARTICIPANTS (p. 15)

PNUCC Comment: The Model Plan does not systematically assess the impact of utility payments on nonparticipants in Model Plan programs, and ignores the impact of such payments on BPA wholesale rates.

NRDC Response: Nonparticipants will not suffer as long as conservation payments are no higher, per kWh saved, than the difference between BPA's average and avoided costs. Most conservation payments under the Model Plan are in fact well below this threshold, assuming that BPA's long-run avoided costs are keyed to new coal and nuclear generation. Whether still less generous incentives could be relied upon to elicit the same magnitude of conservation resources is doubtful; in any case, for reasons reviewed above in the discussion of price-induced conservation, no one has the data needed to determine "the relationship between different levels of subsidies, repayment requirement[s], and levels of consumer participation" (p. 15). Rather than do nothing pending the (speculative) emergence of such data, it seems only prudent to err on the conservative side, provided of course that cost-effectiveness criteria are met.

As the Model Plan notes explicitly, we do not assume that BPA wholesale and marginal generating costs will remain fixed. MPDr at p. 147. Rather, we assume -- in projecting payment levels -- that the absolute gap between them does not increase, in uninflated dollars, over the lifetime of conservation measures. This is a conservative assumption, since the gap

remains constant even if wholesale rate charges increase at a much greater percentage rate than avoided costs. See page 12 above.

(4) INCOME EFFECT/SUBSTITUTION (p. 16)

PNUCC Comment: The Model Plan will result in regressive income transfers, because participation will be disproportionately concentrated among middle- and low-income consumers.

NRDC Response: Avoiding this result is one of the Model Plan's highest priorites. See, e.g., MPSumm at pp. 31-34; MPDr at pp. 153-57. These sections outline a comprehensive strategy for "assuring that the financial assistance and local development provisions of the Act are made available on an accelerated basis to those most in need of such provisions."

PNUCC Comment: Model Plan measures will effectively increase disposable income and reduce electricity prices. As a result, electricity consumption will increase.

NRDC Response: This is a restatement of the PNUCC comment discussed at page 18 above. We supplement our earlier response by noting here that the tiered rate structures recommended in the Model Plan should help inhibit any "substitution" effects. In addition, recall that the Model Plan -- in its assumptions about thermostat settings and high industrial growth -- implicitly incorporates a substantial "substitution allowance." Finally, its concerns about "substitution" should work to reinforce PNUCC's commitment to strong efficiency standards, which will remove "energy guzzling" buildings and appliances from the marketplace altogether.

(5) UTILITY ACCEPTANCE OF PROGRAMS (p. 17)

PNUCC Comment: Conservation can produce financial problems for utilities.

NRDC Response: We cannot resist observing that the same is true of thermal power plants. Note that the conservation financing provisions of the Model Plan contemplate BPA payments to utilities, where needed to compensate for conservation-related revenue losses. MPDr at p. 146.

(6) MANDATORY RENTAL RETROFITS (p. 17)

PNUCC Comment: Mandatory retrofit ordinances are probably illegal and, from a purely political standpoint, untenable. They also raise unspecified "equity problems."

NRDC Response: "Time of sale" retrofit ordinances are not a new and untried mechanism, for the Northwest or the rest of the nation. See page 24 above. We are aware of no successful legal challenges. In the context of the Model Plan's financing provisions, we can see no "equity problems" with the recommended ordinances; as PNUCC itself notes on the preceding page of its comments, equity problems are raised in the absence of these and related mechanisms for ensuring that low-income consumers receive their fair share of conservation benefits.

g. COST-EFFECTIVENESS (p. 17)

PNUCC Comment: NRDC overstates asset lives (by focusing on physical rather than economic lives) and understates the capital charge rate for conservation investments (by using a 2% real discount rate).

NRDC Response: In determining the benefits realized from conservation measures, physical lives are paramount; accounting conventions that arbitrarily fix the "economic life" of a building or industrial process will not prevent the end use

from continuing to consume energy over its physical life. Historically, capital charge rates associated with long-term, low-risk investments have generally trended below 2% real. See MPDr at pp. 28-32.

PNUCC Comment: Energy users demand rapid paybacks on conservation investments.

NRDC Response: That is precisely why the Model Plan incorporates utility financing for cost-effective conservation measures. Note that utilities do not demand rapid paybacks, as evidenced by their willingness to launch ventures that do not recoup their costs for three decades or more (e.g., transmission lines, dams, thermal power plants).

PNUCC Comment: There is little economic incentive to retrofit a building or item of equipment that is approaching economic obsolescence.

NRDC Response: That is correct, and is one reason why the Model Plan forecast assumes substantial rates of non-participation in conservation retrofit programs. Note, however, that many residential and commercial buildings continue to lead useful economic lives for a century or more.

h. TECHNICAL FEASIBILITY (p. 18)

PNUCC Comment: Several of the Model Plan's conservation options constitute high-risk new technologies. Studies of consumer behavior indicate substantial aversion to risk; thus, consumers will not embrace the Model Plan recommendations.

NRDC Response: Again, we are given no guidance about which Model Plan options strike PNUCC as risky. Cf. pages 8-9 above. More fundamentally, PNUCC forgets that one goal of the Regional Plan is to spread risks associated with conservation measures, just as utilities now spread risks associated with thermal power plants. Past consumer behavior -- which in any case is more plausibly attributed to market breakdowns than

risk aversion -- is no guide to the actions of consumers once the Act's financing mechanisms are working.

i. POLITICAL FEASIBILITY (p. 18)

PNUCC Comment: Consumers will resist the relatively high retrofit levels that qualify for utility payments under the Model Plan (e.g., high insulation, multiple glazing).

NRDC Response: PNUCC apparently thinks that substantial numbers of consumers will balk at taking advantage of the extra economic benefits attending increments of insulation and glazing. The source of this skepticism is unclear. Absent structural constraints, why would consumers balk at extra inches of retrofit insulation or an extra pane of retrofit glazing that their utility is paying for? The rationale for fixing prescriptive minima for retrofit payments is to preclude the irreversible loss of cost-effective conservation resources. "Half-way retrofits" waste energy. See MPDr at p. 140.

PNUCC Comment: NRDC "values conservation above all other social values. Aesthetics, other economic factors (e.g., the initial cost of a home), the flexibility to choose one's own living standards, and similar considerations are all subordinated to the social value of conserving energy."

NRDC Response: What NRDC "values conservation above" is more costly, lower-priority generating resources. That is the mandate of the Regional Act. Aesthetics are not addressed in the Model Plan; the point of performance-based building codes, for example, is to leave such choices to designers and consumers. On the economic side, the Model Plan would work to reduce the initial cost of homes to consumers (see, e.g., MPSumm at p. 11), and its effects on living standards -- as PNUCC elsewhere recognizes -- would be strongly positive. In one sense, of course, the Model Plan does have implications for

consumer choices; inefficient new appliances and buildings, which impose substantial costs on society that the purchaser does not pay, would disappear from the marketplace. It is not apparent that consumers will suffer in any way as a consequence, since the higher-efficiency substitutes would deliver the same or improved services at lower life-cycle costs. And the "freedom" to shift the costs of one's activities to one's neighbors is not enshrined in the traditions of this society, for good reason.

j. INNOVATION IN CONSERVATION AND RENEWABLE RESOURCE TECHNOLOGIES (p. 19)

PNUCC Comment: NRDC's reliance on performance standards and subsidies will discourage innovation, by locking everyone into fixed technologies.

NRDC Response: It is precisely to *encourage* innovation that the Model Plan stresses performance standards over prescriptive alternatives. The Plan warns repeatedly against policies that would have the effect PNUCC describes (*e.g.*, MPDr at pp. 150, 164; MPSumm at 15). We challenge PNUCC to cite a single specific example of how the Model Plan would impede or discourage technological advances. If such obstacles have been erected unintentionally, we will work to eliminate them.

k. RESIDENTIAL RECOMMENDATIONS (p. 19)

(1) MODEL CONSERVATION STANDARDS (pp. 19-20)

PNUCC Comment: NRDC's Model Conservation Standard would require "a dramatic reduction from ... current consumption levels, raising questions about the reliability of such savings for resource planning purposes."

NRDC Response: This is untenable logic. By the same reasoning, it is "impossible" for the Japanese to build refrigerators that consume 30% of the electricity needed by

U.S. equivalents. Conclusions about the performance of highly efficient houses cannot be derived from citations to consumption by guzzlers. Note that PNUCC does not directly challenge NRDC's assumptions and the engineering data used to derive NRDC's estimate. While some existing single-family houses undoubtedly do consume 24,000 kWh per year -- the figure cited by PNUCC -- others manage comfortably on substantially less. Neither figure determines what can be achieved in housing built to significantly higher specifications. Finally, the performance "budget" assumed in the Model Plan's "high demand" scenario is 2 kWh/ft^2, not the 1 kWh/ft^2 cited by PNUCC. See MPDr at p. 194. Thus, a 1500 square foot house could consume 3000 kWh/yr, not 1500 kWh/yr. The Eugene Water and Electric Board has measured comparable consumption (2.3 kWh/ft^2) in new resistance-heated houses with designs that fall well short of Model Plan specifications.*

(2) STRUCTURAL FEASIBILITY (p. 20)

PNUCC Comment: NRDC proposes insulation levels that are structurally impossible in some existing houses and inconsistent with current construction practices.

NRDC Response: The Model Plan forecast takes full account of structural constraints in existing buildings, and adjusts penetration assumptions accordingly. Note that houses with limited insulation space will find heat pumps correspondingly more cost-effective. As for new buildings, no particular insulation levels are "required"; recall, once again, that the proposed codes are performance-based. Lower insulation levels can be installed as long as an over-all "design energy budget" is not exceeded.

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*Data submitted to NRDC by Bob Lorensen, EWEB (May 24, 1982).

PNUCC Comment: In advocating wall insulation, NRDC ignores consumer resistance and settling problems.

NRDC Response: Penetration rates for wall insulation are extremely low (see Appendix 1), reflecting NRDC's recognition that many householders will not want to have holes punched in their walls. As to settling, our assumption is that the impact on savings from wall insulation is insignificant, since all settling is downward through the wall cavity and most of the wall will remain fully insulated. We invite PNUCC to indicate what changes it would make in projected savings, with these considerations in mind.

(3) AIR-TO-AIR HEAT EXCHANGERS (p. 20)

PNUCC Comment: More information is needed concerning the performance of heat exchangers, which substantially increase weatherization costs.

NRDC Response: We agree with PNUCC that more data are needed to determine whether heat exchangers must or should be installed in all tightened houses. The assumption that they will be installed uniformly represents a significant conservatism in our cost-effectiveness analysis; even with this added cost, this retrofit measure remains overwhelmingly cost-effective. See MPDr at pp. 130-34. We anticipate the emergence of less expensive strategies for ensuring high indoor air quality (MPDr at 133-34), but do not incorporate that assumption in our calculations.

(4) HEAT PUMP PROBLEMS

PNUCC Comment: Heat pumps will cost $500-$1000 more than NRDC assumes, and penetration rates will be reduced by high costs to consumers.

NRDC Response: The "Northwest costs" PNUCC cites should drop as heat pumps are down-sized to serve higher-efficiency

houses, and as cooling capabilities are removed. Utilities can meet the entire cost and still find themselves purchasing a cost-effective resource (see p. 24 above). Penetration rates assumed for heat pumps are relatively modest (see Appendix 1).

PNUCC Comment: Heat-only heat pumps will take several years to develop.

NRDC Response: That is hardly fatal, for purposes of a twenty-year forecast. Northwest utilities certainly are in a position to accelerate the development and marketing of such devices, however. Note that the technical challenge posed is exceedingly modest -- what is involved is simply the deletion of a trouble-prone part from existing designs. See MPDr at p. 137.

(5) LIGHTING (p. 21)

PNUCC Comment: If NRDC proposes to mandate residential lighting levels and choices of bulbs, Northwest consumers will resist.

NRDC Response: We propose no such mandate. The Model Plan simply recommends, for utility-financed retrofits, the substitution of high-efficiency lights for existing bulbs on an equal-illumination basis.

(6) NEW HOME CONSTRUCTION (p. 21)

PNUCC Comment: Incentive programs for new residences should not encourage installation of electric heat.

NRDC Response: We agree. See MPSumm at p. 11. PNUCC is correct that the discussion at MPDr, pp. 170-71, needs to address this issue explicitly. We also agree with PNUCC that the code approach is the best overall guarantor of efficient new housing; interim incentives for construction of high-efficiency building shells (without reference to fuel source) are still needed, however, to avoid burdening the region with a year or more's production of pre-code "guzzlers."

1. APPLIANCE STANDARDS (p. 21)

(1) CLOTHES WASHERS (p. 21)

PNUCC Comment: The High Conservation case assumes a 50% reduction in gallons/cycle by 2000, which would require 100-200% more efficient models.

NRDC Response: PNUCC draws the wrong conclusion from the assumption cited; the gallons/cycle figure refers to gallons of hot water only. The 50% savings figure (used only in the High Conservation Case) is based on the assumption "that future households increasingly would opt for cold and warm water washes when using clothes washers." MPDr at p. 198. Increased use of colder water reduces electricity needs for heating water even if total water consumption remains constant.

(2) FREEZERS (pp. 21-22)

PNUCC Comment: The Council could ensure that the projected savings were realized if it "were to adopt appliance efficiency standards a la the California model."

NRDC Response: We agree.

REMAINDER OF PNUCC COMMENTS (pp. 22-30)

Detailed responses to these comments will be forwarded following NRDC's presentation to the Regional Council on June 17; time constraints preclude a point-by-point discussion now. Responses to some of the key PNUCC questions follow:

o High-projected saturation rates for efficient appliances reflect the operation of mandatory standards comparable to California's, which have proved easy to enforce and have produced no perceptible incidence of noncompliance (cf. PNUCC comments at pp. 22-23).

o With regard to house-doctoring, NRDC's cost projections accommodate the need for skilled auditors, and NRDC's modest projection of audit results (average reduction of

only 1/4 air changes per hour*) assumes only leak-plugging that does not "require replacing significant parts of walls, ceilings and floors" (cf. PNUCC comments at p. 23).

o We agree that commercial retrofit conservation opportunities must be identified and exploited on a case-by-case basis, "not determined by some formula." See MPDr at pp. 240-45 (cf. PNUCC comments at p. 25).

o In estimating industrial sector conservation potentials, NRDC relied on the Synergic Resources Corporation's analysis only for distribution of total sectoral consumption (determined from BPA records) over broad end use categories. We relied on independent sources for savings estimates (cf. PNUCC comments at p. 27). To the extent Synergic allocated "too much" consumption to a particular end use, it allocated "too little" to another; the Model Plan forecast is affected only if -- as no reviewer has suggested -- Synergic systematically "shifted" consumption out of end uses with relatively low conservation potential.

o Two points should be made regarding DSI consumption. BPA joins NRDC in vigorously disputing PNUCC's assumption (p. 29) that, for resource planning purposes, full use of DSI "technological allowances" should be assumed. See Power Sales Contract Executed by the Bonneville Power Administration (August 25, 1981), § 5(d)(9) ("For purposes of forecasting regional energy needs pursuant to discharging its obligations under the Regional Act, Bonneville shall make provision for only those Technological Allowances that, at the time of the forecast, have been identified by an Industrial Purchaser and are reasonably likely to meet the requirements of Technological Allowances.") Also, the debate over aluminum industry conservation (PNUCC comments at pp. 27-29) should

*Appendix II, "Cost Effectiveness of Residential Sector Retrofit Conservation Measures," at p. 16.

proceed subject to the understanding that the Model Plan's "high demand" forecast assigns no net savings to conservation in this sector.*

o NRDC does not, for forecasting purposes, assume that cogeneration will displace "1560 to 3004 MW of energy demand" by the year 2000 (PNUCC comments at 29). The actual range used in the Model Plan forecast is 938-1580 average MW.** See MPDr at p. 320. SRC's assumption of 623 average MW (PNUCC comments at p. 30) is keyed to an avoided cost of 50 mills; PNUCC omits the SRC projections for higher avoided cost ranges (1122.5 average MW at 65-80 mills, and 5869.3 average MW at 80-95 mills).

Conclusion

We urge PNUCC to reconsider its initial response to the Model Plan. Many of the reviewers' concerns resulted from misunderstandings about the Plan's assumptions and analysis. Those misunderstandings indicate that some portions of the document need to be clarified, but they do not, in our view, signal fundamental or irreconcilable differences between PNUCC and the Coalition.

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*PNUCC is correct that we erred initially in assigning "housekeeping" savings to the aluminum sector in the High Demand Case; these savings were eliminated from the forecast presented in the Model Plan Summary. See MPSumm at p. 28.

**PNUCC's confusion is understandable, since we elsewhere refer to a larger "technical potential."

APPENDIX 1

A. Penetrations of Retrofit Measures in the Residential Sector

[Note: Percentages refer to pre-1980 electrically heated homes. Figures for low and high conservation cases are given separately; those in parentheses are from the high conservation case.]

	1990		2000	
R49 Ceiling Insulation	21.0	(37.7)	32.6	(51.6)
R0-R11 Wall Insulation	5.0	(9.0)	7.7	(12.2)
R11-R19 Wall Insulation	12.3	(22.1)	19.0	(30.0)
R38 Floor Insulation	14.8	(26.5)	23.0	(36.4)
Infiltration Reduction	29.1	(52.2)	44.8	(70.9)
Triple Glazing	19.4	(34.7)	29.9	(47.3)
Space Heat Pumps	19.9	(35.7)	30.6	(48.4)
Heat Pump Water Heaters	31.3	(56.1)	48.1	(76.2)

B. Penetrations of Retrofit Measures in the Commercial Sector

[Note: Percentages refer to pre-1985 commercial buildings. Figures for low and high conservation cases are given separately; those in parenthesis are from the high conservation case.]

	1990		2000	
Fast Payback Retrofits	20	(14)	27	(19)
Capital-Intensive Retrofits	36	(47)	48	(66)

APPENDIX 1 (continued)

C. Percentage of Achievable Industrial Savings Attained by the Year 2000

	Achievable Savings	Percent Realized
Waste heat recovery[a]	20%	80
Improved instrumentation and control[a]	5%	80
Motor efficiency improvements[b]	15%	80
Lighting	72%	80
Housekeeping[c] (after all other conservation measures have been installed)	10%	80

a. Applied to electricity used for process-heat.

b. Applied to electricity used for mechanical drive.

c. Savings are not applied to primary aluminum.

APPENDIX 2

Lifetimes of Residential Retrofit Measures

	Lifetime (in years)
Ceiling insulation	40
Wall insulation	40
Floor insulation	40
Infiltration reduction	
Caulking and weatherstripping	5
Heat exchanger	15
Glazing	40
Space heat pumps	10
Heat pump water heaters	10

APPENDIX 3

NRDC ANALYSIS OF POTENTIAL FOR WIND-GENERATED
ELECTRICITY IN THE NORTHWEST REGION

Wind Generation

I. Introduction

The energy in the winds moving over the Northwest is vast. There are limits, theoretical and practical, to the amount of that energy which can be converted into electrical power, but it is reasonable to expect that by the end of the century wind-generated electricity could contribute between 5 and 10% of the regional total. The raw availability of wind is not going to be the limiting factor in development of regional wind energy conversion systems (WECS). Rather, siting constraints, requirements of integration with the rest of the generating system, and, in the near term, the commercial availability of sufficient numbers of cost-effective wind turbine generators (WTGs) will determine how much wind energy can be tapped.

There are a number of kinds and sizes of WECS. Small WECS, rated between .5 and 15 kW, can supply the electricity needs of individual residences. There are over 100 of these in use in the Northwest already, and one study estimated that by the end of the century some 5,000, with a total rating of 27 MW (1 MW = 1,000 kW), might be installed in Oregon alone.[1/] However, for a number of reasons, we have focused exclusively in this assessment on the much larger, utility-scale WECS. Because of design efficiencies and economics of scale, the MW-size WECS can generate electricity more economically. In addition, they can be located at sites where the wind resource is best, frequently far from major population centers, with the

electricity they generate transmitted via the utility grid. The further economies of installation and operation, and the reduction of adverse environmental effects, which can be realized by siting WECS in clusters, make such "wind farms" the preferable configuration for major wind energy development, and the one on which this assessment focuses. As will be explained in Part III, this forecast assumes the installation of a variety of horizontal axis WTGs, with propeller-like rotors 300-400 feet in length, which turn in a plane perpendicular to the wind, mounted atop towers 200-250 feet high (leaving some 50 feet of clearance between rotor and ground).

Wind, of course, is a renewable resource. This means both that the operating costs of WECS are low, since they require no purchased fuel, and that there is no supply uncertainty. Further, wind generation has few detrimental effects on the environment (see Part II). Another major advantage of wind power, once the WTGs are commercially available in sufficient numbers (see Part III), is that it will require little lead time to bring a WECS farm on line, allowing flexibility in resource planning. In contrast to the 8-10 years it takes to complete a coal-fired thermal plant, for example, it will take only 1-2 years to prepare a chosen site and install a moderate-sized wind farm, with perhaps an equivalent amount of time required to secure building permits and carry out environmental impact studies beforehand.[2/] Moreover, unlike a large

thermal plant, which is an all or nothing proposition, wind farms can be built in increments to reflect actual need for power. Given the current projections of low energy-demand growth in the region over the coming decades, as well as the uncertainty of any such projection and the enormous capital costs of stalling or abandoning a major thermal plant (e.g., WPPSS 1 or 4), wind energy is particularly attractive, since it can be developed in stages as it proves necessary.

II. Siting

Because the power available in a given windstream is proportional to the cube of the wind speed, wind speed is a key factor in identifying favorable WECS sites. A number of efforts to measure and map wind speeds in the region have been undertaken, most notably by Oregon State University (OSU) and Battelle Laboratories. The latter project resulted in a "Wind Atlas," which shows almost a tenth of the five-state region to have potentially develcpable, "Class 4" winds.[3/] The data and exposition in the Wind Atlas form the background for the following discussion. However, average wind speed by itself is a relatively crude measure of the quality of a site for WECS installation.

As important as the average speed is the shape of the wind curve over time, both diurnally and annually. As will be explained in Part IV, the more constant the wind at a given

site and the more its annual shape matches the winter-peaking Northwest annual load, the more desirable it is for utility power. Local topographical features -- ridges, passes, valleys, and so on -- interact with the larger movement of air masses to produce wind qualities which tend to be very site-specific. For this reason, generalizing from scattered anemometer readings is a dubious way to assess the actual harvestable wind resource. A better method is to evaluate the capacity of particular sites, which the present regional wind data only permits in a fairly speculative fashion at this point. This method also produces a more accurate assessment of the siting constraints, such as alternative land uses and environmental impacts, which are independent of wind quality but equally crucial in determining how many WECS can be constructed. A discussion of the WECS capacities of the site areas employed in this assessment will follow a general consideration of these other possible constraints.

A wind farm cannot be built on land reserved as a park or wilderness area. Competing land uses in populated areas may also preclude WECS siting. Fortunately, the majority of prime wind sites are in relatively remote areas, and none identified here are pre-empted by park or wilderness designations. Each large WECS usually requires 1/2 acre or less for its tower and an adequate safety zone.[4/] In addition, however, where the wind is omnidirectional and the WECS are clustered in a two-

dimensional array, the machines must be far enough apart that the wind slowed in passing through one can regain speed (and energy) before reaching the next. Seven to ten rotor diameter spacing generally is thought to be sufficient.[5/] In a hexagonal array this results in about one WECS per square kilometer. The vast majority of this land, however -- all but the half acre safety zone and any service roads and transmission access -- would be available for complementary uses, such as grazing or agriculture.

Whether aesthetic considerations will lead to restrictions on WECS siting turns largely on the degree of public acceptance, which some preliminary indications place quite high.[6/] However, as a conservatism, we have assumed that no WECS farms will be constructed on the northern Oregon or Washington coasts, nor in the more scenic and heavily populated stretch of the Columbia Gorge west of the Dalles, although both are promising wind sites. Some concerns have been voiced about electromagnetic interference with television signals and, in connection with one model of WTG (not included in this forecast), about low frequency noise. It is not now clear to what extent the noise was an isolated problem. The electromagnetic intereference occurs when the WECS blades reflect the signal. The design of the blades and choice of blade materials can substantially mitigate this problem, and relocation or modification of antennae can eliminate it. In

any event, both the noise and interference phenomena are extremely local in character.[7/]

The environmental effects of WECS are negligible, and can mostly be avoided through proper siting. Probably the most serious effects would result from installation, and would be no worse than for other comparable-scale construction (for example, of transmission lines). WECS would generally pose little threat to migrating birds, who usually fly higher than the swept area of the rotors and who would each face less than an 8% probability of collision even if they flew directly through that area.[8/] Of course, siting might be limited or precluded in a fragile ecosystem or where endangered species were potentially threatened, but no such problem has yet been identified in any of the site areas proposed below. It should also be noted that to the extent WECS farms displace generating systems which are more environmentally detrimental, they have a net positive environmental effect.

This assessment views as realistically achievable the development of some six site areas in the Northwest by the year 2000. That is not to say that there are only six developable areas -- quite the contrary -- nor that all these areas will necessarily be developed. But these are areas for which there presently exists enough positive data to support fairly confident projection. The following sections describe the areas briefly, specifying a conservative WECS capacity for each

and suggesting a logic of development. Matching WECS of particular ratings to the site areas then yields the generating capacity assessment given in Part VI.

1. The Southern Oregon Coast: Strong winds, class 5 or higher, blow year-round, peaking in winter (class 7).[9] Cape Blanco is a particularly promising site. A wind farms firm has been evaluating the site over the last couple of years ar has proposed a 30 machine, 80 MW development. The capacity of the site is roughly twice that many WECS.[10] There are other possible sites along the southern coast, though none so favorable. Whiskey Run, south of Coos Bay, for instance, is the site of a 300 kW WECS erected a year ago by Pacific Power and Light.[11] A farm of 25 smaller, 50 kW WECS (with a total capacity of 1.25 MW) is projected to be installed there by the end of 1983.

The degree of early interest in the southern Oregon coast, the consequent existence of very site-specific wind analysis and development planning, the annual shape of the wind curve, and the accessibility of transmission, all suggest that this area will be among the first developed. A total of 50 MW-size machines could be installed here by 1990, 30 of those, in addition to the kW-scale farm mentioned, by 1985 or shortly thereafter.

2. The Columbia Gorge: The Gorge functions as a passageway for the movement of the continental air mass and the

maritime air mass across a strong pressure gradient. The flow is generally westward in winter and eastward in summer. The downwind end of the gorge is windiest. As a consequence, the wind power at the eastern end of the gorge tends to peak in spring and summer. (As mentioned earlier, potential land use conflicts have led us to exclude the western end of the gorge from projected development.) This spring and summer peak renders the wind resource here less valuable than it otherwise would be, as will be explained in Part V, and therefore we project that it will not be exploited to its full extent. There is a potentially large area -- encompassing Juniper Hills, Goodnoe Hills, Columbia Hills, and extending some 80 miles east to Kennewick -- which could provide WECS sites. BPA, in conjunction with the DOE, in May 1981 installed three "Mod 2" 2.5 MW WECS on Goodnoe Hills for testing. Because of the early attention this area has received, and the operational experience which the Goodnoe Hills project will provide, this area would likely begin to be developed following the southern Oregon coast. However, given the unfavorable shape of the annual wind curve, we assume that no more than 100 machines will be placed in this area, with 60 possible by 1990.

3. Western Montana: There is a huge resource here. The mouths of the valley areas in the vicinity of Livingston and Whitehall have class 6 annual average wind energy, peaking in winter (class 7). Some experimental kW-size machines are up

near Livingston. On the plains east of the Rocky Mountains, however, is a class 4-5 area which dwarfs these others, comprising perhaps 8,000 square miles, range enough for over 20,000 WECS.[12/] The area is sparsely populated and has a good annual wind shape (class 6 winter peak). One factor which may slow development is a lack of sufficient transmission to carry large amounts of power. We conservatively estimate that 200 machines could be installed in western Montana by 2000, but assume only one farm of 25 could be developed by 1990.

4. <u>Southwestern Wyoming</u>: An extensive, though somewhat more rugged, area of class 4-5 average (class 6 winter) wind also exists in this area. An experimental Hamilton-Standard 4 MW "WTS 4" will be fully installed farther east at Medicine Bow by autumn 1982, and installation of a Boeing "Mod 2" is also planned.[13/] More site-specific "prospecting" is necessary to prove the full extent of this resource, but we assume conservatively that 60 WECS could be installed by 2000, all after 1990.

5. & 6. <u>Southern Idaho and Northeastern Nevada</u>: Promising wind sites exist in the Snake River Plain near Burley, Idaho and in the Owyhee Mountains farther west. Preliminary OSU data suggest that these areas together could accommodate as many as 100 WECS.[14/] Again, more site-specific and higher quality data is needed and is being gathered. Another likely wind farming area is near Wells, Nevada; at least 60 WECS could be

installed there.[15/] Because these areas are relatively unproved, and recognizing the element of indeterminacy in any preliminary assessment, we will assume conservatively that a total of no more than 100 more WECS might be installed by 2000 in these areas or any others. It should be emphasized that there are numerous other possible areas already identified which warrant further study and may prove out.[16/] Moreover, there are almost certainly farmable sites that remain as yet undiscovered. Events will doubtless prove the achievable development scenario sketched above wrong in certain of its details, but the general bounds of regional wind-site potential suggested here are almost certainly conservative.

III. Availability of WECS

In the last five years, the technological feasibility of generating electricity from wind on a MW scale has been demonstrated. The basic design hurdles have been crossed and operating prototypes have confirmed that the designs are workable. The task now is to refine the existing designs for greater efficiency -- a process that is well underway -- and to bring WTGs into large-scale commercial production.

This "third generation" machine, however, faces obstacles. The DOE funds that backed much of the previous research and development -- the Mod 1 and Mod 2, and the preliminary design phase of the third generation Mod 5 -- may be cut under the

present administration. Although there is considerable interest in private sector financing on the part of manufacturers, wind farms firms, and utilities, high interest rates and market uncertainties make capitalization difficult. The recent decline in world oil prices, lowering the cost of thermal generation, has introduced further uncertainty, and forced up the cost of capital to develop wind energy. Nevertheless, if wind power gets developed substantially, we are almost certain to see the more efficient, higher-rated machines because economies in design (such as reducing weight, increasing rotor diameter, and simplifying construction) are projected to reduce the cost of WECS-generated electricity by a third or more over existing models.[17/] Given the extent of the wind resource and the escalation of the cost of competing generation, it is more probable that not that utilities will make a substantial commitment to wind power over the next decade, and thus that the larger machines will be produced.[18/] But the present is a crucial time. If all the elements do not come together soon, the development of wind energy will suffer a disproportionate set-back, as design teams at the manufacturers are disbanded and investment capital is redirected. BPA, however, could and should act as a catalyst for this pivotal phase. A BPA contract for a large number of advanced WECS for future delivery (or a contract for the output of a number of independently developed wind farms) could

provide the threshold of reliable demand that would enable manufacturers to undertake the five- or six-year process of final design, prototyping, testing, tooling, and building up to mass production levels. In turn, such a contract would benefit BPA by ensuring its priority in the delivery schedule, and by guaranteeing availability of a highly desirable renewable resource that might otherwise be squandered.

Although a number of informed participants estimate the late 1980s as the likely advent of major production of "third generation" WTGs,[19/] we have conservatively assumed here that only ten of the larger machines could be in place in the Northwest, perhaps as a test run, by 1990. Between 1990 and 2000 we assume the larger WTGs will become the generic machine and be used exclusively; in the early years it is possible that some second generation machines will continue to be installed. We have employed a rating of 6.2 MW for WECS installed during this period. That is an average of the expected ratings of three representative third-generation machines -- the G.E. Mod 5A now rated at 7.3, the Boeing Mod 5B rated at 7.2 MW, and a projected family of Hamilton-Standard models in the 4-6 MW range -- lowered to account for the possibility that some of the WTGs initially installed may be the smaller second-generation machines.[20/]

Between 1985 and 1990 we have assumed that any WECS installed will have an average rating of 3.2 MW. This is the

average of two machines presently in the prototype testing phase: the Boeing Mod 2 (2.5 MW) and the Hamilton-Standard WTS 4 (4 MW).[21/] It is altogether possible that the rated output of the Boeing machine will be increased before major production. We assume that production levels of over 100/year will be attained in the same period. Until that level is attained, supply of MW-scale WTGs will be limited. But since the capacity we have projected as achievable by 1990 is less than 3% of the total likely, by one reasonable estimate,[23/] to be available then, there should not be a supply problem for the Northwest. If the larger machines are in fact commercially available before 1990, our projection of achievable installed capacity by 1990 could well prove too low.

The only MW-size WECS which this assessment includes in the period through 1985 are Boeing Mod 2's rated at 2.5 MW, potentially to be installed at Goodnoe Hills and Cape Blanco (see Part II). We have assumed a capacity factor of 35% for all WECS; the site areas identified here should enable an average capacity factor at least that high to be attained.[24/]

IV. System Compatibility

Because wind is an intermittent resource, some have thought that utility-integrated WECS cannot reduce the requirement for conventional generation within a system. A utility must plan to meet expected loads, the argument runs, and if it cannot

count on being able to draw on wind-generated electricity when needed (since the wind may not be blowing) then the value of that electricity is lower to it and it must have back-up generating capacity to take up the slack. This is correct, but the problem is not as acute as it first appears for two reasons. One is that the argument rests on a dubious premise, that a wind system cannot be counted on to produce when there is demand. The other is that this way of stating the problem ignores the possibility of storage, a very real possibility in the Northwest given the extensive hydroelectric system.

As to the first point, the reliability of wind generation depends on both the nature of the wind system in question and the nature of the load requirements. If many WECS were widely dispersed over an area large enough that the winds in it would be to some degree independent of one another -- as is the case with the system envisioned for the Northwest -- there would be a high probability that <u>some</u> power would <u>always</u> be available. One study using hourly wind data from only two sites in the midwest (where no effort at dispersal was made) concluded that, depending on the year, the wind-power system in that context could be counted on at any given hour to contribute between a fifth and a half of its rated capacity.[25] Although the particular results of that study cannot be generalized to the Northwest, they do suggest that some firm capacity can be obtained from wind-power in the Northwest even before storage

is considered. To the extent diurnal and seasonal wind cycles at various sites, and the corresponding load requirements, are predictable, the WECS farms could be located to maximize this residual minimum firm capacity. Constructing wind farms at high gusting sites with a variety of WECS that have different cut-out speeds (i.e., different speeds at which they cease generating) to enable "ramped shutdown" could also increase reliability by ensuring that a whole wind farm would not go out of service at once.

Given the storage capacity of the Northwest hydro system, the amount of wind-generated power that can be relied upon and credited to the system as a whole is even greater -- potentially total. The hydro system can function as a sort of battery: when wind is blowing, less water is run through the dams; when the wind is not blowing so hard, the water earlier held back can be used to meet load. In practice, however, the integration of the two systems is trickier, and flow constraints on the hydro system which are independent of wind integration may limit storage capacity. Water flow must be managed, not only to produce electricity, but also to balance runoff, shipping, fish runs, recreation, and the like. One possible problem is that hourly fluctuations in the wind system cannot be accommodated fully; another is that the hydro system, especially in a high water year, may not have the flexibility in the spring to store any wind power.[26/] But both problems, to the extent they are real, can be mitigated.

In order to respond to unpredictable hourly fluctuations in wind power, the hydro system would need a measure of flexibility. On the one hand, water levels would have to be kept low enough that water could be held back to accommodate a surge in wind power. On the other, it would have to be possible to raise hydro flow levels when wind was down. Independent flow constraints might make it impossible in certain cases to meet one or the other contingency. It should be noted at the outset that this management problem will be less acute inasmuch as the wind system can be sited so as to generate a diurnal power curve that matches the curve of daily demand. The problem will also be less acute -- perhaps avoided altogether -- to the extent that the short-term fluctuations in wind can be predicted. To that extent, the problem ceases to be one of blind hour-to-hour response. With the amount of unpredictable wind power variation reduced, less hydro system flexibility would need to be preserved for unanticipated adjustments to integrate wind, and other demands on flow management could more easily be met. Preliminary indications are that wind variation is significantly predictable at least a few hours in advance, and that predictability may improve.[27/]

It should also be noted that the amount of hydro system flexibility required to manage unpredictable hour-to-hour fluctuations in wind is a function of the penetration level of wind power. Where wind provides a negligible proportion of

total system generation, even great fluctuations in its output can be easily accommodated. If all the wind power estimated here to be achievable by 2000 were in fact installed, it would constitute less than 10% of hydro system capacity. Furthermore, this is a problem which will not be faced, if at all, until late in the 1990s, because it is not until then that wind power can have achieved significant penetration -- only about 20% of total realizable wind power (or less than 2% of hydro capacity) is projected to be achievable by 1990.

The possible lack of storage capacity in the hydro system in spring, when run-off and hence river water levels are greatest, could give rise to two related problems. One is a storage problem: in a high water year it might be impossible to hold back flow in spring to store wind power which could not be used directly. The other is an overgeneration problem: if load demand and intertie capacity could be met by the system without wind, and hydro could not be throttled back, the wind turbines might as well be shut down. As to the first, it is not yet clear to what extent the hydro system, despite generally high water levels, might be available for <u>short-term</u> storage -- a couple of days or less. Such storage would enable wind power production to be evened out and its reliability to be enhanced (as weather patterns were anticipated, for example), even if long-term storage were not possible. More creative and sophisticated computer modeling and, even more important,

actual experience in accommodating wind-generated power in shaping loads and managing river flows are crucial to understanding the limits on (and costs of) integrating wind with the complex BPA hydro system. This underscores the value of undertaking at least one sizeable wind farm project in the near future for research and development purposes.

One other possible method of meeting the storage problem deserves mention: pumped storage. This entails building a new reservoir off the main course of a river. Using wind energy during a period of overgeneration (e.g., at night or during spring), water can be pumped into the reservoir to be stored and then released through hydro turbines when energy is needed. This increases the usable output of the wind system, but it also increases the cost of wind energy, since the cost of the pumped storage system must be assigned to it. However, since that cost could be amortized over the life of the storage facility, perhaps 50-100 years, the relatively low cost of power produced by WTGs once mass production levels are achieved may permit pumped storage.

With or without storage, however, the wind system would have a quantifiable level of reliability, as explained earlier. Another partial answer to the seasonal "overgeneration problem," then, would be to shut down a corresponding amount of base-load thermal generation, rather than wind, thus saving incremental fuel costs. A more

important step, however, is to site the wind system, as earlier suggested, so as to generate an annual wind power curve which is lowest in spring and early summer. This will minimize the proportion of annual wind power lost to either of these problems. This assessment has attempted in a preliminary way to integrate this solution by drastically scaling back from the site's theoretical capacty the amount of WECS installed in the spring-peaking east Gorge area (see Part III).

V. Regional Large-Scale Wind Generation Potential

Correlating WECS of appropriate average ratings (see Part III) with identified wind sites (see Part II) yields an assessment of achievable wind generation potential, summarized in Table 1. The totals arrived at here -- 89 MW, 487 MW, and 2,812 MW, respectively, for 1985, 1990, and 2000 -- are in the range of other regional estimates. For example, BPA, in a supplement to an OSU assessment, concluded that six sites under study had a potential for 2,540 MW of installed capacity.[28/] The Oregon Governor's Wind Task Force estimated that 1,396 MW of wind energy -- 1,333 MW provided by utility scale machines -- could be developed within Oregon alone by the year 2000.[29/] Another study, undertaken by the University of Washington Program in Social Management of Technology, estimated the upper limit of wind generated electricity in Washington in 2000 to be 500 average MW, or about 1500 MW

nameplate capacity.[30/] New sets of regional estimates are currently being prepared by BPA, the PNUCC Wind-Energy Subcommittee, and Battelle Laboratories (the latter for the Northwest Power Planning Council), and are expected to be consonant with those arrived at here.

TABLE 1: Achievable Large-Scale Wind Generation Potential in the Pacific Northwest

Site	1985			1990			2000		
	No. of WECS	Average Rating per Unit (MW)	Nameplate Capacity (MW)	No. of WECS	Average Rating per Unit (MW)	Nameplate Capacity (MW)	No. of WECS	Average Rating per Unit (MW)	Nameplate Capacity (MW)
1. Southern Oregon Coast	32	2.5	80	20	3.2	64			
	25	.05	1.25	10	6.2	62			
2. Columbia Gorge	3	2.5	7.5	60	3.2	192	40	6.2	248
3. Western Montana				25	3.2	80	175	6.2	1085
4. Southwestern Wyoming							60	6.2	372
5 & 6. Southern Idaho & Northwestern Nevada							100	6.2	620
TOTALS	60	1.5[a]	89[b]	115	3.5	398	375	6.2	2325
CUMULATIVE TOTALS	60	1.5	89	175	2.8	487	550	5.1	2812
CUMULATIVE AVERAGE MW (x 35% capacity factor)			31[b]			170			984

a. Average ratings per unit are rounded to the nearest tenth.

b. Nameplate capacity and cumulative average MW are rounded to the nearest whole number.

REFERENCES

1/ Oregon Alternate Energy Development Commission, Wind Task Force Final Report, Table 2-2, p. 9 (1980).

2/ Pacific Northwest Utilities Conference Committee, Wind-Energy Subcommittee of the Alternative Resources Committee, Wind-Energy for Utilities - Part 1, Table 8, p. 48 (January 1982).

3/ "Class 4" areas have a mean wind power density of 250-299 watts/m^2, with a corresponding wind speed of approximately 13.4-14.2 mph. The parallel figures for "class 5," "class 6," and "class 7" areas, mentioned below, are respectively: 300-399 watts/m^2 with 14.3-15.6 mph; 400-999 watts/m^2 with 15.7-21.0 mph; and 1000 watts/m^2 with 21.1 mph. Elliot, D.L. and Barchet, W.R., Wind Energy Resource Atlas: Volume 1 - The Northwest Region, Table 2.2, p. 21 (April 1980).

4/ Wind-Energy for Utilities, supra note 2, p. 29.

5/ Wind-Energy for Utilities, supra note 2, p. 39; Wind Task Force Final Report, supra note 1, p. 17.

6/ Wind Task Force Final Report, supra note 1, pp. 20-21.

7/ For a fuller discussion of the potential noise and electromagnetic interference problems, see Wind-Energy for Utilities, supra note 2, pp. 35-37, and Wind Task Force Final Report, supra note 1, pp. 19-20.

8/ Wind Task Force Final Report, supra note 1, p. 20.

9/ For definition of wind classes, see note 3 supra.

10/ Telephone conversation with Angus Duncan, Director of Northwest Projects, Windfarms, Ltd., on February 25, 1982.

11/ "Data, Power Mount," The World, Coos Bay, Oregon, March 20, 1982.

12/ Wind Energy Resource Atlas, supra note 3, pp. 57-83.

13/ "Medicine Bow Windmill Becalmed," The Energy Daily, February 23, 1982.

14/ Telephone conversation with Robert Baker, Oregon State University, March 1982.

15/ Id. Cf. E. Wendell Hewson, et al., "Executive Summary, Network Wind Power Over the Pacific Northwest" (1978), cited in Bonneville Power Administration, Division of Power Resources, Wind Energy Integration Study, p. 5 (August 1980), which places 200 WTGs at Wells.

16/ See, e.g., William Steigelmann, et al., Pacific Northwest Electrical Supply Alternatives and Costs: Electricity Generation from Advanced/Renewable Energy Systems, prepared for the Washington Energy Research Center, Washington State University, p. 3-61 (January 1982).

17/ U.S. Department of Energy, "Wind Energy Systems Program Plan," Docket # CAS-RM-81-404, p. 32.

18/ Some utilities have already made such a commitment. For example, Pacific Gas and Electric included 82.5 MW (nameplate) for 1990 in its previous generation expansion plans, and is revising that figure upwards, perhaps to as much as 380 MW (nameplate) by 1992, in its latest plans. Hawaiian Electric has signed an agreement to purchase up to 80 MW (nameplate) of wind-generated power from a private windfarms firm, starting by 1985. Nesbit, W., "Going with the Wind" in EPRI Journal, p. 9 (March 1980).

19/ General Electric, for example, has projected that it will produce 360 Mod 5A WTGs in 1989, bringing its cumulative production between 1982 and 1989 to 788. Witwer, J.G. and Balma, M., Developing Wind Energy Resources, SRI International, Business Intelligence Program Report, p. 15 (1980).

20/ Specifically, we derived the 6.2 MW average by assuming that one out of ten of the machines installed during the period would be a second generation machine with a rating, as explained, of 3.2 MW.

21/ It may well prove desirable and cost-effective to employ WTGs in the .2-.5 MW range on certain sites as well. Cf. Pacific Northwest Electrical Supply Alternatives and Costs, supra note 16, p. 3-82 ff. Omitting them from the present assessment is an additional conservatism. Since the smaller machines do not require as high a wind regime, their use in conjunction with larger WTGs on sites identified here, where appropriate, would increase the capacity of those sites. Further, they may make it sensible to farm additional wind sites.

23/ Wind Task Force Final Report, supra note 1, Table B-2, p. B-2.

24/ Two studies by OSU using data from the Northwest yielded annual wind network capacity factors of 33% and 37%, respectively. Other projections, not specific to the region, range from 35% to 44%. See Berger, M. and Seiffert, R., Preliminary Resource Assessment: Large-Scale Wind Power, BPA, p. 5 (June 1980).

25/ Buerhring, W.A., et al., Reliability, Energy and Cost Effects of Wind-Powered Generation Integrated with a Conventional Generating System, Argonne National Laboratory, Figure 1 (June 1980). This study measured overall system reliability probabilistically in terms of frequencies and durations of failures to meet electrical loads. The reliability index used was "firm-capacity equivalent": the amount of dependable capacity that could be removed from the wind-aided system in order to return system performance to the original level of reliability. Thus, the results are dependent not only on the regional wind data and particular wind-system employed, but also on the load curve and the conventional generating system studied.

26/ See Bonneville Power Administration, Division of Power Resource, Wind Energy Integration Study, pp. 18-31 (August 1980).

27/ Id., pp. 31-32.

28/ Nick Butler, BPA Supplement to OSU Report Entitled "Network Wind Power Over the Pacific Northwest," p. 3 (June 1978).

29/ Wind Task Force Final Report, supra note 1, p. 15.

30/ Program in Social Management of Technology, University of Washington (in collaboration with House and Senate Committees on Energy and Utilities, Washington State Legislature), Summary of a Report on Decentralized Electricity Generation for Washington, p. 7 (February 1981).