UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
James P. Gleason, Chairman
Fredrick J. Shon
Dr. Oscar H. Paris

In the Matter of	)	
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point, Unit No. 2)	)	Docket Nos. 50-247 SP 50-286 SP
POWER AUTHORITY OF THE STATE OF NEW YORK (Indian Point, Unit No. 3)	)	April 12, 1983

LICENSEES' TESTIMONY
OF GEORGE L. FITZPATRICK ON COMMISSION QUESTION 6

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INTRODUCTION

My name is George L. Fitzpatrick. My business address is 11 East 44th Street, New York, New York 10017.

I currently serve as President of Applied Energy Group, Inc., a management and technically-oriented consulting and software development firm offering services in the areas of Load Research, Load Management, Load and Energy Forecasting, and Economic Evaluations.

Prior to this, I held the position of Vice President, Load Research and Demand Planning for Stone and Webster Management Consultants, Inc. I was responsible for the coordination and direction of consulting activities in the Load Research and Load Management areas within the Corporation. Additional responsibilities included analyses of data processing requirements and potential new markets for consulting activities.

My utility-based experience consists of nine years with Long Island Lighting Company where I held the position of Manager, Load Research, Costing and Forecast Division. My prime responsibilities centered on electric peak and energy forecasts; electric and gas weather normalization; statistical sample design development; load research study implementation; load data

management and analysis; annual population survey; all long-range demographic projections; the collection, processing, and overall supervision of billing of customers under commercial/industrial time-of-use rate; the electric class of customer annual system load research study; and all statistically-based studies performed by the Economic Research Department. In 1978, my responsibilities were expanded to include fully allocated and marginal cost-of-service studies for electric and gas and total factor productivity studies.

My academic background includes a Bachelor of Arts Degree in Economics with a concentration in Statistics as well as a Master of Business Administration Degree in Economic Theory, both from St. John's University. I have had additional experience in the area of application of various statistical techniques for forecasting and descriptive analyses purposes. Through my utility-based experience and continuing education, I have acquired additional expertise in the utilization and interpretation of statistical techniques such as logistic function fitting, two and three stage multiple regression, Box-Jenkins stochastic and multiple transfer functions, and multiple regression techniques for time series, cross sectional, and pooled data bases.

I have also had additional formal training in the areas of engineering economic analyses as well as data processing systems and applications.

I have testified as an expert witness on subjects such as electric and gas, peak and energy forecasts, load research studies for cost-of-service analysis, load management, conservation, cogeneration, and statistical studies for weather normalization of gas sendout and electric energy requirements data in the following New York State Public Service Commission proceedings: Case Numbers 26733, 26829, 26985, 27136, 27154, 80003, 27319, 27374, 27375, and 28223.

I have presented testimony on behalf of the Member Systems of the New York Power Pool on the subjects of load forecasting, energy conservation and economic analysis in the New York State Energy Master Plan II Proceedings. I have also presented forecasts, conservation and economic analyses on behalf of the Power Authority of the State of New York (the Authority) in connection with the Arthur Kill Coal/RDF Facility Corps of Army Engineers Proceeding.

A more detailed presentation of my qualifications is presented in Appendix "A" to my testimony.

PURPOSE OF TESTIMONY

The purpose of my testimony is as follows:

I. To provide a discussion of the Member Systems of the New York Pool consideration of the future impacts of Conservation in the most recent State Energy Master Plan II proceeding.

II. To provide information on the New York State Energy Office's consideration of conservation in their formulation of the latest State Energy Master Plan.

III. To give an indication of the extent to which both price and non-price induced conservation has already penetrated the marketplace via the free market forces, utility programs and regulatory endeavors.

IV. To provide an update on the progress of the New York Public Service Commission's latest investigation into the conservation issue as addressed in Case #28223 from a Con Edison perspective, and to provide preliminary information on the peak demand and annual energy impacts of the following residential conservation devices for the Con Edison service territory:

a) Refrigerators (manual and auto defrost)

b) Residential room air conditioners

c) Residential lighting

d) Residential water heating measures (water heating blankets, low flow showerheads, and heat pump water heaters).

Additionally, I will provide an extrapolation of those results to the Power Authority-served southeast New York residential households.

V. To demonstrate that the High Impact, Mid Range, and Low Impact economic scenarios presented by ESRG in a study entitled "An Analysis Of The Need For And Alternatives To The Proposed Coal Plant at Arthur Kill" (ESRG 81-21) are not the most reasonable for an objective assessment of the total costs of the shutdown of the Indian Point plants since certain components of that ESRG study are either statistically suspect or have been selectively utilized to yield downward-biased cost projections. My analysis of the ESRG Report entitled "The Economics of Closing the Indian Point Nuclear Power Plants" will necessarily be abbreviated due to my clients' belated receipt of this document.

I. CONSIDERATION OF CONSERVATION BY THE MEMBER SYSTEMS OF THE NEW YORK POWER POOL IN THEIR NEW YORK STATE ENERGY MASTER PLAN II SUBMISSIONS

As part of my work for the New York Power Pool in the State Energy Master Plan II Hearings, I had the opportunity to review the major conservation forecasts of the State's eight major electric utilities including Con Edison and the Power Authority. This review encompassed both the investigation of the assumptions contained in the Report to the New York State Energy Office pursuant to Section 5-112 of the New York State Energy Law for each of these utilities as well as follow-up conversations with forecasting personnel at each company. As a result of my investigation, I concluded the following:

1) The Member Systems of the New York Power Pool had accounted for the DOE major appliance efficiency targets and corresponding per unit energy reductions in their "most likely" load and energy forecasts. Conversely, my analysis of ESRG's statewide forecast of conservation potential in that same proceeding showed that ESRG had improperly reflected the 1980 FEA Appliance Efficiency Targets in their

projection. (See Exhibit GLF-6 of my SEMP II Rebuttal Testimony which is Appendix B to this testimony).

2) The Member Systems of the New York Pool had employed reasonable projections of future increases in the real price of electricity, thus insuring reasonable decreases to the "most likely" forecast for price related conservation responses. These real price projections accurately reflected the official SEMP II capacity expansion plans.

3) The Member Systems of the New York Power Pool have given sufficient, and perhaps optimistic consideration for the potential of conservation measures and strategies in their "most likely" peak load and energy forecasts. The following items, which have been included in the utilities' forecasts, are examples of this consideration.

A) Incorporation of the DOE 1980 Appliance Efficiency Targets - Although these targets are no longer mandatory from either a state or federal perspective, the Member Systems have made the assumption that such targets will be achieved or exceeded in the future appliance stocks in their respective service territories. The appliances that are affected by these improved efficiency targets are:

	Original DOE Proposal For Per Appliance Energy Reduction %
Central Air Conditioning	17
Window Air Conditioner	22
Water Heater	15
Clothes Dryer	4
Clothes Washer	26
Range	3
Refrigerator (Frost Free)	28
Refrigerator (Manual)	33
Freezer	22
Dishwasher	20
Color TV	35
Black & White TV	65

Recognition of these or greater forecasted per unit energy reductions for improved appliance efficiencies has served to greatly reduce the Member System's future load projections.

B) In the commercial sector, the Member Systems have reduced future forecasts for the impacts of conservation measures in this sector. As an example, Con Edison has forecast saturation of Load Limiting Devices of more than 70% in its service territory by the year 2000 and has lowered both its peak and energy forecasts accordingly. The percent reduction utilized by Con Edison in their forecasts is based upon actual Con Edison experience, and from my review, appears quite reasonable.

Con Edison has also included other conservation related reductions in its "most likely" forecast:

1) Assumed increasing use of load management techniques in response to rate structure changes (which affect energy as well as peaks).

2) Included a "non-cost-effective" conservation forecast reduction amounting to approximately 5% in 1995 and 7% in 2000. This reduction is separate from "price related" conservation captured by Con Edison's econometric model and other cost effective measures such as the appliance efficiency improvement energy reduction.

The following is a representative list of the additional measures included in various degrees by some or all of the Member Systems:

a) Time of use rate implementation

b) Movement towards marginal cost pricing policies

c) Continuation of programs to provide consumers with information on types of conservation measures and their savings potential

d) Storage rates

e) Interruptible rates

f) Energy audits

g) Weatherization financing

Thus, in my opinion, Member Systems of the New York Power Pool have made a reasonable accounting for conservation in their long range plans.

II. THE NEW YORK STATE ENERGY PLANNING BOARD'S CONSIDERATION OF CONSERVATION IN THE FINAL SEMP II REPORT

For its part, the New York State Energy Planning Board has made conservation the cornerstone of its overall long-term energy policy as embodied in the State Energy Master Plan II Final Report. On page 5 of the Executive Summary of SEMP II, there is a discussion of the role of conservation in the official state load and energy forecasts.

> "The forecasts reflect significant conservation resulting from rising energy prices, mandated efficiency standards and state conservation programs now underway. They consider, in a systematic manner, the interrelationships of economic activity, fuel prices, national and state energy policies, fuel substitution, conservation and renewables, as well as the availability of conventional fuels."

Thus, both the Member Systems of the State of New York Power Pool and the New York State Energy Planning Board have given major consideration to the future impact of conservation on energy demand in New York State.

Two parties (Environmental Planning Lobby and the New York City Energy Office) sponsored forecasts of conservation potential prepared by Energy Systems Research Group (ESRG). The two studies are:

"An Analysis Of The Need For And Alternatives To The Proposed Coal Plant At Arthur Kill", (ESRG 81-21), June 15, 1981.

and

"The Conservation Investment Alternative For New York State" (ESRG 80-42) September, 1981.

These analyses presented scenarios for conservation both from a downstate (Con Edison - Power Authority (SENY)) and statewide perspective. These studies were, in ESRG's own words, "...not offered as a blueprint for immediate program action over the next 20 years" but, rather, "to show...one choice of plausible target conservation levels in order to test the proposition that conservation could feasibly play a major role in the State..." (ESRG 80-42, page 4).

It is clear from the above, therefore, that ESRG never intended their analyses to be utilized as an official planning document (as both the Member Systems and the SEO did intend theirs to be)

and that it is inappropriate for ESRG to utilize such methodologies and assumptions in the presentation of High Impact, Mid Range and Low Impact Effects on Ratepayers for the early retirement of the Indian Point 2 & 3 plants.

III. A DISCUSSION OF THE DIFFERENCES BETWEEN FREE MARKET-INDUCED CONSERVATION VS. SUBSIDY-INDUCED CONSERVATION

Generally speaking, "price-induced conservation" would be the conservation of energy either by reduction in intensity of use of appliances or changes to more efficient appliance stocks that would be caused by increases in the real price of electricity either through the "real" or "perceived real" increases in the price of electricity. Non-price-induced conservation can be thought of as conservation induced by subsidy programs based upon the active intervention of utilities, regulatory authorities, or government. While price-induced conservation will usually affect the intensity of use for the short run and appliance decisions in the long run, non-price induced conservation would be directed at altering appliance decisions only.

"Intensity of use" conservation can be thought of in terms of short-run price elasticity, that is, a consumer's short-run response to a "real" increase or a "perceived real" increase in the cost of energy. In this type of conservation response, a consumer alters his utilization of existing appliances or end uses such as reduction of lighting in the home, lowering of heating thermostats, or raising of air conditioning thermostats, lowering water heater temperature, etc.

"Appliance decision" elasticity is more of a long-run response. Literature indicates that such long-run elasticity may take between 5-7 years before it is fully effective, and such resulting energy reductions are usually of greater magnitude than short run impacts. Economic theory suggests that consumers will opt for more efficient and, thus, less energy consuming appliances and end uses in some direct relationship to the increase in the real price of electricity over time. The quantification of such a relationship is called the "price elasticity of demand" response.

Economic analysis performed by the utilities, the State Energy Office and others indicate that the potential for price induced conservation (from free market forces) is quite significant. Based upon AEG's analysis of the six residential conservation measures for Con Edison as part of Case 28223 and further investigation of relevant portions of Con Edison's "most likely" long-range forecasts, "price-induced" impacts are expected to account for conservatively 67% of the total achievable impacts for the measures studied.

During the Energy Crisis of 1973-74, consumers made dramatic efforts to save electric energy. Realistically, these short-term savings came primarily from consumers' alteration of energy usage

patterns rather than a wholesale replacement of less efficient appliances with a more efficient variety.

Little is known about the potential for the "replacement" phenomenon that may occur if consumers substitute appliance decision conservation for intensity of use conservation. That is, it is conceivable that as consumers opt for more efficient appliances in the future, usage patterns that had been modified in the short run may revert to more traditional comfort and usage levels as more efficient appliances come on line. Thus, caution must be exercised in assuming that short run intensity of use conservation is a lasting condition. Rather, it may be a temporary phenomenon until the longer run appliance decision conservation takes effect.

Essentially, while some parties view conservation in a total impact sense, the utilities add the sophistication that there is a cost effective or free market-accessible portion of that conservation, and consequently, there may be a subsidy induced portion for the more marginal conservation measures and markets. It is extremely important to make the distinction between free market conservation and subsidy produced conservation, since such a distinction is critical to the overall evaluation of the economic feasibility of such measures. For example, if one were to postulate a $100 million program to assist New York State residents in replacing current refrigerators with 50% more

efficient refrigerators, the resultant cost benefit analysis would propose to view the $100 million as a cost and the total kWh savings of the 50% more efficient refrigerators as the benefit. However, the true perspective would be to discount the 50% benefit by that benefit that would have occurred in any case due to both:

1) Consumer's reaction to higher electricity prices.

2) The availability in the marketplace over time of a lower level efficiency refrigerator (that is currently estimated to be, on average, 33% more efficient).

Thus, a total percentage gain from the $100 million subsidy investment would be (50% - 33%) 17% not 50%. It is clear from the foregoing example that an accurate realistic view of the timing and the total impact of the "free market" forces is necessary if conservation subsidies are ultimately ordered by the PSC as a result of Case 28223.

IV. A DISCUSSION OF THE FURTHER CONSIDERATION OF CONSERVATION IN NEW YORK STATE PURSUANT TO NEW YORK STATE PUBLIC SERVICE COMMISSION CASE NO. 28223

Overview

In response to the Commission Order in Case 28223 dated May 7, 1982, Con Edison has thus far provided estimates of the maximum potential conservation impact for six residential measures. Those measures are as follows:

1) Refrigerators (manual and auto-defrost)
2) Residential room air conditioners
3) Residential lighting
4,5,6) Residential water heating measures - (water heating blankets, low flow shower heads, and heat pump water heaters)

AEG was retained by Con Edison to provide the following data for each device for use in subsequent analysis:

1. Energy savings of a more efficient device relative to a less efficient device. These annual figures were further broken down into on and off peak costing periods for the summer and winter.

2. Concomitant peak load impact of the more efficient device relative to the less efficient device.

3. The additional cost of the more efficient device relative to the less efficient device.

AEG also developed the maximum system impacts for the above-mentioned conservation devices. Appendix C, Exhibit GLF-2 entitled "Maximum Potential Conservation Impacts" contains this information. It is important to note that the analysis of conservation potential for these devices looked at the incremental conservation that could occur after the free market forces impacted these devices in the future. Thus, these impacts would be the incremental impacts that could be gained through subsidization.

Con Edison Study - Peak and Energy Impacts

For the Con Edison system, the incremental maximum system peak and annual energy impacts of these six conservation measures has been estimated to be 326 mW and 1286 gWh, respectively. These impacts are over and above the free market force impacts for the affected appliances that are already included in the Con Edison official forecast. Those free market force impacts that have been accounted for in the Con Edison "most likely" forecast for these six measures have been estimated to be 660 mW and 2613 gWh,

respectively. Thus, the Con Edison "most likely" forecast has accounted for a minimum of 67% of the total conservation savings available from the six identified conservation measures.

Extrapolation of Con Edison Study Results to the Power Authority

A similar formal analysis has not been performed for the Power Authority with respect to these six measures. However, as a general statement, I would expect that the load and energy impacts in the case of each of the six measures would be significantly lower than that shown for Con Edison in Appendix C. My reasons for this expectation are as follows:

1. The Power Authority indirectly serves only a fraction of the number of residential households as does Con Edison. It is estimated that the Power Authority's Public Housing accounts serve approximately 250,000 households as compared to approximately 3 million households for Con Edison.

2. Virtually all of the households served by the Power Authority are master-metered. Master-metering diminishes, if not eliminates, incentives for households to conserve and usually removes the appliance purchase decision from the individual households.

For the purpose of discussion, however, I have performed a

mathematical extrapolation of the incremental maximum conservation potential for the Power Authority utilizing the results of AEG's analysis for Con Edison. The results of that extrapolation are as follows:

	System Peak Impact (MW)	Annual Energy Savings (GWH)
Con Edison	326	1286
Power Authority	27	107

Incremental Conservation Measure Cost Effectiveness

It is important to note that, as part of the study for Con Edison, an incremental cost/benefit analysis of the six measures was performed utilizing a method that assessed the impacts on the utility's unit cost of electricity. That is, an investment by Con Edison in any measure at a level that would serve to increase the unit cost of electricity to consumers was not considered to be cost effective.

Under the criteria for this test, only incremental utility investments in the case of more efficient room air conditioners were found to be cost effective. However, even in that case, the

were found to be cost effective. However, even in that case, the maximum rebate that would be allowed in order to avoid higher unit costs would be $15.53 per device. This amount would be significantly below the total estimated incremental cost of the more efficient device ($47.74).

Conservation Analysis Limitations

During the course of AEG's analysis for Con Edison, we identified several impediments to both the accurate assessment and full implementation of the subject conservation measures. From an assessment perspective, a number of data components lack the statistical rigor that would be required for an assessment with a high degree of confidence. For example:

1. The uncertainty surrounding the efficiency levels of the current appliance stock.

2. The uncertainty surrounding future conservation program participation rates.

3. The lack of accurate information on the average annual kWh per appliance as well as their coincident peak demand levels.

4. The uncertainty concerning the amounts of conservation

that will occur without a subsidy program.

5. The magnitude of the potential offsets to certain conservation strategy implementation (e.g., more efficient refrigerators with added features, thermal savings of one appliance being made up by another).

Thus, from a data constraint perspective, the potential variance surrounding the base case usage values could conceivably be larger than the total percentage savings that is projected from the associated conservation measure. We have also identified a number of institutional impediments to the full implementation of the certain conservation measures analyzed. They are as follows:

1. Significant Saturation of Master-Metered Residential Buildings

Approximately 20% of the residential dwelling units in the Con Edison service territory are master-metered apartments. Master-metering is a condition in which a building landlord has a single meter for a multiple number of apartment units. The landlord, in turn, assesses a fixed monthly electricity charge based primarily upon the number of rooms. This results in the removal of any economic incentive for individual tenants to conserve electricity. Furthermore, when a landlord is faced with the replacement of a piece of

equipment in a tenant's apartment, the landlord will most likely opt for the least expensive replacement (usually the least energy efficient). It should be recognized that the following four measures under consideration would be affected by this impediment:

1. Lighting Improvements
2. Refrigeration
3. Air Conditioning
4. Water Heating

2. Incidence of Appliance Ownership in Residential Rentals

In many apartments in New York City, major appliances are purchased by landlords rather than individual tenants. In most cases, such purchases are made in large quantities with price as the major consideration. Given Con Edison's customer mix, which has a significant number of apartments (apartments comprise approximately 71% of the residential units in the Con Edison service territory), the evaluation of the incidence of appliance ownership will be a key determinant in a conservation program design for refrigeration, electric cooking, and air conditioning.

3. The Ramifications of a Relatively Large Residential Low Income Population in the Con Edison Service Territory

A 1977 survey performed for Con Edison by Audits and Surveys Inc. showed that over 30% of the residential customers in the Con Edison service territory can be classified as low income families (under $10,000 annual income). This fact becomes extremely important when the time comes to design incentive programs for residential conservation measures. This problem may be somewhat mitigated by the fact that the majority of these low income customers live in master-metered apartments. Thus, incentive programs for low income customers may better be aimed at landlords than the low income families themselves. In any event, this is an issue worth studying to insure that conservation programs reach the appropriate market segment.

4. The Problem of Segregating the Incremental Costs of Higher Efficiency and Added Features

There is another important variable associated with consumer purchases of more efficient air conditioners and refrigerators. This unknown centers around the new energy consuming "features" that are being built into more energy efficiency appliances (e.g., ice makers in refrigerators, etc.). Thus, if one assumes that all future refrigerator purchases will be of the 33% more efficient variety and further postulate a $20 incentive program is required to

have consumers purchase a 50% more efficient unit, an average savings of 250 kWh's per year per unit would result. However, it may well be that there would be no savings associated with the more expensive model because of the offsets that may be included in such a model. Also higher efficiency models may contain additional features not found in the units they are replacing. This factor would serve to complicate any prospective incentive program.

Conclusions

From the results of AEG's analysis of the six conservation measures for Con Edison in PSC Case 28223 thus far, I offer the following conclusions:

1. The incremental maximum impact of these six measures is relatively small in both an absolute sense and in comparison the amount of conservation reduction already included with these measures in the Con Edison forecast.

2. By order of the PSC, the measures analyzed for Phase I of the Case were the measures that were conceived to have the greatest potential for cost effective incremental savings. Thus, other measures may have additional conservation potential over and above that included in the

Con Edison "most likely" forecast, but I would expect that the incremental impact between Con Edison's "most likely" forecast and the maximum potential to be significantly smaller.

3. AEG's analysis for these six measures showed that the Con Edison "most likely" forecast already contains specific reductions that accounted for the large majority of the maximum total impact for these measures. With the suspension of the 1980 DOE Appliance Efficiency targets by the federal government, the potential exists for an over-accounting for conservation in the Con Edison forecast.

V. COMPARISON OF ENERGY DEMAND GROWTH RESULTS CONTAINED IN ESRG'S "FOOTNOTE 7" WITH RESULTS UTILIZED IN SCENARIOS EMPLOYED IN "INDIAN POINT STUDY"

In their calculation of the "range" of revenue impacts, ESRG relies upon the forecasts contained in a prior ESRG study entitled:

> An Analysis of the Need for and Alternatives to the Proposed Coal Plant at Arthur Kill; A Report to the New York City Energy Office and the Corporation Counsel of New York, ESRG Study No. 81-21, June, 1981.

This report is referenced as Footnote 7 in ESRG's testimony in this proceeding entitled "The Economics of Closing the Indian Point Nuclear Power Plants".

The forecasts presented as part of this study were for the Con Edison service territory as well as the Power Authority's southeastern New York customers.

Four scenarios were presented in this report:

1. High Case
2. Low Case
3. Base Case - Average of High Case and Low Case
4. Conservation Case

In point of fact, however, the growth rates shown on Table 2 cannot be duplicated from the contents of ESRG's study referred to in Footnote 7, page 15, of the ESRG report which the following table shows:

Indian Point Vs. Footnote 7

Growth Rates

	High Impact	Mid Range	Low Impact
Indian Point Testimony	.5%	0	-.7%
Footnote 7	1.25%	.5%	-.6%

It can be seen from this comparison of "Demand Growth Scenarios" that ESRG has utilized variations of their prior study that appeared to be skewed toward an overall lower range of energy demand growth rates which would have a result of biasing the entire analysis in the direction of lower overall cost estimates for the Early Retirement of the Indian Point plants.

CHANGES IN THE CHARACTERIZATION OF THE ESRG'S CONSERVATION SCENARIO

In a review of Table 2, page 15 of the ESRG Indian Point Report, it can be seen that under the column "Load Growth" a range of growth rates of different energy demand scenarios is utilized in the determination of High Impact, Mid Range, and Low Impact Cost Scenarios for the Early Retirement of the Indian Point plants. As noted earlier, these scenarios were purportedly obtained from ESRG's Footnote 7 which is a prior analysis done for determining the impact of conservation alternatives on the need for the Arthur Kill Coal/RDF Facility in New York City. While the similarities of these two pages are evident, the differences in the two reports are even more important for the purposes of viewing the ESRG's conservation "scenarios".

While the overall methodologies employed and much of the verbiage from the two studies are identical, the intent of the SEMP II

ESRG submissions appear to be quite different from the Arthur Kill Report. The text of the SEMP II Conservation Scenario presentation was significantly expanded over and above that presented with the Arthur Kill Report. The following citations from this expanded text should be noted:

> "The object of this study is to analyze the potential for an intensive conservation program in New York State as a substitute for or complement to additional power plant construction...While the conservation scenario is not presented as a blueprint for immediate action, it does offer first approximation measure of the merits of such a program." (Emphasis added).

further:

> "At the outset, it is worth clarifying the character of the conservation scenario as designed and evaluated in the study. To begin with, there are two types of functions it is not meant to serve. First, it is not offered as a blueprint for immediate program action over the next twenty years. Rather it represents one choice of plausible target conservation levels in order to test the proposition that conservation could feasibly play a major role in the State...While it embodies the main contours of any candidate program,

there is no claim that the scenario is precisely what would emerge in an actual program." (Emphasis added).

ESRG has erred in its forecasts, technological evaluations, timing and extent of conservation impacts, comparative economic analyses, and even in the most basic deductive reasoning looking at the relative probabilities of success of various competing alternatives.

The following sections will touch briefly some of the major methodological flaws and erroneous assumptions that are contained in ESRG's Footnote 7.

WEAKNESSES OF THE ESRG CONSERVATION SCENARIO

In the case of the Conservation Scenario, ESRG has projected that almost 80% of the impact of conservation will be felt by the New York Power Pool System by the year 1990. Furthermore, the scenario shows full implementation of the total conservation potential in the first twenty years. This finding goes directly against statements made by ESRG in other proceedings and also an analysis performed by the National Academy of Sciences. The National Academy of Sciences in their analysis of the potential for conservation implementation similar to that proposed by ESRG have estimated that the full impact from such a program will be felt between twenty to fifty years in the future in industrial

plants and over fifty years in the residential sector. This is totally at odds with the nine year 80% implementation that ESRG suggests.

Additionally, there appears to be a methodological inconsistency in ESRG's implementation of their conservation scenario. ESRG's methodology relies, in large measure, on logistic curves that are fitted to historical data. Logistic curves have a flattened S-shape property. Therefore, if full implementation of a technology requires twenty years, "the point of inflection" or that point at which half of the technology has been implemented should occur between years nine and eleven. However, ESRG purports to find an 80% penetration of their conservation scenario in the first nine years of the forecast period.

ESRG's use of an accelerated conservation scenario is unrealistic. For example, one has only to look at the so-called 1980 FEA Appliance Efficiency Targets upon which ESRG bases a good portion of its conservation reductions. These appliance efficiency targets originally scheduled for implementation in the 1980 appliance product line, have been suspended, and the future viability of these regulations is uncertain as is the more optimistic 1986 increase in appliance efficiency targets referred to in the ESRG report.

LACK OF CURRENCY OF ESRG FORECAST AND METHODOLOGY

The Footnote 7 Study was predicated on a data base that is now between three and six years old. The use of such an outdated study belies ESRG's statement, made in response to a data request, that its "forecasting model is subject to constant change and improvement both in its data structure and in the analytical approach employed."

ESRG COST BENEFIT ANALYSIS METHODOLOGY FOR ASSESSING COST EFFECTIVE CONSERVATION MEASURES

Page 19 of ESRG's Indian Point Report in a discussion of the Conservation Scenario contained in Footnote 7 states:

> "Our June, 1981 study also developed a conservation scenario consisting of conservation measures and levels that were technically feasible and cost effective compared to energy supply"

Thus, according to ESRG's acceptance criteria for conservation measures, all measures included in their conservation scenario must be cost effective.

However, an analysis of ESRG's conservation measures and their associated cost effectiveness points to four major conceptual

errors in Sections III, IV, and V of the 1981 ESRG Arthur Kill Report. They include the following:

1. ESRG's failure to perform a valid incremental cost/benefit analysis for each conservation measure.

2. ESRG's incorrect inclusion of benefits attributable to free market forces in its cost/benefit analysis.

3. The improper treatment of the impacts of more efficient appliances in the conservation scenario. The cost/benefit of measures that were double counted in the Conservation Scenario.

4. ESRG's failure to recognize that for certain end uses, the energy conserved in the conservation scenario is larger than the energy left to be conserved after the implementation of their base scenario.

OTHER ESRG ERRORS AND INCONSISTENCIES

The preceeding situations have served to provide information on some sample of ESRG's errors and inconsistencies. The following is a brief summary of some additional errors that have been uncovered during the course of my investigations of these ESRG studies:

1. ESRG's staff's alteration of forecast input data.

2. Utilization of incorrect and inconsistent FEA Appliance Efficiency Improvement targets.

3. Improper development of confidence bands around ESRG'S "most likely" forecast.

4. Lack of econometric justification for forecast assumptions employed.

5. Inability to quantify the impacts of important exogeneous variables.

6. Incorrect computer algorithms for computing conservation scenario dollar savings.

7. Overstatement of conservation scenario savings. (ESRG admitted $3 billion overstatement. Subsequent computation of ESRG's savings indicated overstatement of $6 billion).

RESUME OF

GEORGE L. FITZPATRICK

SUMMARY OF QUALIFICATIONS

Extensive background in load research, load forecasting and load management with a graduate degree in economic theory and a concentration in statistics. Experience includes the development and defense of short and long run econometric-based electric and gas forecasts, and overall management of load research programs with specific expertise in sample design and weather normalization methodologies. Has testified as an expert witness in the areas of load forecasting, load research, and load management.

CURRENT POSITION

Mr. Fitzpatrick is the President of Applied Energy Group, Inc. (AEG), a management consulting firm that serves the needs of the energy industry primarily in the areas of load research, load forecasting, load management, and strategic energy planning studies.

PROFESSIONAL BACKGROUND

Stone & Webster Management Consultants, Inc. 1979 - 1981

Mr. Fitzpatrick held the position of Vice President-Load Research and Demand Planning. He was responsible for the coordination and direction of consulting activities in the Load Research and Load Management areas within the Corporation. Additional responsibilities included analyses of data processing requirements and potential new markets for consulting activities.

Long Island Lighting Company 1971 - 1979
Manager, Load Research and Forecast Division

As a Manager of the Load Research and Forecast Division, his prime responsibilities centered on electric peak and energy forecasts; electric and gas weather normalization; statistical sample design development, load research study implementation; load data management and analysis; Long Island Lighting Company's annual population survey; all long-range demographic projections; the collection, processing, and overall supervision of billing of customers under Long Island Lighting Company's commercial-industrial time-of-use rate, the electric class of customer annual system load research study; and all statistically-based studies performed by Long Island Lighting Company's Economic Research Department.

Manager, Load Research, Costing and Forecast Division

His responsibilities were expanded in 1979 when the Load Research, Costing and Forecast Division was formed. As manager, his responsibilities were expanded to include fully allocated and marginal cost-of-service studies for electric and gas and total factor productivity studies.

SELECTIVE CONSULTING PROJECTS

Load Research

Power Authority of the State of New York

Supervised the review of the existing load research program and formulated a management plan to specify future needs in the areas of sample design, hardware, software, and staffing.

Consolidated Edison Company of New York, Inc.

Supervised the technical and data processing review and assisted in the development of recommendations for a five-year management plan for the load research program.

Pacific Gas & Electric Company

Performed a comprehensive audit of the PG&E Load Research Data Management and Analysis system. Also, assessed the value of load research to all relevant departments in the Company including recommendations for more cost effective uses of load research data for both current and future applications.

Electric Power Research Institute

Advisor to EPRI's Demand Program. Author of RP 1585-3 "Load Data Management and Analysis"; co-author of EPRI Rate Design Study Topic Paper 3: "Issues in Load Research."

Tennessee Valley Authority

Conducted review of TVA's Sampling Plan strategies and methodologies.

Tacoma City Light

Supervised the development of PURPA sampling and specification of organizational structure for a new Load Research Group.

Long Island Lighting Company

Designed and implemented stratified sampling software that employed Dalenius-Hodges and Neyman Allocation techniques with stratum optimization and validation. Also directed LILCO's Load Research Program.

Conservation

Consolidated Edison Company of New York, Inc.

Project Manager for a Conservation Assessment study which included designing a methodology and performing analysis to impact conservation measures in the residential and commercial sector to meet requirements imposed by New York PSC in Case 28223.

New York Power Pool

Analyzed the conservation allowances contained within the Member System's individual long range forecasts and critiqued intrvenors' conservation forecasts and analyses.

Power Authority of the State of New York

Analysis on behalf of PASNY of ESRB Conservation Assessment Report submitted in FERC Case 2729: Prattsville.

Load Management

Power Authority of the State of New York

Supervised the development of an evaluation of potential Load Management strategies for the New York State Power Authority, including a cost/benefit analysis and specific Load Management test programs.

Long Island Lighting Company

Assisted in the preparation of a June, 1978 Load Management study. Specific responsibilities included estimating Load Management reductions included in LILCO's load forecasts by major component.

Load Forecasting

Long Island Lighting

Directed the preparation of LILCO's annual long range peak and energy forecasts during the years 1974 - 1979. Constructed the first engineering end use and econometric end use models for electric forecasting in New York State; utilized Box-Jenkins stochastic and transfer functions for

short run electric forecasts; employed two and three stage regression techniques in SIC-based commercial-industrial forecasting.

Power Authority of the State of New York

Supervised the preparation of forecasts of impacts for cost-effective applicable Load Management strategies for the Upstate Municipal Systems served by the Authority.

Carolina Power & Light

Supervised the preparation of energy and peak demand forecasts of maximum load and energy impacts for electric heat pump water heaters within the Carolina Power & Light service territory. Study commissioned by U.S. Power Management Corp.

NCR Corporation

Performed engineering economic cost benefit analyses and multi-scenario market projections for potential NCR energy-related product entries.

Expert Testimony

Has testified as an expert witness in the following New York State Public Service Commission proceedings: Case Numbers 26733, 26829, 26985, 27136, 27154, 80003, 27319, 27374, 27375, 29223 on subjects such as electric and gas peak and energy forecasts, load research studies for cost-of-service analysis, load management, cogeneration, conservation and statistical studies for weather normalization of gas sendout and electric energy requirements data.

Presented expert testimony on behalf of the Member Systems of the New York Power Pool on the subjects of Load Forecasting, Energy Conservation and Economic Analysis in the New York State Energy Master Plan II Proceedings.

Presented rebuttal forecast, conservation and economic analyses on behalf of the Power Authority of the State of New York in connection with the Arthur Kill Coal/RDF Facility Corps of Army Engineers Proceeding.

EDUCATION

St. John's University, MBA Economic Theory, 1972
St. John's University, BA Economics, 1969
C. W. Post College, MS Candidate, Management Engineering

Continuing education courses in Engineering Economics, Load Research, Demand Forecasting in Electric Power Systems, Box-Jenkins Forecasting Techniques. FORTRAN, COBOL, and

BASIC. Concentration in logistic curve analyses; two and three stage multiple regression techniques; Box-Jenkins stochastic and multiple transfer functions; and utilization and interpretation of multiple regression models and associated analytical techniques.

AFFILIATIONS

American Statistical Association
Mathematical Association of America
Omicron Delta Epsilon

PUBLICATIONS

"How Electric Utilities Forecast", EPRI Peak Load Forecasting Methodologies, EPRI Symposium Proceedings, New Orleans, 1979.

"Report of the Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article 3, Section 5, 112 of the Energy Law of New York State, Exhibit 7", LILCO Load Forecast Methodology, 1979.

"Report of the Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article 8, Section 149-b of the Public Service Law, Exhibit 7", LILCO Load Forecast Methodology, 1974-1978.

"Issues in Load Research", Topic Paper 3, EPRI Rate Design Study (co-author) 1981.

Speaker, "Issues in Load Research", EPRI Rate Design Study Executive Transfer Conferences, San Francisco, Kansas City and Washington D.C., 1980.

Speaker, "Load Forecasting Working Group Chairman Reports" (3), Utility Modelling Forum (EPRI sponsored) San Francisco, 1979.

Instructor, "Load Research and Load Management Seminar" Stone and Webster Utility Management Development Course, New York (2 courses) 1980.

Speaker, "Allocating Revenues Between Service Classifications: Necessary Load Research", National Regulatory Research Institute, Ohio State University, 1980.

"The Load Research Process Above and Beyond PURPA" Public Utilities Fortnightly, March 18, 1982.

"Load Data Management and Analysis" EPRI RP1588-3 December, 1981.

Exhibit ____ (GLF-6)

Comparison of ESRG's Rendition of
FEA Appliance Efficiency Targets vs.
Actual Targets in Federal Register

	Average Reference Use Per Appliance in 1980	Average Reference Use Per Appliance in 1980	ESRG's Interpretation of 1980 FEA Targets	Actual 1980 FEA Target
Refrigerators	1163	1008	13%	28%
Freezers	1381	1234	11%	22%
Ranges	693	658	5%	3%
Televisions	172*	155	10%	44%
Clothes Dryers	985	955	3%	4%
Clothes Washers	102	102	0%	26%
Dishwashers	352	295	16%	19%
Room A/C	412	315	24%	22%
Central A/C	1895	1602	15%	17%
Water Heaters	3353	3010	22%	19%

*Note: Low Reference Case Value is higher than High Reference Case Value

NOTES:

1. Space heating equipment (electric and auxiliary) have been omitted

2. Appliance life, on average, is 15 years. This analysis makes the safe assumption that with average lives less than the forecase period, all pre 1980 FEA Target Appliances will be replaced with units that meet 1980 targets.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

MAXIMUM POTENTIAL CONSERVATION IMPACTS

	Residential Device	Annual Energy Savings (GWH)	Maximum System Peak Load Reduction (MW)
a)	Room Air Conditioners	219	209
b)	Lighting (1)	252	19
c)	Refrigerators		
	Manual Defrost	29	4
	Automatic Defrost	411	54
d)	Water Heaters		
	Heat Pump	175	18
	Low Flow Showerheads (1)	141	15
	Insulation Blankets (1)	59	7

(1) For these measures, conservation savings are based on relative efficiency improvements. Therefore, increasing base case efficiency will result in decreasing savings over time. Maximum conservation potential will thus occur in an intermediate year.

UNITED STATED OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
James P. Gleason, Chairman
Dr. Oscar H. Paris
Frederick J. Shon

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point, Unit No. 2)	:	Docket Nos. 50-247-SP 50-286-SP
POWER AUTHORITY OF THE STATE OF NEW YORK, (Indian Point, Unit No. 3)	:	April 12, 1983

CERTIFICATE OF SERVICE

I certify that I have served copies of Licensees' Testimony of George L. Fitzpatrick, Eugene T. Meehan, William J. Wagers, George C. S. Wang, Allan M. Stewart and Con Edison's Testimony of Dr. Peter C. Freudenthal on all parties by United States mail, first class, postage prepaid this twelfth day of April, 1983.

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