Conservation Law Foundation
Docket No. 5330
Exhibit CLF-PLC-1

STATE OF VERMONT
PUBLIC SERVICE BOARD

DIRECT TESTIMONY OF

PAUL CHERNICK
PLC, Inc.

ON BEHALF OF THE

CONSERVATION LAW FOUNDATION OF NEW ENGLAND
VERMONT PUBLIC INTEREST RESEARCH GROUP
VERMONT NATURAL RESOURCE COUNCIL

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Q: Mr. Chernick, please state your name, occupation and business address.

A: My name is Paul L. Chernick. I am President of PLC, Inc., 18 Tremont Street, Suite 703, Boston, Massachusetts.

Q: Mr. Chernick, would you please briefly summarize your professional education and experience?

A: I received a S.B. degree from the Massachusetts Institute of Technology in June, 1974 from the Civil Engineering Department, and a 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.

As a Research Associate at Analysis and Inference, and in my current position, 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 generation plants and transmission lines; retrospective review of generation planning decisions; ratemaking for plant under construction; ratemaking for excess and/or uneconomical plant entering service; conservation program design; cost recovery for utility efficiency programs; and the valuation of environmental externalities from energy production and use. My resume is attached to this testimony as Exhibit CLF-PLC-2.

Q: Mr. Chernick, have you testified previously in utility proceedings?

A: Yes. I have testified approximately sixty times on utility issues before various regulatory, legislative, and judicial bodies, including the Massachusetts Department of Public Utilities, the Massachusetts Energy Facilities Siting Council, the Illinois Commerce Commission, the Texas Public Utilities Commission, the New Mexico Public Service Commission, the District of Columbia Public Service Commission, the New Hampshire Public Utilities Commission, the Connecticut Department of Public Utility Control, the Michigan Public Service Commission, the Maine Public Utilities Commission, the Minnesota Public Utilities Commission, 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. Subjects I have testified on include nuclear power plant construction costs and schedules, nuclear power plant operating costs, power plant phase-in procedures, the funding of nuclear decommissioning, cost allocation, rate design, long range energy and demand forecasts, utility supply planning decisions, conservation costs and potential effectiveness, generation system reliability, fuel efficiency standards, and ratemaking for utility production investments and conservation programs.

Q: Have you testified previously before this Board?

A: Yes. I testified three times before the Board. The two most recent occasions were in Docket 5270, first on behalf of the Conservation Law Foundation (CLF) and second on behalf of the Central Vermont Public Service (CVPS) conservation collaborative.[1]

Q: Have you been involved in utility resource planning in Vermont?

A: Yes. I have been a consultant to the CVPS collaborative with CLF and the DPS since late 1988. None of the information presented in this testimony comes from the collaborative effort, other than material in public documents.

Q: Have you authored any publications on utility ratemaking issues?

A: Yes. I have authored a number of publications on rate design, cost allocations, power plant cost recovery, conservation program design and cost-benefit analysis, and other ratemaking issues. These publications are listed in my resume.

Q: What is the purpose of this testimony?

A: The purpose of this testimony is to review the connection between energy efficiency programs and the proposed purchase of Hydro-Quebec power (the HQ purchase) and energy by the 24 Vermont utilities (the Participants).

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[1]Part of the latter testimony reflected the opinion of CLF (as well as the other intervenors) and of CVPS, but not the Department of Public Service (DPS).

Q: How is the purchase related to utility-sponsored energy efficiency programs?

A: To some extent, any two utility resources are potential competitors. Specifically, if the Participants included all cost-effective conservation in their resource plans, the need for and economics of the HQ purchase would be much less compelling. Conversely, once the Participants are committed to the HQ purchase, the amount of cost-effective energy efficiency potential will be reduced. Thus, a premature commitment to the HQ purchase could result in higher costs to Vermont ratepayers in the long run, even if the HQ purchase is less expensive than the Participants' <u>supply</u> alternatives.

Q: If the HQ purchase is less expensive than other supply options, does that necessarily imply that it is the most economical resource?

A: No. Efficiency investment may be even less expensive than the HQ purchase.

Q: If efficiency is less expensive than the HQ purchase, will it not be able to displace the HQ purchase, even once a contract is signed?

A: Not necessarily. The total cost of the HQ purchase is fairly high; it is my understanding that the contract is designed to be slightly less expensive than a new coal plant. Large efficiency investments are economical at lower costs than the cost of the HQ purchase. However, efficiency which is less expensive than the total purchase cost may not be cost-effective once the HQ contract is signed. A large fraction (and perhaps all) of the total purchase cost is recovered through fixed charges, consisting of demand charges and take-or-pay energy charges. Most efficiency investments will have a difficult time competing with a resource whose marginal cost is zero.

Q: Even after the Participants become committed to the HQ purchase, if they do, would there not be other supply resources which conservation could back out?

A: There certainly would be <u>some</u> resource which efficiency investments could back out. However, it appears that locking in the proposed purchase would greatly reduce the amount of cost-effective energy efficiency investment. Only a small fraction of the energy in Vermont's supply mix would have high avoidable costs. Some conservation measures are so inexpensive that they are cost-effective, even if their only effect on power supply is that they allow the utility to avoid the fuel costs of a nuclear plant. However, the amount which is cost-effective at that low avoided cost is much less than the amount which is cost-effective for avoiding a higher-priced fuels (such as oil), or the entire cost of a long-term purchase (such as the HQ contract). Since the cost of the HQ contract is largely unavoidable once the contract is approved, the energy cost avoidable by efficiency investment would fall to the price of the remaining fuels.

Q: Could the Participants resell the HQ energy for a profit to other utilities?

A: The Participants are likely to be able to resell the energy at a price higher than the energy charges. However, this price would generally reflect a split in savings between the buyer and seller. Since the variable cost of the resale would be very low, the price will usually be much lower than the cost of the buyer's avoided energy cost. The amount received by the Participants would also often be reduced by the cost of transmission charges.

For example, consider the resale of economy energy from Schedule B in 1997 to a utility displacing 1% sulphur #6 oil, a common marginal fuel in New England. Assuming a capacity charge of $319/kW ($1225 in 1985 dollars, plus 10 years of Handy-Whitman inflation at 5% to 1995, times a 16% carrying charge) and a 75% capacity factor, the capacity charge per kWh will be 4.9 cents.[2] Escalating the 1.774 cent/kWh energy charge at 4% CPI inflation for 12 years to 1997 produces an energy charge of 3.2 cents/kWh. The total cost of the purchase is thus 8.1 cents/kWh. DRI's Fall 1989 oil price projection gives a 1997 price for 1% sulphur #6 oil of $4.77/MMBTU; at a fairly poor heat rate of 11,000 BTU/kWh, this is equivalent to 5.25 cents/kWh. Assuming a split-savings agreement, the revenue to the Participant would be 4.2 cents, or barely more

[2]With a real-levelized carrying charge, this would be more like 3.6 cents/kWh.

than half of the cost of the HQ purchase,[3] and about 80% of the avoided fuel cost. If the Participant must pay (or absorb) a wheeling charge of 2 mills, the net revenue would be 4 cents.

Thus, the price that the Participants are likely to be able to negotiate for the resale of HQ energy to other utilities is likely to be well below the total cost of the purchase. While such resale would moderate the net cost of purchasing too much power from Hydro-Quebec, it would not provide a very strong incentive for energy efficiency investments.

Q: How large might the potential be for cost-effective electricity conservation in Vermont?

A: No precise answer to that question is currently available. The amount of cost-effective conservation depends on the social avoided cost (including externalities and risk reduction), on the composition of current and future stocks of buildings and equipment, on the evolution of efficient technologies, and other factors. No comprehensive study of conservation potential has been performed for Vermont. However, we can get a rough sense of the potential by examining the results of studies performed in other states. It should be noted that these studies generally reflect technology options from several years ago: the cost of efficiency improvements have fallen, and potential has increased. The values of avoided costs used in these analyses vary, but they generally represent some proxy

[3]The revenue would be about 62% of the total cost if the capacity charge were real-levelized.

for new baseload plant construction, without any adjustment for risk or externalities.[4] Also, these studies generally do not examine fuel-switching from electricity to direct fuel use, which my work for the Boston Gas Company has indicated is highly cost-effective, both in terms of direct costs and in terms of total social costs, including externalities.

Chernick, et al. (1989), a study prepared for the Minnesota Department of Public Service, determined that the total cost-effective conservation potential for Minnesota's electric utilities was 52%. We estimated that potential cost-effective efficiency savings were 60% in the residential class, 50% for farms, 60% for commercial customers, and 35% in industry.

Power to Spare (New England Energy Policy Council, 1987) estimated that technologies which were then commercially available could reduce Vermont electric energy requirements by 35% by the year 2005, compared to utility forecasts which included their projections of efficiency improvements. With "potentially available" technology, which included technologies judged likely to be available in the forecast period, the potential reduction in usage by 2005 rose to 57%.

Lovins (1986a) estimated a 50% cost-effective potential savings in energy use of the 1984 building and equipment stock in Ontario. In the industrial sector, 70% savings were

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[4]Except for the PLC, Inc. (1989) study, and Lovins's work, (1986a, 1986b) these analyses generally ignore avoided line losses and avoided transmission and distribution costs. Krause, et al., (1988) use an avoided cost which only reflects the utilities' fuel costs.

possible, in the commercial sector 32% savings, and in the residential sector, 46% savings.

Lovins (1986b), a report to the Austin (TX) Electric Utility Department, found that cost-effective efficiency investment by 2005 could reduce annual peak demand by 73%, and energy usage by 72%.

Usibelli, et al., (1983), a study commissioned by DOE, found that technically feasible energy conservation measures costing less than 40 mills (roughly equal to the Northwest Power Planning Council's estimate of avoided supply costs) could reduce residential electricity demand in 2000 by 36.5% in the Pacific Northwest.

Geller, et al., (1986), prepared for Pacific Gas and Electric, examined seven end-uses representing 70% of PG&E's residential electricity consumption. They found that cost-effective efficiency investment could reduce electric energy needs in 2005 by 25%-44%, depending on the penetration of current and prototype technologies.

Miller, et al., (1989), a draft study for the New York State Energy Research and Development Authority, estimated that efficiency investments in the 1986 building stock which were cost-effective under their "societal" test, would yield 34% savings in the residential class, 46% reduction in commercial electric usage, and 17% savings in the industrial class, for a total savings of 34%.

California Energy Commission (1984) limited its scope to retrofit technology and capability for office and retail buildings built before 1983. That study concluded that full implementation of cost-effective measures, with pay-back periods of one to three years, would reduce the electrical usage in those buildings by 36%.

Krause <u>et al.</u>, (1988) studied the residential loads of Michigan's two largest utilities, and estimated conservation potential from existing and prototype technologies at 42% of usage in 1995 and 56% in 2005, if those measures were pursued aggressively.

Overall, it seems reasonable to expect cost-effective energy efficiency potential in the 30-70% range, depending on the level of avoided costs, the time frame used, and other variables.

Q: How much of Vermont's energy supply is expected to be provided by power sources which have low avoidable costs?

A: The DPS's forecast of Vermont electric energy requirements in the 1988 Twenty Year Electric Plan for the year 2000 is approximately 6.3 terawatthours (TWH, or billions of kWh). Load growth has been somewhat higher than might have been expected from the 1984 data used in the Twenty Year Plan, so I will assume that energy requirements at the turn of the century would be about 10% higher than the Plan's estimate, or 6.9 TWH. Existing and committed sources (using DPS assumptions, where available) at the end of the century with low variable costs include:

- Vermont Yankee (286 MW at 69% capacity factor): 1.8 TWH,
- Other New England nuclear entitlements (64 MW at 65% capacity factor): 0.4 TWH,
- Vermont hydro: about 0.5 TWH, and
- Small Power Producers: 0.9 TWH,

for a total of 3.6 TWH. Some of the thermal small power producers may be dispatchable, with significant variable costs, but the 0.9 TWH includes only the DPS's estimate of small power committed by 1987, and excludes any contracts signed since then.[5] On the other hand, some of the small power projects may not be completed. With these uncertainties, roughly 3.3 TWH of energy for the year 2000 would be supplied with existing high-fuel-cost sources or with sources yet to be committed.

Q: Is the HQ purchase large enough to affect the amount of cost-effective electric conservation in Vermont?

A: Yes. The HQ contract would supply about 3.0 TWH of energy from 2001-2011, and over 2.2 TWH from 1996-2015. If the Participants exercised their maximum cancellations, the energy deliveries would be 2.2 TWH from 1996-2011, and over 1.4 TWh through 2015. However, most of the cancellations would have to be elected by 4/91 and 11/92. The Participants will have to act very quickly if they are to have significantly better

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[5]The DPS 20-year plan is now over a year old, and some of this data may be slightly stale. In addition, I have supplied estimates for some of the values, such as in-state hydro generation. I intend for the values to be indicative, rather than definitive.

to act very quickly if they are to have significantly better information about efficiency opportunities by 1992 than they do today. If those early cancellations are not exercised, but all of the later cancellations are exercised, the 2001-2011 purchase level would be 2.7 TWH. I will treat this as the base-case purchase level.

The combination of HQ with existing and committed sources would essentially fulfill Vermont's energy needs into the next century.[6] Of the output of 6.9 TWH, roughly 6.3 TWH would be served by the sources with locked-in costs, leaving only 0.6 TWH, or less than 9% of energy requirements at the turn of the century to be provided by high-fuel-cost or new supplies. Thus, aggressive efficiency programs would rapidly run out of displaceable energy supplies.[7]

Q: How long would this condition persist?

A: With load growth of 2% annually, output requirements would reach 7.7 TWH by 2005, opening some room for efficiency investment. Still, only about 1.4 TWH (or 18% of output) would be displaceable over the 15 year period from 1990-2005. Only with the retirement of Vermont Yankee, currently scheduled for

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[6]In the 1996-98 period, with most of the HQ purchase in place and the Merrimack purchase still in effect, the situation would be even more extreme.

[7]I have performed this analysis on a statewide basis. The results for individual utilities will differ. CVPS, for example, represents a larger portion of Vermont energy sales (about 55%) than it does of the HQ purchase (about 40%), so it would be less affected than would the average utility.

2007,[8] would a significant amount of Vermont's energy supply be displeacable by efficiency investments.

Q: What changes in the HQ contract would mitigate the problems you have identified?

A: The adverse effect of the HQ purchase on cost-effective conservation could be mitigated through any of several changes in the contract, or a combination of such changes.

First, the scale of the purchase could be reduced. If the purchase were one third the proposed size (about 1 TWH), 2.3 TWH (or 33%) of energy output in the year 2000 could be displaced by efficiency investment.[9] By the year 2005, the displaceable energy would rise to 3.1 TWH, or 40% of output. While these values are at the low end of the likely range of cost-effective efficiency improvements, they provide substantial opportunities for efficiency investment, and roughly triple the scale of programs which would be cost-effective, compared to the base case.

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[8]This date is subject to change in either direction. Early unplanned retirement of Vermont Yankee (or any other nuclear unit) is a distinct possibility. This would not provide much opportunity for coordination with efficiency programs. Planned early retirement would be more advantageous. Vermont Yankee may also attempt to extend the life of the plant; that decision may or may not be subject to review by the PSB. The NRC is currently formulating rules for the extension of nuclear plant operating licenses by 20 years, which would take Vermont Yankee to 2027. Even without those "life-extension" rules, Vermont Yankee may be able to extend its operating license to 2011, 40 years after it received its operating license.

[9]A 50-MW QF contract, for example, would be much less problematic in this regard than the proposed HQ contract.

Second, shortening the length of the purchase would reduce its interference with energy efficiency investments. Purchases in the next few years would tend to have less effect on the economics of efficiency improvements than would later purchases. Since utility efficiency programs can only ramp up at limited rates, reductions of 20-30% are unlikely until late in the decade.

Third, adding provisions which would allow the Participants to back out of portions of the HQ purchase, even after the schedules have started, would reduce or eliminate the conflict between the purchase and energy efficiency. If the Participants could reduce their take of the purchase under a reasonably flexible set of circumstances (e.g., on a few years' notice, and if efficiency programs reduce sales by specified amounts), efficiency could back out the HQ purchase, just as it could back out new generation sources, existing oil, or other high-variable-cost supplies.

Fourth, redesigning the rates and the take-or-pay obligation would reduce the conflict between the HQ purchase and energy efficiency. If the demand charge were a small part of the purchase cost, and if the energy charges were all avoidable, efficiency would continue to have a fair opportunity to compete with the HQ purchase.

In summary, the proposed HQ purchase is problematical due to its large size, its extensive length, its inflexibility, and its low variable cost. Correcting some combination of these problems would allow Vermont utilities to aggressively pursue efficiency opportunities, which are likely to be more economical for ratepayers in the long run than the full HQ contract.

Q: Given these options for mitigation of the contract, do you have any specific recommendations for the Board regarding the disposition of Participants' petition?

A: No. I have not performed the analysis necessary to determine what combination of these fixes to the purchase contract would be most advantageous to Vermont, nor to determine what combination would be most acceptable to Hydro-Quebec. Before the Board approves any purchase from HQ, it should require the Participants to demonstrate that changes in the contract terms have mitigated the conflict with efficiency investments.

Q: If the Board were faced with a choice between the entire HQ purchase as proposed, or with no purchase from HQ, without any opportunity for mitigation, what action would you advise?

A: I have not reached a definative conclusion on that matter. Given a choice of the entire HQ purchase as proposed (without any of the mitigation measures discussed above), or a major efficiency program without any new long-term HQ purchases, the efficiency option is likely to be preferable, in terms of expected cost, environmental benefits, and risk mitigation. In the absence of a formal Vermont-specific comparison of the HQ purchase to efficiency investments, I would recommend that the Board carefully consider (and heavily weight) the magnitude of the efficiency resource it would be jeopardizing if it allowed the HQ contract to go into effect as proposed.

Q: Does this conclude your testimony?

A: Yes.

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