Demand Forecasts and Electrical Energy Politics: The Pacific Northwest

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The task of energy forecasting, it would seem, has rarely attracted the intellectually modest or meek. Sometimes predictions display so much technical virtuosity and claim such precision that some say it appears that forecasters know more about the future than we do about the past [10, p. 63]. Yet, as many forecasters themselves have realized, theirs is a human and hence social and political activity. Technical skills are employed in the service of particular social goals. Energy forecasting is political because energy policy is political. It is also political because the assumptions and methods that forecasters employ reflect their world views and ideological preconceptions. As forecasters Bill Keepin and Brian Wynne themselves put it, "...policy modelling, which appears to be purely technical and objective, always contains embedded assumptions about institutional parameters and relationships framing the assumptions about technical constraints and possibilities" [9, p. 54].

This is not to say that forecasts are merely rationalizations. However, assessing forecasts involves understanding their social and ideological context. (In fairness, our assessments themselves need contextualizing; the historian is also a product of his or her social situation.)

Largely because of the Pacific Northwest's hydroelectric power legacy (three-quarters of the region's generating capacity is hydro) and the institutionalized role of the Bonneville Power Administration (BPA) as transmitter, wholesaler and marketer of the energy generated at federal dam sites, electrical energy planning in the region has been distinctive in at least two respects: first, public and semi-public bodies play a large role in the process of planning and undertaking, not just regulating and reviewing, development. Second, planning takes place on a regional basis; since 1981, the Northwest Power Planning Council has been a unique body, established by federal legislation, with members appointed by the region's state governors, and charged with overseeing Bonneville and other power agencies to put a regional electrical energy plan into action.

If this would suggest a rationalistic, far-sighted approach to electrical energy policies in the region, remember that the Northwest is the home of the Washington Public Power Supply System, a sad monument to misguided

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expectations and unattainable, not to mention undesirable, goals. The Supply System decided in the late sixties and early seventies to build and operate five large nuclear plants. Costs soared and the projects suffered massive construction delays; in 1981, a recalculated budget put the expected total cost at $23.9 billion. The next year, two of the projects were terminated; one was mothballed about 63% complete. In 1983, another, 76% finished, was also put on "extended construction delay." In that year, WPPSS defaulted on $2.25 billion of municipal bonds issued to finance the two canceled projects. WPPSS suffered a multitude of slings and arrows, some from its own quiver, but bad energy forecasting was a prime cause of its swollen ambitions and inglorious results.

Before the energy crisis of the early seventies, energy forecasting had been a relatively simple matter. Extrapolation of past trends by relatively simple time series and curve-fitting methods had been sufficient to the task of predicting continual growth. The 1970s saw, nationally and internationally, a veritable paradigm shift in demand forecasts to deal with the risk and uncertainty of those years. Growing sophistication in econometric techniques grounded in price theory was one way that forecasting changed. So, too, was end-use forecasting, which derived energy demands from forecasts of the stocks, efficiencies and utilization levels of energy-using devices. But the improved techniques complemented a change in outlook. Explicit awareness of the probabilistic, stochastic nature of forecasting supplanted earlier determinism. Single-valued forecasts gave way to forecasts with multiple paths, sensitivity analysis and attempts to use decision theory in evaluating alternatives. Forecasters began to consider policy choices in their models. Indeed, the notion that demand forecasting preceded supply policy and set the agenda for it gave way to a more interactive view. Forecasts were reconceptualized as scenarios, narratives of appropriate steps toward feasible outcomes. Environmentalists, often with formidable skills in economics, engineering and management, helped to change the vocabulary of energy forecasting and policy. Soft energy paths, least-cost planning, demand-side management, true marginal cost pricing--these were some of the terms which entered the arena.

In the 1970s in the Pacific Northwest, new forecasting methods and concepts encountered resistance. Institutional inertia, vested interests and ideological rigidity all made the politics of demand forecasting contentious. Since the early 1950s, the Pacific Northwest Utilities Conference Committee (PNUCC), a group representing the region's utilities, had issued an annual twenty-year load and resource forecast covering the so-called West Group area, roughly Washington, Oregon, northern Idaho and Montana west of the Continental Divide. Yet it is important to note that PNUCC itself did not prepare the predictions it published. It simply added up the forecasts it received from more than one hundred utilities serving the West Group area. In turn, all but the largest public utilities relied on BPA staff to prepare their forecasts. Bonneville also calculated the loads of the Direct Service Industries, energy intensive firms, mostly aluminum refiners, who had been locating in the region since cheap Federal hydropower became available on the eve of World

War II. In sum, Bonneville forecasts accounted for about forty percent of the demand projections in the PNUCC report [20, p. 4].

Given even a modest degree of hindsight, it is not hard to find flaws in PNUCC-BPA methodologies. The sum-of-utilities forecast simply passed on the biases of the individual utility predictions. Thus, a local utility hoping to attract an employer, developer or commercial customer to its service area would understandably project a need for the energy to serve the potential load. So might a utility in a neighboring community, competing for the same customer. The PNUCC forecast had no way to eliminate the tendency toward double-counting. Second, the BPA guidelines for individual utility forecasts, established in its 1965 *Load Estimating Manual*, were confusing and outmoded. According to a 1976 critique, the manual:

> ...does not adequately address how to prepare the forecast....
> ...provides insufficient documentation on techniques prescribed...
> ...has no specific examples (or case studies)...
> ...is out of date with respect to both data available...and techniques in use.... [6, pp. 7-8].

The four large private utilities in the region, as well as most of the major publics, did conduct their own forecasts. As late as 1976, these ranged in sophistication from fairly elaborate econometric models to Pacific Power and Light's method of assuming a constant annual growth rate after correcting for weather conditions.

At times, it seemed as if any consideration of economic variables was utterly foreign to power forecasters in the sixties and early seventies. During a "Dialogue on Power Demands," in 1972, Oregon's State Engineer asked a Bonneville manager, "[W]ill the increasing cost of electricity cut back in the demand for electricity?" The reply: "Well, off-hand I can say we haven't considered that" [13, p. II-4].

However faulty the planners' methods were, they did have one saving grace; until about 1973, they worked. Electric load growth had marched forward at a steady pace, seemingly in lock step with advancing real output. Loads tripled between 1955 and 1975. Residential electric space heating and the growth of the Northwest aluminum industry led the way.

But power planners saw history as destiny, and they pronounced it good. They took past correlation of electricity and output to mean necessary causation. In its annual publication, "The Electric Energy Picture in the Pacific Northwest," Bonneville reached back to prehistory for a chart presenting the "Growing Energy Consumption from Primitive to Technological Man." Another figure plotted gross national product versus per capita energy consumption for fourteen nations. That U.S. energy consumption levels were almost twice as high as Sweden's while income levels were nearly the same went unmentioned [17, pp. 402-403].

The language is telling. Bonneville called predicted demand levels "requirements," as if there were no alternative to building all the generating facilities to meet them. Thus planners imbued their forecasts with a rhetoric

of inevitability. The forecasts themselves "required" a supply-oriented strategy for the future.

Similarly, the forecasts tended to assume a single way to meet anticipated demand. All models exclude factors viewed as beyond the modeler's ken, but the BPA, PNUCC, and Northwest utility forecasts considered only one supply possibility, central station thermal power. This was embodied in the Hydro-Thermal Power Program of 1968, which presented a schedule calling for two coal plants and *twenty* large nuclear plants to be in operation in the Northwest by 1990. As elsewhere, in the Hydro-Thermal Power Program, the language of inevitability prevails: "New thermal plants are...assigned to private utilities or public agencies on the basis of requirements to meet load" [19, p. 19].

Thus, it is easy in retrospect to scorn the kind of forecasting that undergirded regional power planning in the Northwest in the 1960s and 1970s. The forecasts "worked" when trends remained unaltered. When the context changed, the predictive power of the forecasts plunged. Yet it is important to keep in mind that, just as forecasts guide policy, policy and politics also affect forecasting. The Northwest's power planners got forecasts that justified the policies they wanted.

The mid-1970s saw a proliferation of new kinds of forecasts of Northwest electricity demand. By this time, the OPEC oil embargo of 1972-73 had provoked a sense of national and even global energy crisis. In the Northwest, late 1973 brought near-drought conditions, low stream flows, and urgent pleas for curtailment of electricity use. Although voluntary efforts apparently reduced demand 5.6%, utility planners found the experience unsettling. "The future outlook...is not optimistic," reported a study group [14, p. 3]. From 1974 through 1976, Bonneville aggressively recruited 88 public utilities to participate in WPPSS Projects 4 and 5.

As the stakes rose, several new players entered the energy forecasting game. Oregon's state Department of Energy was one of the first into the fray, issuing *Oregon's Energy Future* in January 1977. Although the report criticized utility planning only gently, its methodology and presuppositions were at odds with the blend of boosterism and fatalism inherent in the West Group forecasts. First, Oregon insisted, "future energy consumption is neither fixed nor predestined. It is the result of individual and collective decisions made now and in the future" [12, p. 20]. The DOE also broke with the past by employing an econometric model which explicitly took energy prices into account. Forecasts that ignored demand elasticity did so at their own peril. While Oregon electric utilities were still expecting the state's demand to grow by 6.7% in the next decade, *Oregon's Energy Future* estimated a 4.0% rate of increase. For the 1986-96 decade, Oregon utilities predicted 5.2% annual growth, the DOE only 2.2% [12, p. 53].

A complex political logic probably affected the DOE report. Private utilities served the large majority of Oregon households. These utilities were losing access to cheap Federal hydropower, since BPA was mandated to serve public utilities first and also had long-term power sales contracts with the Direct Service Industries. Expectations of tight supply conditions would make

Bonneville unwilling to commit to selling hydropower to the private utilities and thus drive up Oregon ratepayers' bills.

Another report was in progress when *Oregon's Energy Future* was issued. In November, 1975, the Pacific Northwest Regional Council, with representatives of the governors of Washington, Oregon and Idaho and a Federal member appointed by the President, had commenced a million-dollar, two and one-half year regional energy study. This Northwest Energy Policy Project (NEPP), like the Oregon forecast, dealt with other forms of energy as well as electricity. It presented a comprehensive twenty-five year forecast for the Northwest for electricity and for direct applications of fossil fuels.

The NEPP's Director, Myron B. Katz, was a Bonneville Power Administration employee on loan to the Project. BPA, indeed, contributed over $300,000 of services and resources. The Governors in the region included the adamantly pro-nuclear Dixy Lee Ray of Washington as well as her predecessor, Dan Evans, an engineer and also a supporter of nuclear energy. The project commissioned ten study modules on various aspects of the topic from management, engineering and economic consultants around the nation. Considering this background, one might have expected a report vindicating the supply-oriented, centralized path of regional utility planners. In fact, the NEPP's approach and results took a far more moderate path. The Project wrapped itself in the mantle of scientific objectivity, trying "to restrict itself to calm, scientific deliberation and to eschew enthusiasm for or against competing programs and policies.... This principle of objective scholarship has been a dominant article of faith for NEPP" [11, p. vii]. At the same time, it tied forecasting to policy, accepting the task of laying out a menu of policy choices and their associated implications for decision-makers to digest [11, p. 38]. Thus, unlike the rhetoric of utility forecasts, the NEPP accepted the principle that forecasts did not dictate a single future course of action. Like many forecasts from the mid-seventies onward, the Project offered not one but a range of estimates of future electrical loads. According to its medium forecast, demand would increase about 2.93% per annum between 1975 and 2000, approximately doubling in that span. But the low forecast foresaw only a 1.43% annual growth rate (about 43% overall for the period); the high growth projection was a 4.38% annual rate (almost tripling between 1975 and 2000). It graciously reported in its Executive Summary, "NEPP's high energy-growth forecast for electricity is consistent with the forecasts of the region's electric utilities"[11, p. 8]. (In fact, the most recent West Group forecast had predicted a 4.9% growth rate, substantially higher than the project's high estimate.) Yet it later judged the chance of reaching or surpassing the high forecast as ten percent or less [11, pp. 59,68]. Also notable in the NEPP was an effort to assign dollar costs to a payoff matrix matching strategies and outcomes and implicitly to calculate the risk-weighted expected values of alternative supply policies. Finally, in its presentation of policy options, demand-side strategies, notably conservation, gained equal billing with centralized supply.

Thus, despite its roots in the region's political and energy establishment, the Northwest Energy Policy Project broke with some of the tenets of establishment faith. We can only surmise what political forces were acting

upon the Project. There was, to be sure, the growing discrepancy between PNUCC forecasts and experience. The 1974 forecast, for instance, estimated loads for 1977-78 that turned out to be 12.4% higher than actual demand. If this seems modest, consider that the prediction overstated loads by the equivalent of about two and one-half large nuclear plants, half the entire expected output of WPPSS's nuclear venture. Equally significant, we can hypothesize, was the fact that the Project lacked direct utility responsibility. Utilities, especially public-owned ones in the Northwest, have taken with utmost seriousness their duty to meet the loads placed upon them. The costs of potential shortages were reckoned not only in dollars and cents but in reputations ruined and missions failed. Despite their links to Bonneville, the Project's leaders apparently tried to assess the region's prospects without the sense that shortages were utterly intolerable.

Moreover, outsiders had entered the Pacific Northwest's electrical energy planning process. Environmentalists objected strenuously to plans for BPA to supply power for a new aluminum refinery in Oregon, the Alumax plant. Eventually, in 1975, Bonneville agreed to delay signing a contract with Alumax, put its plans for expanding its power marketing role on hold, and prepare an elaborate Environmental Impact Statement (EIS) on its role in the Pacific Northwest power supply system. Six volumes of a draft Role EIS appeared in 1977.

In preparing the statement, Bonneville sought participation from some of its most stringent critics. The Natural Resources Defense Council (NRDC) and other environmental groups began work on an alternative regional demand forecast. The Energy Research and Development Administration (predecessor of the U.S. Department of Energy) subsequently provided funding. *Choosing an Electrical Energy Future for the Pacific Northwest: An Alternative Scenario* appeared in final draft form in January, 1977. As the origins and the title of the study suggest, the Alternative Scenario was a sharp challenge to other Northwest energy forecasts. It calculated a long-term growth rate in central station generation at less than 0.5% annually, a gain of under ten percent in twenty years, and pointed out that no new power plants beyond those already approved or under construction in 1977 would be needed to meet the load in 1995. For that year, the Alternative Scenario expected less than half the energy load in the region that the PNUCC had forecast [4].

The Alternative Scenario also differed from other demand forecasts in that it was clearly a call to action. The scenario was therefore a road map to guide the region down a conservation-oriented energy path. Unlike the Northwest Energy Policy Project, which employed a rhetoric of detachment and impartiality, the NRDC study was a work of advocacy for policies designed almost to eliminate future load growth--mandatory conservation, innovative electric rates moving toward marginal cost pricing, efforts at improving energy efficiency. Yet it was careful to avoid sounding excessively utopian. For example, it adopted "fairly conservative" assumptions about commercialization of energy-efficient technologies and did not incorporate all innovations that could increase efficiency [4, p. 11]. It relied extensively for data and technical information on a consultant's study on conservation that Bonneville itself had commissioned.

In *Chain Reaction*, a recent study of civilian nuclear development, Brian Balogh notes how counter-experts in the sixties and seventies broke through the barriers that contained debates over nuclear power and helped to delegitimate the claims of experts who had pressed for rapid development since World War II [2, pp. 321-322]. The Natural Resources Defense Council study exemplifies a similar process in the realm of electrical energy policy. As Balogh points out, containment of public debate by expertise is easier in policy formulation than in implementation. When public actions, such as siting, financing and building large power plants, were required, expert claims encountered resistance.

A mere observer in 1977 might well be bewildered by forecasts which differed so wildly. Was the Northwest to adhere to a PNUCC forecast which implied twenty-six new central station thermal plants by 1995 to meet a nearly-tripled load? Or could it realistically strive to implement the Alternative Scenario? The Energy Research and Development Administration commissioned yet another consulting firm, TRW Energy Systems Planning Division, to assess the rival plans' "numerical accuracy, economic feasibility, and institutional impact..." [15, p. iii]. Its September 1977 report in large measure vindicated the NRDC's Alternative Scenario. The NRDC end-use projection of residential demand "must be judged a detailed, highly explicit, quantitative approach to the complex process.... It is a convincing approach...." [15, ch. 2, p. 8]. Although the commercial and manufacturing sector calculations depended on some unreliable demographic and technical assumptions, the overall verdict on these Alternative Scenario forecasts was also favorable.

The TRW consultants' judgment of the PNUCC "Power Plant" forecast was more critical. The utilities' forecast indicated a ninefold growth over twenty years for a category of manufacturing firms known as "other industrial." According to the evaluators, "The magnitude of this overestimation may be more than twice the 1975 usage of the primary aluminum industry," the largest power user in the region. Less egregious was the PNUCC's projection of a doubling of demand for electricity for appliances, presented "without explanation or justification" [15, ch.1, pp. 7-8]. TRW found the cost of implementing the Alternative Scenario $6.3 billion cheaper than the Power Plant proposal.

As the scope of expert discussion of energy demand forecasts widened, public interest in the subject also grew. A month after TRW provided its professional assessment of the NRDC and PNUCC forecasts, the Washington Public Interest Research Group issued its own report, noting "inherent problems with the PNUCC forecasts" [22, p. 89]. Lest the reader still think that forecasts were neutral technical tools, the students' report concluded by listing the League of Conservation Voters' ratings of the Northwest congressional delegation's votes on key energy and environment issues.

By the end of the 1970s, the downward spiral of the WPPSS nuclear projects had politicized Northwest energy policy still more. Decisions in the previous decade had already incurred severe costs, and forthcoming decisions further jeopardized the region's hopes of maintaining its reliance on cheap electricity. Between 1977 and 1980, Congress debated proposals to coordinate

and control electricity resource decisions for the Northwest. The measures differed in their orientation to rapid load growth and thermal generation, on the one hand, or conservation and renewables on the other; the Pacific Northwest Electric Power and Conservation Act which President Carter signed on December 5, 1980 attempted a compromise. Major changes were in store for the Northwest.

Bonneville and the utilities of the Northwest grappled with these changes but were loath to discard the rapid growth forecasts that had led them toward crisis. BPA head Don Hodel had set the agency's tone in 1975 with a speech delivered to the Portland City Club on "The Prophets of Shortage." He attacked "a small, arrogant faction which is dedicated to bringing our society to a halt...the anti-producers, the anti-achievers" [21, p. 124]. Sterling Munro, Administrator during the Carter presidency, was less inflammatory, but his agency remained inhospitable to alternative views.

The PNUCC, meanwhile, restated its apparently blanket preference for overforecasting rather than underforecasting: "If experience shows that more than enough resources have been scheduled, the schedules can be corrected...; but if too few resources have been scheduled, there may be no way to avoid the public injury from the resulting shortage" [18, p. II-6]. Annually, the PNUCC revised its West Group forecasts slightly downward, but its predictions regularly exceeded actual loads. PNUCC attempted to justify its forecasts by comparing them with a consultant's econometric model, but the model predicted lower growth rates than the PNUCC's summation yielded. And the model itself overpredicted the Northwest's demand growth.

Bonneville, as it assessed its possible institutional futures under different versions of regional power legislation, revised its 1977 draft of the Role Environmental Impact Statement. Yet the the revised draft, issued in April 1980, seemed no more reconciled to slowing growth patterns for the Northwest. It ignored the NRDC's Alternative Scenario, and its section on conservation was, in the NRDC's words, "couched exclusively in platitudes" [5, p. A-59]. Apparently in response to the NRDC's objections to the draft, the final statement, issued December 1980, added a five-page summary of the Alternative Scenario--and a fifty-four page rejoinder to it [16].

Why the resistance to alternative load growth forecasts? We can only suggest an explanation. In 1962, economists Harvey Averch and Leland Johnson argued that a profit-maximizing utility subject to a regulatory constraint on its rate of return would have an incentive to over-invest in facilities that would enter its rate base [1]. This Averch-Johnson effect might account for adherence to inflated load growth estimates in the case of a private utility but does not apply to the Northwest's public and semi-public agencies. We must explain their behavior in historical and institutional terms. The success of hydropower development from the thirties through the sixties had convinced them prosperity came coupled rapid energy growth. Public utilities feared that they would lose ground to the investor-owned companies if they slowed their growth. The aluminum companies depended on abundant cheap energy for their well-being, and Bonneville in turn liked the flexibility that the firms' demand patterns gave it. Of course there were also the normal forces

of bureaucratic aggrandizement, technological optimism and civic boosterism that biased power planners toward high demand forecasts.

By the time its final EIS appeared, Bonneville was entering a new era. The Pacific Northwest Electric Power Planning and Conservation Act rendered moot many of the options for BPA's institutional arrangements that the EIS had so closely scrutinized. More dramatically, the WPPSS projects at the heart of the original Hydro-Thermal Power Program could no longer be sustained. Robert Ferguson, the new WPPSS Managing Director, halted construction on Plants 4 and 5 in May 1981. (Early the next year, the plants were terminated.)

Also in May 1981, Peter Johnson, President Reagan's appointee, became Bonneville's new Administrator. When he assembled his top managers for a strategic planning retreat in September 1981, he quizzed them: What would the long-run annual average load growth for the region be? The consensus was only 1.5%. "It was quite a revelation," Johnson later reflected. Bonneville had been in a "period of delusions" [8]. Indeed, without the terminated WPPSS reactors, without the two others placed in mothballs soon afterward, and without four more reactors later canceled by private utilities, the Northwest spent the 1980s coping with electricity surplus, not shortage. The lights did not go out in the Pacific Northwest, but the region and the nation have paid dearly. Demand forecasting alone did not lead to the unexpected denouement of termination, mothballing, and default in the early 1980s and surplus for the next decade, but the forecasts offered "solutions" that were really part of the problem.

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