Testimony of
Paul L. Chernick

on Behalf of
Conservation Intervenors

before the
Board of Environmental Protection

in the Matter of the
Basin Mills Hydroelectric Project Application

November 16th, 1992

1. Introduction and Summary

a. Witness Identification and Qualifications

Q: Please state your name, position, and business address.

A: I am Paul Chernick, President of Resource Insight, Inc (RII). My business address is 18 Tremont Street, Suite 1000, Boston, MA 02139.

Q: On whose behalf are you testifying?

A: I am testifying on behalf of Conservation Intervenors (CI).

Q: Please summarize your qualifications.

A: I received an S.B. degree from the Massachusetts Institute of Technology in June, 1974 from the Civil Engineering Department, and an S.M. degree from the Massachusetts Institute of Technology in February, 1978 in Technology and Policy. I have been elected to membership in the civil engineering honorary society Chi Epsilon, and the engineering honor society Tau Beta Pi, and to associate membership in the research honorary society Sigma Xi.

I was a Utility Analyst for the Massachusetts Attorney General for over three years, and was involved in numerous aspects of utility rate design, costing, load forecasting, and the evaluation of power supply options. Since 1981, I have been a consultant in utility regulation and planning, first as a Research Associate at Analysis and Inference, after 1986 as President of PLC, Inc., and in my current position at Resource Insight. I have advised a variety of clients on utility matters. My work has considered, among other things, the need for, cost of, and cost-effectiveness of prospective new generating plants; conservation potential; conservation program design and evaluation; and the valuation of environmental externalities from energy production and use. My resume is Attachment 1 to this testimony.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified approximately 100 times on utility issues before various regulatory, legislative, and judicial bodies, including in New England:

- the Massachusetts Department of Public Utilities,

- the Massachusetts Energy Facilities Siting Council,
- the Vermont Public Service Board,
- the Vermont Legislature,
- the New Hampshire Public Utilities Commission,
- the Connecticut Department of Public Utility Control,
- the Rhode Island Public Utilities Commission, and
- the Maine Public Utilities Commission.

I have also testified before utility regulators in Texas, New Mexico, the District of Columbia, Michigan, Minnesota, South Carolina, Pennsylvania, and Florida, as well as the Federal Energy Regulatory Commission, and the Atomic Safety and Licensing Board of the U.S. Nuclear Regulatory Commission. A detailed list of my previous testimony is contained in my resume.

Q: Have you testified in any other cases involving BHE?

A: Yes. In 1984, I testified before in Maine Public Utilities Commission (MPUC) Docket 84-113, on the cost-effectiveness of the Maine utilities' plans to complete Unit 1 of the Seabrook nuclear plant. I testified that completing Seabrook would be uneconomical for BHE and for the other utilities. My projection has proven to be correct; EUA Power, the utility that purchased the Maine utilities' Seabrook capacity, has been unable to sell the plant's power at a high enough price to cover its costs, and is now in bankruptcy. Later in 1984, I testified on the prudence of the Maine utilities in purchasing Seabrook capacity in the 1970s, and in continuing to support construction of Seabrook Unit 2, which was abandoned.

In February 1991, I testified in MPUC Docket 90-286, on the adequacy of BHE's demand-side planning (DSM) portfolio. I critiqued a number of aspects of BHE's DSM planning, including BHE's efforts to promote increased electric use, treatment of customer savings as if they were costs, low savings goals, limited program offerings, and poor program design. Many of my criticisms were reflected in the MPUC's decision in that case; BHE's current DSM plans include some, but not all, of my recommendations.

b. Purpose and Summary of Testimony

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to assist the Board of the Department of Environmental Protection in determining whether the public benefits of the Basin Mills hydroelectric dam justify granting Bangor Hydroelectric Company (BHE) a permit at this time.

Q: Please summarize your conclusions.

A: BHE's application for a permit for the Basin Mills project is premature: the Company is asking for a permit too early. The Board does not yet have enough information to make a prudent decision about whether, as required by the Maine Waterways Development and Conservation Act, "the project will result in significant economic benefits to the public" and whether "the advantages of the project are greater than the direct and cumulative adverse [environmental] impacts over the life of the project."[1]

Bangor Hydro currently does not expect to need power from Basin Mills until 2002. Identified energy conservation programs could push that need back to some time between 2005 and 2009. The Company estimates that construction of Basin Mills will take four years. Allowing ample additional time for the licensing process, the Board could safely wait until at least 1998, and possibly until after the turn of the century, to consider granting a permit for the project. By that time, alternative supply options may be clearly less expensive than Basin Mills.

On the other hand, granting BHE the permit at the current time could have costly consequences. With the permit in hand, BHE would be tempted to ignore cheaper and more environmentally benign supply options. The Company's customers would then be subjected to unnecessarily high rates, and Maine's environment would suffer unnecessary damage.

I conclude that the Board should decline to issue an MWDCA permit for Basin Mills until at least 1998. At that time, should the Company reapply, the Board and BHE will have more complete information on the timing of the need for new supply, and on the availability of other cheaper, cleaner options for producing power. Whereas postponing the decision carries little or no risk, granting a permit at this time could lead to higher costs for BHE's ratepayers, and to unwarranted damage to Maine's natural resources.

Q: How have you organized the remainder of your testimony?

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[1] Maine Waterways Development and Conservation Act, 38 M.R.S.A, Section 636.

A: First I explain how, through an improved energy conservation effort, BHE could delay the need for new supply until some time between 2005 and 2009. I show that BHE has underestimated the amount of cost-effective energy and demand savings available in its service territory. By 2002, improved energy conservation programs could displace an additional 63 MW of supply.

I then discuss the harm to BHE's customers and to Maine's environment that could result if Basin Mills were granted a permit at this point in time. I suggest that a permit would be a disincentive for BHE to improve its conservation programs and to investigate other cheaper options for power than Basin Mills; this disincentive would result in higher customer bills and unnecessary damage to the environment.

I conclude by presenting to the Board my recommendation that it deny the Basin Mills permit without prejudice.

2. Improved Energy Conservation Programs Could Delay the Need for New Supply Until Some Time Between 2005 and 2009

a. BHE's Energy Conservation Programs Are Poorly Designed

Q: Why do utilities offer demand-side management programs?

A: Utilities are responsible for providing sufficient electricity to meet their customers' needs for energy services, such as light, heat, and power. Traditionally, when a customer has needed an energy service, for example, lighting, the utility met that need by providing electricity. As the demand for power grew, utilities simply built more plants to supply it, and power lines to deliver it. Over the past few years utilities have realized that it is often cheaper to meet the customer's need for light by helping the customer install efficient light bulbs (which provide the same amount of light, but require less electricity) than by building new power plants. More generally, utilities are finding that by helping their customers use energy more efficiently, they can reduce customer bills and delay the need for new power plants.

Thus, utilities throughout the country now offer so-called demand-side management (DSM) programs,[2] to reduce customers' demand for electricity by taking advantage of opportunities for energy efficiency. The programs help customers learn about, fund, and install energy efficiency measures.

A successful set of utility demand-side management programs covers all of the opportunities for obtaining energy savings, and uses all cost-effective means to get customers to install energy-saving measures. For example, many utilities offer programs that install measures for residential customers for free.

Q: Can BHE's DSM programs obtain all the savings available from its customers?

A: No, for two reasons. First, BHE's programs do a poor job of capturing savings from their target customers. Second, there are vast pockets of savings that BHE leaves untapped: BHE's programs address only a limited number of energy savings opportunities.

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[2] Demand-side management programs include energy conservation and load management programs. Energy conservation programs reduce the amount of energy (kWh) a customer requires. Load management programs merely shift the timing of customer's energy needs from on-peak periods to off-peak periods. Load management programs reduce the peak demand on a utility's system, and thus save capacity (MW), but they generally do not actually save any energy.

Q: Please give an example of how BHE's programs do a poor job of capturing savings.

A: Over the past few years, New England utilities have learned a lot about how to design energy conservation programs that yield high savings. BHE's program designs seem to ignore the experience of its neighbor utilities.

For example, other utilities have learned that audit programs, which only provide customers with information, do not lead to high savings; most customer need financial incentives (rebates or even free installation) to overcome institutional roadblocks to implementing energy conservation measures.[3] Consequently, most leading New England utilities do not even offer audit programs. They rely instead on programs that offer customer incentives. In contrast, BHE *does* offer audit programs to its residential and commercial customers, even though other utilities have found these programs so ineffective as not to be worthwhile.

Q: Does BHE ignore other well-known principles of energy conservation program design?

A: Yes. Utilities have learned that the hardest part of obtaining savings from residential customers is getting the measure to the customer's home. Because customers often lack the time or know-how to purchase and install efficiency measures, utilities rely on so-called direct-installation programs, which install measures in the customer's home, for free. Typical measures installed include energy-efficient light bulbs, simple air infiltration measures, a cleaning of refrigerator coils, and water heating efficiency measures.

Amazingly, BHE's direct-installation program (called Wrap-up/Seal-up) only offers water-heating measures. It leaves behind all the savings it could obtain from lighting, space heating and refrigeration. If BHE redesigned Wrap-up/Seal-up to take better advantage of its visit to the customer's home, the program would reap much higher savings.

Q: Please discuss other sources of savings that BHE's programs are completely overlooking.

A: BHE is leaving untapped some of the most important sources of savings. In particular, BHE ignores the savings that can be secured during the construction or renovation of a building.

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[3] A few examples of roadblocks are lack of qualified staff, in a small business, to purchase and install measures; hassle and difficulty, in a large organization, of obtaining approval for purchases of energy conservation measures; lack of cash flow for conservation investment for both residential and commercial customers; and split incentives between landlords and tenants, where a landlord has no incentive to pay for a measures because the tenants receive all the savings.

Q: Why should a utility develop a DSM program to address new construction?

During construction, it is very cost-effective to install high-efficiency equipment, such as efficient chillers, and to build with energy-efficient materials, such as insulation with a high R-value[4]. Though these energy conservation measures pay for themselves in just a few years, developers seldom take the initiative to install them. They are reluctant to pay the cost of energy-efficient materials and equipment when the tenants or future owners, and not the developer, will be the ones to benefit from lower energy bills. Developers may also install inefficient equipment because they are unfamiliar with high-efficiency alternatives.

Q: Have other New England utilities developed New Construction programs?

A: Numerous utilities in New England have recognized that the savings that can be obtained during construction and renovation are sizeable and long-lasting (they tend to last 40 years or more), but that certain roadblocks keep developers from installing these measures. In response, these utilities designed residential and commercial/industrial new construction programs. The programs offer technical advice to developers, and generally pay all of the extra cost of energy-efficient building materials and equipment. Utilities with New Construction programs include Granite State Electric (NH), Massachusetts Electric (MA), Narragansett Electric (RI), United Illuminating (CT), Boston Edison (MA), Western Massachusetts Electric, (MA) Connecticut Light & Power (CT), Green Mountain Power (VT), Central Vermont Public Service, and Central Maine Power. In contrast, BHE makes no attempt to capture the savings available during new construction and renovation.

Q: What other sources of savings is BHE overlooking?

A: BHE does not attempt to obtain any energy savings from commercial or industrial motor use, even though motors account for more than half of the energy used by BHE's industrial customers. BHE also leaves untouched all the savings that it could obtain from improvements to the heating, ventilation, and cooling of commercial and industrial buildings.[5] Nor does BHE yet have in

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[4] A higher R value indicates a more effective insulator.

[5] It is likely that certain Payload bidders (I describe the Payload program in the next section of my testimony) will deliver savings from motors and from heating, ventilation and air conditioning (HVAC). These bids, however, should not supplant a systematic and comprehensive effort by BHE to squeeze all the cost-effective savings it can from the motors and HVAC systems in its service territory.

place a program that would encourage residential and business customers to purchase high-efficiency appliances and equipment.

b. BHE could obtain additional savings by implementing more aggressive programs

Q: Has BHE underestimated the savings it could obtain from energy conservation?

A: Yes. The following evidence suggests BHE has grossly underestimated the savings that the Company could obtain from energy conservation:

- The preliminary responses to BHE's Payload program were nearly three times as great as the utility predicted they would be.
- A study *commissioned by BHE* found that BHE could obtain an additional 8.4 MW by 2002.
- A careful review of the study shows that in fact, with aggressive energy conservation programs, by 2002 BHE could secure savings of at least 51 MW.

Q: What is the Payload program?

A: The Payload program allows large commercial/industrial customers and Energy Service Companies (ESCOs) to bid for the right to act as energy conservation entrepreneurs, obtaining energy conservation savings that they then sell to the Company. The Company has already received preliminary bids from interested parties. Final bids are due at the end of November 1992. The Company projected that Payload would yield 2.5 MW of savings.

Q: How much DSM was offered in the preliminary bid responses to Payload?

A: According to BHE, respondents to the preliminary bid offered over 50 GWh per year of savings, equivalent to 7.1 MW, or nearly three times the Company's original estimate.[6] [7] These savings would be obtained from commercial and industrial customers.

Note that these estimates only take into account the *preliminary* bid responses. Final bids will probably represent a greater amount of savings. In later years, future rounds of bids will yield still more savings.

Q: Could the additional savings from Payload affect the timing of the need for Basin Mills?

A: Yes. BHE's planning assumptions underestimated the amount of savings Payload would yield. The additional savings from Payload could contribute towards delaying the need for Basin Mills.

Q: Has BHE requested an independent review of its DSM programs?

A: Yes. BHE commissioned a study of its DSM programs from the consulting firm of RCG Hagler/Bailly. This study found that there were additional savings of between 5.4 and 8.4 GWh available to the Company by the year 2000.

Q: Why is RCG's estimate of available energy savings greater than that of BHE?

A: As RCG's study points out, omissions in BHE's programs and errors in BHE's planning assumptions led the Company to underestimate the amount of its DSM resources.

RCG found that Bangor Hydro could obtain additional savings if it implemented programs to secure savings from new construction and from key commercial and industrial sectors such as motors.[8]

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[6] Letter from Bangor Hydro to Charles Jacobs, Administrative Director, Maine P.U.C., regarding Bangor Hydro-Electric Company's Request for Commission Approval of PAYLOAD Program pursuant to Chapter 380, Section 4(a); letter dated August 31, 1992.

[7] To convert from energy (MWh) to capacity (MW), I assumed a load factor of 80%. The load factor represents the fraction of total hours, in a year, when the measure is saving energy. To convert from MWh to MW, one divides MWh by (8,760 * Load Factor) A measure that saves energy 24 hours a day, every day (such as a motor efficiency improvement) would have a load factor of 100%. If that measure saved 8,760 GWh in a year, it would save 8,760 / (8,760 * 1) MW, or 1 MW. The RCG study implies a load factor for commercial and industrial savings of between 75% and 85% (see RCG report, Tables 4-3 and 4-4). BHE's estimated load factor for savings from the Payload program is 86% (see RCG report, Table 2-2).

[8] Review and Analysis of Bangor Hydro's DSM Plans and Programs, Final Report, R.E. Ciliano, et al., RCG/Hagler Bailly, November 1991; see in particular Section 4, "Comparison of BHE Targets with Screening Analysis Results," and Section 5, "Observations and Conclusions."

RCG also found that BHE made poor assumptions when projecting the savings the Company could obtain from its energy conservation programs. For example, the Company did not account for emerging energy efficiency technologies. The Company also did not account for changes in consumer behavior that would persist beyond the duration of a program.

Q: Do you believe that RCG's study has identified all of the additional DSM available to BHE?

A: No. Flaws in RCG's study lead it to underestimate the amount of energy and demand savings available to BHE. In order to understand these flaws, it is helpful to understand the way in which RCG estimated BHE's savings.

RCG first estimated the "technical potential" for savings. This is the level of savings that could be achieved through the implementation of *all* commercially available energy conservation technologies. Then, RCG determined the "economic potential" which takes into account whether a measure would be *cost-effective*. From the economic potential, RCG then derives "market potential:" the level of savings obtained from customers who actually *decide* to invest in a measure. RCG used the market potential as its bottom line for the level of savings BHE could acheive. The size of the market potential depends in part on how aggressive RCG assumes BHE's programs are.

Q: Did RCG correctly estimate economic potential?

A: It is hard to tell if RCG's study properly estimated economic potential. RCG does not provide enough information about the specific efficiency measures it considers. For example, it lists equipment replacement as an efficiency measures, without specifying how efficient the new equipment will be. It is possible that RCG underestimated economic potential, if it made conservative assumptions about efficiency levels.

Q: Did RCG correctly estimate market potential?

A: No. For example, in order to determine market potential, RCG relied on market diffusion curves: curves that indicate the rate at which a technology is adopted by customers. Examination of RCG's curves shows that they underestimate the customer acceptance of measures, and thus underestimate market potential.

Attachment 2 shows the market diffusion curve that RCG assumed for electronic ballasts. Electronic ballasts are a big improvement over the conventional magnetic ballast that power

fluorescent lighting. They eliminate the annoying fluorescent light hum, they have longer lives than conventional ballasts and therefore require less maintenance, and they are highly cost-effective. Yet, inexplicably, RCG assumes that electronic ballasts will only be able to capture 30% of the market.

c. Conclusion on Amount of Additional DSM Available

Q: What is a more realistic estimate of the savings BHE could secure by 2002?

A: I calculated a more realistic estimate of the savings BHE could secure by 2002, based on RCG's estimate of economic potential, instead of on market potential. I found that through DSM programs comparable to those of other New England utilities, BHE could obtain savings of 51 MW by 2002.

Q: Please describe how you arrived at your figure of 51 MW.

A: I began with RCG's estimate of economic potential for 2002, 77 MW.[9] From this I subtracted RCG's estimate the amount of conservation that would occur naturally, without any BHE programs, 11 MW. This left an economic potential of 66 MW. Because I am interested in the amount of *additional* savings from energy conservation BHE can obtain, beyond what it is already planning, I subtracted out the amount of conservation BHE assumes in its forecast for 2002, 15 MW.[10] This left a total of 51 MW of additional savings that BHE could acheive by 2002.

Q: Is it characteristic of BHE to ignore such a large source of savings?

A: Yes. Unfortunately, BHE does not have a good record of pursuing conservation activities. BHE's performance, and its DSM programs in particular, have been subjected to repeated PUC investigations. The PUC's investigations have twice resulted in substantial penalties against the Company, through a reduction in its rate of return, based upon BHE management's inefficiency and its failure to address energy conservation needs. Significantly, the PUC has also denied

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[9] RCG actually only provides figures for the years 2000 and 2010. I interpolated between these years to obtain a figure for 2002.

[10] BHE assumes that it can obtain 26 MW of DSM savings by 2002. This includes 4 MW of savings from before 1990. As I am only predicting additional savings available from conservation programs (not from load management programs) I subtracted savings from load management programs. These amounted to 7 MW.

approval for the Basin Mills project itself, in large part because of BHE's inadequate planning of demand side management programs.

Q: What is the history of the PUC's dealing with BHE regarding its conservation programs?

IN 1987, PUC found that BHE's managerial performance in energy conservation and least-cost planning was characterized by "confusion and inefficiency," "inadequate communication," and a "recalcitrant relationship with the regulatory community." The PUC identified a "general failure to formulate and communicate conservation and demand management policy and strategy" within the Company.[11]

In 1990, the PUC rejected BHE's application for a certificate of public convenience and necessity for Basin Mills. The PUC wrote:

> [BHE] has failed to adequately plan its demand side resource... Moreover, we find that BHE's resource planning has been deficient in that Bangor Hydro has not ... pursued its required least cost plan in the areas of conservation and demand management in accordance with Title 35-A and Commission rules.[12]

The PUC's findings were affirmed by the Maine Supreme Judicial Court, which observed that BHE "conducts its DSM planning according to its own cost-effectiveness criteria, not in compliance with Chapter 380 [of the PUC's regulations] or the MEPA [Maine Energy Policy Act]."[13]

The PUC held a follow-up investigation in 1991, concerning BHE's performance, policies, and management practices in the areas of demand side management and least-cost planning. In its order, the PUC wrote:

> The evidence in this proceeding continues to show that Bangor Hydro's DSM philosophy is contrary to applicable statues and regulations, and that the Company's performance in the DSM area has continued to be in accord with its own philosophy rather than the applicable statutes and regulations.[14]

The PUC observed that BHE's failures in planning for energy conservation "are not at all due to incompetence, but to the singular reluctance of BHE management to accept a fundamental

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[11] Bangor Hydro-Electric Company, Re: Investigation of Reasonableness of Rates, No. 86-242 (MPUC December 22, 1987).

[12] Maine Public Utilities Commission order in Dockets No. 89-193 and 89-195, August 17, 1990; p.13.

[13] Bangor Hydro-Electric Company v. Public Utilities Commission, No. PUC-90-5000 (April 4 1991).

[14] Re: Investigation Into Bangor Hydro-Electric Company's Performance, Policies, and Management Practices in the Areas of Demand Side Management and Integrated Least-Cost Planning, Docket No. 90-286 (MPUC May 31, 1991).

fact of its own existence, which is that it is a regulated public utility." Noting that deliberate "noncompliance" with state law and PUC rules "is behavior which must ... be dealt with severely," the PUC imposed a substantial penalty upon the Company's rate of return.

d. Effect of Additional DSM on the Need for Basin Mills

Q: How much capacity would the ~~an~~ additional 51 MW displace?

A: The 51 MW of savings would displace 63 MW of capacity. This because BHE maintains a 24% reserve margin: for every MW of demand, the Company must have at least 1.24 MW of capacity available.[15] The reserve margin helps BHE reliably provide power, even in the event that one or more of its plants is out of service.

It is important to keep in mind that the 63 MW is in no way a "final" amount of capacity savings. BHE's conservation programs will continue running beyond 2002, and will continue to provide additional capacity.

Q: How reliable is BHE's projection of its need for Basin Mills?

A: BHE's projection of needing Basin Mills in 2002 is based in part on its forecast of load growth over the next ten years. The forecast, written in 1991, projects load to grow at about 1% a year. This growth rate may be excessive. All of New England, including Maine, has been experiencing an economic slowdown. To the extent the slowdown is longer or more serious than BHE assumed, it will decrease BHE's load growth. Load growth that is slower than BHE's predictions would delay the need for Basin Mills or any other new supply, especially if the Company has implemented aggressive energy conservation programs.

Q: What is the status of BHE's supply resources between 2001 and 2009?

The need for Basin Mills is precipitated by the retirement, in 2001, of diesels (19 MW) and of Graham unit 4 (18 MW).[16] In 2002, BHE anticipates a shortfall of power, which it is proposing to meet with Basin Mills. But in 2003, BHE will receive committed upgrades to its purchases

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[15] Reserve margin from Applicant's Responses to Resource Agencies' and Interested Parties' Request for Additional Information, Volume II of II, March 1992; p. B-2.

[16] BHE Base Case run of Capacity Expansion Plan, "Table 3", in BHE Chapter 36 1991 Long-Term Avoided Cost Filing, December 30, 1991.

from UltraPower 5 and 6, and from the Penobscot Energy Recovery Project (PERC), providing an additional 17 MW and 4 MW, respectively. Thus the need for power is lessened in 2003. In fact, with Basin Mills in place, BHE expects an 11 MW *surplus* in 2003, and a 2 MW surplus in 2004.

In 2005, Graham 5 (30 MW) is scheduled for retirement. BHE plans to replace the lost capacity with power purchases amounting to 25 MW. The next significant need for new supply occurs in 2009, when Maine Yankee, of which BHE owns 62 MW, is scheduled for retirement.

Q: Until when could the additional 63 MW of capacity from conservation be reasonably expected to delay the need for Basin Mills?

A: The additional 63 MW of reduced capacity that the Company could acheive through aggressive conservation programs can reasonably be expected to delay the need for Basin Mills until some time between 2005 and 2009, as shown in Attachment 4 to this testimony. Achieving any substantial fraction of RCG's identified DSM potential would eliminate the need for Basin Mills in 2002, even if BHE chooses to retire Graham #3 and #4 and all of its diesels. If Basin Mills is not needed in 2002, it also would not be needed in 2003 or 2004, because of the 21 MW increase in power deliveries from Ultrapower and PERC.

In 2005, if BHE chooses to retire 30 MW of Graham #5, it would need some new capacity. However, the need is only 5 MW if Veazie is expanded, or 11 MW without Veazie. Capacity need grows slowly from 2005 to 2008, reaching 18-24 MW, depending on the fate of Veazie. Even if Basin Mills turns out to be a cost-effective addition in the next century, it is not clear that this 32 MW capacity addition would be justified by these small shortfalls in capacity; in 2008, 18 MW of purchases from Independent Power Producers (IPPs) or other utilities may be less expensive than 32 MW of Basin Mills. Only with the retirement of Maine Yankee, now scheduled for 2009, is BHE likely to need new supply on the scale of Basin Mills.

Q: Would the DSM potential be better used to back out IPP purchases, rather than Basin Mills?

A: No. Attachment 3 shows no need for any IPPs, or Basin Mills, until 2005. At that point, BHE will face a choice between IPPs, Basin Mills, continued operation of the existing diesel or Graham units, or construction of other resources.

Q: Sometime between 2005 and 2009, when BHE eventually does "run out" of conservation savings, should the Company build Basin Mills?

A: It is too early to know whether, 13 to 17 years hence, Basin Mills will be the cheapest and most environmentally benign new supply option. It is even premature to determine whether it will be cost-effective in 2001-2005 to retire Graham 3-5 and the diesels, which collectively represent 80 MW of capacity, more than twice that provided by Basin Mills. Even the retirement date for Maine Yankee is not fixed in stone: the nuclear industry has been working hard to obtain extensions to nuclear plant operating permits. Continuation of generating unit operation beyond the originally planned life is quite common; retirement of a power plant, like retirement of an automobile, is an economic decision, based on the condition of the equipment, the demands placed on it, the costs of repairs, the costs of alternatives, and similar considerations.

If some of the retirements occur, and new capacity is needed, it would be speculative to attempt to determine today what would be the most cost-effective capacity addition for 2005, let alone 2009.

Q: When might the Board reasonably determine whether BHE should receive a permit for Basin Mills?

A: The Board could reasonably and safely postpone a decision on the Basin Mills permit until at least 1998. It appears that BHE projects a three-and-a-half- to four-year construction time for Basin Mills.[17] Assuming, conservatively, that new supply would be needed in 2005, and allowing three to four years for BHE to obtain any necessary permits that would follow the permit from the Board, postponement until 1998 seems quite reasonable. If, as seems more likely, new supply is not needed until 2009, the Board could safely defer decision on Basin Mills until 2002.

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[17] See Second Stage of Consultation, Basin Mill Hydroelectric Project, Application for License, Vol. IX, Exhibit H, Federal Energy Regulatory Commission Required Evaluation Information, February 1990; Appendix D, p. 18. See also Basin Mills Hydroelectric Project, Vol 1, Exhibit C: "Construction History and Proposed Construction Schedule," July 1990; p. C-4.

3. Risks of Granting a Permit at This Time for the Basin Mills Project

Q: Could any harm be done by granting BHE a permit for Basin Mills now, instead of waiting until 1998 (or beyond)?

A: Yes. It is imprudent at this point in time to grant BHE a permit to build Basin Mills. A permit for Basin Mills could keep BHE from pursuing conservation options and supply options that would cost less than Basin Mills. This could hurt BHE's customers and Maine's environment. It is therefore too early, at this point, to determine whether, in the words of the Maine Waterways Development and Conservation Act, "the project will result in significant benefits to the public," and whether "the advantages of the project are greater than the direct and cumulative adverse [environmental] impacts over the life of the project."

Q: Did uncertainty about future developments play a role in the Maine PUC's decision to deny approval of Basin Mills?

A: Yes. As I mentioned earlier, in August of 1990, the PUC denied without prejudice BHE's petition for a certificate of need for Basin Mills in 2000. One of the reasons for the PUC's decision was that it was too early to determine whether Basin Mills was needed. The PUC wrote:

> Undoubtedly, many of [BHE's] forecasts will change over the course of the next few years. Indeed, some of these changes may be dramatic... it seems unwise to expose BHE's ratepayers to any more uncertainty than is absolutely unavoidable. Formulating any least cost plan by deciding whether to approve a project six years before construction is to start, especially a project such as Basin Mills that will almost double the rate base of the Company, would have precisely this effect. Therefore, were we to approve the project today, we would in all likelihood be revisiting the decision.[18]

a. The Effect of a Permit for Basin Mills on BHE's Pursuit of Energy Savings

Q: What likely effect would a permit for Basin Mills have on BHE's energy conservation efforts?

A: If BHE knows that it will be able to build Basin Mills, BHE is likely to relax its energy conservation efforts, rather than develop new, aggressive DSM programs. I pointed out above

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[18] Maine PUC, *op. cit.*, pp. 4-5.

the numerous types of savings that BHE is not effectively pursuing: savings from new construction, from motors, from residential lighting, from appliances, from high-efficiency equipment, just to name a few. I also quoted the PUC's opinion of the inadequacy of BHE's previous DSM efforts, and its "recalcitrant" attitude towards state law requiring implementation of cost-effective energy conservation. Given its weak record in DSM efforts, if BHE knows that it can obtain power from Basin Mills, the Company is not likely to improve its DSM programs.

Q: How would weak DSM programs harm BHE's customers?

A: A weak energy conservation effort will hurt BHE's customers. Since DSM programs reduce the costs of energy services, all customers' bills will tend to be higher with less DSM.

If BHE curtails its DSM programs, then it will have to use expensive supply to meet the demand that it could otherwise have eliminated through conservation measures.

Q: How would a weaker DSM program affect Maine's natural resources?

A: Under a weaker DSM program, Maine's natural resources will suffer. Without the benefit of additional DSM, BHE will have to supply more power. Generating additional power imposes environmental costs. Currently, changes in BHE's energy use will be met by changes in generation from various New England power plants burning heavy oil. These plants release many pollutants into the air, including sulfur dioxide, nitrogen oxides, carbon dioxide, particulate matter, and air toxics such as lead and mercury. DSM programs can economically back down these plants long before Basin Mills could be in operation.

Also, weaker DSM programs will eventually lead to a greater overall need for new supply (especially if BHE does not implement a program to capture savings during construction of new buildings). New plants will further affect Maine's environment, as through the construction of dams.

b. The Effect of a Permit on BHE's Acquisition of New Supply

Q: What effect would a permit for Basin Mills have on BHE's acquisition of new supply?

A: If BHE receives a permit to build Basin Mills, it is likely that the Company will commit to building Basin Mills, rather than pursue cheaper and more environmentally benign supply options.

Q: Does BHE believe that Basin Mills is its lowest-cost new supply option?

A: Yes. BHE compared the cost of Basin Mills to the cost of an alternative supply, consisting of a mix of power from a combustion turbine plant, and power purchased from an IPP. BHE found that Basin Mills was less expensive than this alternative supply mix.

Q: Do you agree with BHE's assessment?

A: No. I believe that BHE's analysis is flawed, because it overestimates the cost of the power from an IPP. There are two reasons for this overestimate. First, BHE bases its cost projection on the responses it received to a request for proposals (RFP) that, as I will show, was not worded to elicit a strong response from bidders. Second, it is generally expected that over the next few years, new supply technologies that are both cheaper and cleaner will be on the market. These supply technologies are not reflected in BHE's projections of the cost of power in 2002.

i. The responses to BHE's 1991 RFP are not an accurate indication of the cost of new supply

Q: Please describe the RFP from which BHE obtains its projections of the cost of new supply in 2002.

A: BHE bases its projections for the cost of new supply on responses it received to an RFP it issued in 1991. I have enclosed a copy of this RFP as Attachment 4. The 1991 RFP was simply a follow-up to a previous RFP issued in 1989. The 1989 RFP solicited proposals for 30 MW of supply to come on-line in 1994, and 60 MW of supply for 1998. The Company received a number of responses to this first RFP.

In late 1991, BHE issued a second RFP. This RFP was only a one-page letter, which was most unusual, since RFPs are usually thick packets of information and forms necessary to prepare a serious bid. The letter informed respondents to the 1989 RFP that BHE was planning to build Basin Mills, to be on-line in 2002. The Company then wrote

> Based upon our forecasts, the Basin Mills Project appears to be an economically attractive option and has therefore been included in our resource plans. However, if independent power suppliers were willing and able to supply equivalent amounts of power at the same or lower prices, the need to proceed with the Basin Mills

Project might well be affected. Therefore, we are asking all respondents to review their bids and to resubmit them if they think they can compete favorably with the costs of the proposed Basin Mills Project.[19]

This paragraph hardly entices independent power producers to submit a bid. It is expensive (on the order of $100,000) for IPPs to assemble a bid. If BHE had sincerely sought independent power bids to compete with BHE, it would have issued a more complete RFP which detailed the cost of Basin Mills and provided other important information. Moreover, the response time for this RFP (four weeks) was shorter than for the first RFP (six weeks). The tone and form of the RFP suggest that it was merely a straw man.

The one-page letter, the weak language it contained, and the short response time probably discouraged many potential suppliers from going through the expense of submitting a bid. I do not believe, therefore, that the responses to the 1991 RFP represent a reasonable estimate of the cost of new supply.

ii. Cheaper and cleaner supply options may become available in the next few years

Q: Is it likely that supply options cheaper and less destructive to the environment than Basin Mills will become available over the next few years?

A: Yes. It is generally expected that new cheaper supply technologies will appear on the market over the next few years. Furthermore, much of this new technology will have less environmental impacts than current technology. These new supply options include new gas-fired turbine technology, fuel cells, wind power, and wood gasification technology, among others.

Over the last few years, the efficiency of low-emission combustion turbine plants has risen, and the cost has fallen, so that natural-gas-fired combined-cycle units (which use the waste heat from the combustion turbine to operate a steam turbine) are the standard source of new capacity in much of the country. Concerns for reducing emissions from coal-fired power plants has led to the development of clean and efficient coal-gasification technology, which are just beginning to be applied commercially to supply clean coal-derived gas to combined-cycle units. The same technology can be applied to wood to produce highly efficient and clean wood-powered electricity.

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[19] Letter from BHE addressed to "All Bangor Hydro-Electric Company Power Supply RFP Respondents," dated September 13, 1991, signed Jeffrey A. Jones, Manager, Power Supply.

Another rapidly emerging technology is the fuel cell, which converts chemical energy to electricity without combustion, and therefore without emission of pollutants. Fuel cells are very efficient and quiet, and can be economically assembled in small sizes. These characteristics allow fuel cells to be located near the end user, so the waste heat can be used for space and water heating, while reducing losses of electricity and the need for distribution lines. The first commercial fuel cell units are now entering service; they may be widespread by the turn of the century.

Q: Does Maine have a large wind energy potential?

A: Yes. Maine is endowed with strong winds. In fact, Maine's wind resources could meet the electricity needs of the entire state. Even if one excludes wind over all urban and environmentally sensitive land, Maine's wind potential is 6,390 MW, or the equivalent of 200 dams the size of Basin Mills.[20]

Q: Is wind power likely to be competitive with Basin Mills?

A: Yes. The Department of Energy and the Electric Power Research Institute are co-funding a $40 million dollar project whose goal is to commercialize windpower systems capable of delivering electricity at 5¢/kWh, by 1998.[21] The U.S. Windpower company has already announced the development of a new turbine design that can produce power at this price.

If windpower can meet and maintain the 5¢/kWh price target, it would appear to be competitive with Basin Mills, which BHE expects to produce power at 6.1¢/kWh.

Q: Are you projecting that one of the resources you discussed will be less expensive than Basin Mills in 2005 or 2009?

A: No. I am not projecting the costs of any of these resources 13-17 years from now. Differences between projections and reality have repeatedly and seriously affected utility resource decisions over the last quarter-century, throughout New England and nationally. Coal plants built in the

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[20] See An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States, D.L. Eliot et al., Pacific Northwest Laboratory (PNL-7789), August 1991; Table B-1.

[21] See Electric Utility Week, November 2, 1992, p. 2.

1960s met environmental constraints in the 1970s and were converted to oil.[22] In the 1970s, oil-fired plants were built for continuous baseload service, and then operated as cycling units after oil prices rose sharply. Nuclear plants undertaken in the early 1970s to avoid the environmental problems of coal plants and the high price of oil were cancelled in late 1970s and early 1980s, as safety concerns raised construction costs and lead times. The completed nuclear units have been uneconomical to build, as well as less reliable and more expensive to operate than projected. In the 1970s, gas-fired utilities scrambled to convert to oil or build coal or nuclear plants before gas became unavailable; in the 1990s, gas is plentiful and cheap, while much of the replacement capacity is uneconomic.

In the 1960s, coal appeared to be the power source of the 1970s. In the early 1970s, oil and nuclear were to be the fuels of the future. In the late 1970s, coal and nuclear were expected to fuel the 1980s. In the 1980s, coal was expected to be the fuel of the 1990s. Now that we are in the 1990s, natural gas appears to be the major fuel for the rest of this decade, and well into the next century. There is no reason for me, BHE, or the Board to try to guess now what fuels and generating technologies will be preferred in the first decade of the twenty-first century, and whether Basin Mills will be competitive with it.

Q: What costs would a commitment now to building Basin Mills impose on BHE's customers?

A: If BHE implements its plan of building Basin Mills for the year 2002, BHE will effectively be shutting itself out from cheaper and less environmentally destructive supply options. BHE's customers will face unnecessarily high costs: costs would have been lower if BHE had, for example, bought power from a wind farm.

Q: What would be the cost to Maine's environment of a commitment now to building Basin Mills?

A: The Maine environment is likely to suffer unnecessary damage if Basin Mills is built. Many of the new technologies I discussed would impose less damage on Maine's natural resources than would Basin Mills.

Q: Does BHE's analysis of environmental externalities support the Basin Mills permit application?

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[22] In the 1960s, many U.S. coal plants were located for proximity to cheap high-sulfur coal. Most of those plants will have to install scrubbers or switch to distant low-sulfur coal sources in the 1990s under the acid rain provisions of the U.S. Clean Air Act Amendments of 1990 (Title IV).

A: Not really. BHE computes monetary values for the environmental effects of air emissions from thermal power plants, but does not include any environmental cost from Basin Mills.[23] BHE's treatment of air emissions relies on values I have developed or supported in other jurisdictions, and the general approach is correct. However, BHE abuses the externality valuation method by only valuing the effects of the thermal alternatives, but not those of Basin Mills.

BHE dismisses the externalities of Basin Mills, by assuming that all adverse environmental effects of the dam will be fully mitigated. I understand that this assumption is disputed on *quantitative* grounds by other governmental agencies responsible for management and restoration of the Penobscot river's fish resources. BHE's externality analysis completely breaks down if Basin Mills will reduce the viability of fish restoration efforts.

Even if BHE were correct that the number of fish with the dam (and various mitigation measures, such as stocking and trap-and-truck) would be as great as without the dam, BHE quite cavalierly dismisses the *qualitative* environmental effects of the dam.

> [S]ome individuals assert that [the trap-and-truck] option is unacceptable for philosophical reasons. No economic value can be attributed to this philosophical objection.[24]

An economic value can be attributed to anything that people care about and would be willing to pay for. Just as RCG can distinguish between the value to anglers of wild and hatchery salmon, BHE should be able to determine the value to anglers of fishing in a wild run, rather than a trap-and-truck run, and to the general public of knowing that the Penobscot supports wild salmon, rather than BHE pets.[25] BHE should at least acknowledge the value of natural ecosystems, even if it cannot always associate them with precise dollar benefits.

BHE also errs in asserting that conservation creates adverse environmental externalities.[26] BHE offers no rationale for this assumption, and appears to rely on a November 1990 working paper of the Bonneville Power Administration (BPA). At that time, BPA was proposing that

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[23] Applicant's Responses to Resource Agencies' and Interested Parties' Request for Additional Information, Vol I of II, March 4, 1992.

[24] *Op. Cit.*, p. 15.

[25] Angler Evaluations of Potential Management Programs for Atlantic Salmon on the Penobscot River, Volume 44, June 1992; p. 76.

[26] *Op. Cit.*, Appendix C.

conservation be treated as creating less than $0.5 mills/kWh (<$0.0005/kWh) of environmental cost, without specifying the exact cost; since then, BPA has settled on a 0 environmental cost for conservation.[27] Indeed, BHE admits that there is "little research supporting" its position on conservation, and that the environmental cost of conservation is "usually estimated to be zero" (*Op. Cit.*, Appendix C, p. 10).[28] While the value BHE selects for environmental costs of conservation may not be high enough to affect any of BHE's analyses, the assignment of any such cost is one more indication of this utility's hostility to conservation.

BHE similarly biases its analysis of wood-fired power plants by assuming that their carbon dioxide (CO_2) emissions would be very high, roughly 60% higher than coal plant emissions. In most cases, wood-fired plants will have little or no net carbon emissions. Wood-fired plants typically use either waste wood or the harvest of thinned trees from forestry land. Waste wood would otherwise rot to form CO_2 and methane, a much more potent greenhouse gas than CO_2. The harvest of weed trees allows the growth of new trees, or additional growth of existing trees, which will take up roughly the same amount of CO_2 released in burning the harvested wood. Hence, it is not clear that wood-fired power plants produce any net long-term emissions of greenhouse gases.

Despite BHE's enthusiasm for valuation of air pollution externalities in justifying Basin Mills, BHE does not appear to have included reduction in power plant emissions in its evaluation of energy conservation options. Had BHE include externalities in the benefits of conservation, the cost-effective conservation potential would be significantly larger. Again, BHE's evaluation of alternatives is biased in favor of Basin Mills and against conservation.

Q: Could you please summarize the risks that the Board will incur if it gives BHE a permit at this point in time to build Basin Mills?

A: A permit for Basin Mills is likely to affect BHE's planning in two ways: BHE will not aggressively pursue energy efficiency opportunities, and BHE will probably commit to building Basin Mills, instead of actively investigating supply options other than Basin Mills.

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[27] BPA also uses a 2 mill/kWh environmental costs for new hydro projects, despite mitigation. BHE ignores this BPA estimate.

[28] Indeed, conservation programs may reduce environmental costs, by ensuring the safe disposal of existing equipment containing toxic or ozone-depleting materials, and by providing a mechanism for recycling of materials that would otherwise be thrown away.

If BHE offers weak conservation programs, customer's energy needs will be higher than under strong DSM programs. Higher demand for energy will raise costs to customers, unnecessarily strain Maine's environment, and will hasten the need for additional supply.

If BHE commits to building Basin Mills, it will be giving up opportunities for meeting its customers' needs with cheaper and less environmentally damaging supply. Even though BHE claims that Basin Mills is the cheapest option for meeting its need for power, this assessment is incorrect. BHE's 1991 RFP was not worded so as to elicit a strong response, and the Company has not fully considered any emerging supply technologies. Once again, BHE would be unduly raising costs to customers and imposing damage on Maine's environment.

4. Conclusion

Q: What action do you recommend the board take on the Basin Mills permit?

A: Commenting on the consequences of denial of approval to build Basin Mills, BHE wrote:

> Denial of this license application would mean that this valuable energy source would most likely go undeveloped. This in turn would force [BHE] to obtain an equivalent amount of energy from more expensive sources and pass these additional costs onto the ratepayers.[29]

I believe than BHE, in fact, has it backwards: by committing to building Basin Mills, BHE locks its ratepayers into bearing the costs of a plant that is not likely to be best option. The next few years will see the advent of energy sources cheaper and more environmentally benign than Basin Mills. Aggressive energy conservation programs can further delay the need for Basin Mills. At any rate, today, the Board does not have enough information to make a good decision on the Basin Mills permit.

BHE itself acknowledges that it does not need the power from Basin Mills until 2002. I have shown that if the Company aggressively pursues energy conservation measures, it is likely to delay the need for Basin Mills until at least 2005, and possibly until 2009. Therefore, the Board can safely decline to approve Basin Mills until at least 1998. By then, the Board and BHE will have the advantage of more information on BHE's need for new supply, and on the economic and environmental cost of alternative supply options. With this additional information, the Board will be able to make a better decision than if it attempts, at the current time, to assess the costs and benefits of Basin Mills. A delayed decision offers the further advantage of maintaining pressure on BHE to improve its energy conservation programs. I would remind the Board that the PUC reached a similar conclusion when it was confronted with a premature application for approval of this project. The caution shown by the PUC is equally appropriate here, where the Board must balance the risk of serious environmental harm against the public benefits that are, at this point in time, simply speculative.

Given the risks associated with granting the permit at this time, and the advantages of delaying a decision, based solely upon energy-planning considerations, the Board should deny a

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[29] Basin Mills Hydroelectric Project, Application for License, Volume I of X, Exhibit D "Cost and Financing," July 1990; p. D-6.

permit without prejudice, and allow the Company to return to the Board at a time closer to the projected need for the facility. The Board may well determine that the dam is unacceptable for environmental reasons, and deny the permit it outright.

Q: Does this conclude your testimony?

A: Yes, it does.

Attachment 3: Bangor Hydro's Load and Capacity, 2000-2009

Year	BHE Forecast Peak MW	BHE Forecast Capacity Need	BHE Forecast Capacity Changes	BHE Forecast Capacity w/o IPPs, Basin Mills w/o Veazie	BHE Forecast Capacity w/o IPPs, Basin Mills Veazie	Shortfall w/o extra Conservation w/o Veazie	Shortfall w/o extra Conservation / Veazie	Additional Potential DSM w/ Reserves	Description of capacity change
2000	258	320	--	322	328	-2	-8	55	
2001	260	322	-13	309	315	13	7	58	Graham #3 retirement
2002	263	326	-34	275	281	51	45	61	Diesel and Graham #4 retired; Beaverwood purchase increases
2003	269	334	21	296	302	38	32	64	Ultrapower and PERC purchases increase
2004	276	342		296	302	46	40	67	
2005	281	348	-29	267	273	81	75	70	Graham #5 retired
2006	284	352		267	273	85	79	73	
2007	290	360		267	273	93	87	74	
2008	297	368		267	273	101	95	77	
2009	304	377	-62	205	211	172	166	80	Maine Yankee retired