INCENTIVES FOR COST CONTAINMENT BY ELECTRIC UTILITIES: AN ANALYSIS OF FLORIDA O&M EXPENSES

PRELIMINARY DRAFT

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ABSTRACT

This report analyzes and critiques the Florida O&M Benchmark Methodology. Empirical results indicate that the regulatory technique has different implications for firms in similar situations, resulting in uneven treatment of firms. In addition, statistical analyses call into question the predictive capability of the O&M Benchmark approach to forecasting costs. The methodology might be modified by use of a different price index. Alternatively, other regulatory instuments could be introduced to enhance incentives for cost containment by the electric utilities.

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*** The conclusions are those of the authors are not intended to represent the views of PURC sponsors.

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Regulators have developed mechanisms for monitoring managerial performance, including management audits and the evaluation of information obtained via hearings. Rate-of-return hearings permit regulators to determine the allowed rate of return and the revenue requirements appropriate for that utility's situation. In addition, regular review of price changes stemming from fuel adjustment clauses provides a mechanism for ruling on fuel purchases and capacity utilization. In a number of states, including Florida, planning workshops and hearings provide information on demand forecasts and utility capacity investment plans, so managerial decisions in this area are systematically reviewed and critiqued. Of the remaining areas involving managerial discretion, decisions regarding non-fuel operating and maintenance expenditures loom relatively large in the cost of service.

If the total cost of service were broken into components, the shares for the nation as a whole (and for Florida) reveal some interesting trends over the past few years. Except for a few utilities, rate base less accumulated depreciation has become less a factor that in the past. Declining or stable energy prices have brought the share of fuel cost down as well. Other operating and maintenance expenses have become more important as a component of cost. For example, nationwide, operation and maintenance expenses (O&M) rose from 12.7 percent to 17.6 percent of total utility expenses between 1972 and 1985. At the state level, the Florida Public Service Commission (FPSC) has responded to this trend by implementing a benchmark for screening increases in O&M.

Rationale for O&M Benchmarking

Now is an appropriate time to analyze the increasingly important regulatory topic of screening utility operating and maintenance expenses. Because this expense category is large and growing, it is impossible to review every expense decision or determine the validity or prudence of each individual item. A random sample of such outlays might be studied, but individual items are integrally linked to larger programs, so regulators are left to second-guess management or to evaluate these programs with the benefit of hindsight.

The above approaches do not provide incentives for cost-effective decision-making by management. Such second-guessing introduces the possibility of asymmetric treatment of outlays: programs that turn out to be highly cost-effective are included as legitimate costs. Excluded might be those programs which turn out to be marginal, or which are less productive because of unanticipated developments. Such a regulatory reward structure would bias utility outlays away from sets of risky O&M programs which have high expected returns. Customers could be worse off under such a scenario. Thus, Florida regulators have turned to a benchmark approach to identify potential problems in O&M outlays by electric utilities and to provide incentives for cost containment.

Regulators survey the seven large categories of O&M (production, transmission, distribution, sales, accounting, service and informational, and administrative and general), compare expenses to a benchmark, and require further justification if expenses exhibit growth above and beyond what is considered "normal". If adequate justification is not given, the expenses are disallowed when determining revenue requirements for the future years.

Broad issues arising in O&M benchmark regulation include incentives for operating efficiently and the resultant cost to the consumer. If all benefits from increased productivity or cost savings are required to be immediately passed to the consumers, the program creates disincentives to reduce production costs. Regulatory lags provide incentives for cost containment to the extent that a relatively wide range is established for the allowed rate of return. Short-run efficiencies are captured by stockholders, and ultimately are passed on to the rate-payers at the next regulatory review. Regulation relies on the threat of a rate case to induce production efficiencies. However, rate cases are costly in terms of time and money, for both utilities and regulators.

The current method adopted to review Florida utility O&M expenses uses a compound index to ratchet some base-level O&M. Although it was initially tried by the Michigan Public Service Commission in 1979, it was subsequently discontinued (1983). In Florida, the index employed for the review of production O&M incorporates only the CPI-Total rate of inflation compounded over the period between the base-year and the test-year (see Appendix 1a). The index used to screen all other categories of O&M combines this inflation factor with the compound growth in the Average Number of Customers over the same period (see Appendix 1b). The FPSC, however, does not limit its regulatory purview to outcomes which exceed this index. This figure establishes a starting point for further study. Justification can be required for **any** expense category, even when it is not labeled a potential problem by the benchmark formula.

This regulatory approach to cost containment raises several issues, including fairness (incidence of the regulatory burden), accuracy (predictive capability of the current benchmark), and reasonableness of the standard (whether causation or even correlation can be established). This short report presents an analysis of the O&M benchmark technique as applied to the Southern United States, and discusses possible alternative approaches to the set of problems raised by O&M expenses.

Using an estimate of O&M expenses as a benchmark implies an acceptable level of O&M growth. Thus, requiring managers to justify O&M increases greater than would be predicted by an index sets a standard by which managerial efficiency is to be judged. Management would be expected to justify any differential between actual and benchmark numbers. In anticipating this process, however, companies will tend to screen their O&M programs by the same method. Therefore, the current benchmark methodology affects the yearly budgeting for O&M, and consequently the long-run health of the utility.

Test of the Benchmark

In order to evaluate the present benchmark approach to O&M regulation, we gathered data on actual expenditures by utilities in the Southern Electric Exchange (SEE). These companies are listed in Exhibit 1. We found that applications of the benchmark resulted in

Exhibit 1
SEE Companies Used in Analysis

1. Alabama Power Co.
2. Appalachian Power Co.
3. Arkansas Power & Light Co.
4. Arkansas Missouri Power
5. Baltimore Gas & Electric Co.
6. Carolina Power & Light Co.
7. Central Louisiana Electric Co.
8. Delmarva Power & Light Co.
9. Duke Power Co.
10. Florida Power & Light Co.
11. Florida Power Corp.
12. Florida Public Utilities
13. Georgia Power Co.
14. Gulf Power Co.
15. Gulf States Utilities Co.
16. Kingsport Power Co.
17. Louisiana Power & Light Co.
18. Mississippi Power Co.
19. Mississippi Power & Light Co.
20. Nantahala Power & Light Co.
21. New Orleans Public Service
22. Potomac Edison Co.
23. Potomac Electric Power Co.
24. Savannah Electric & Power Co.
25. South Carolina Electric & Gas Co.
26. Virginia Electric & Power Co.
27. Tampa Electric Co.

unequal treatment across firms and over time depending on choice of base-year, the particular cost inflation index (CPI-Total) and the customer growth factor (average number of customers a utility serves). Utility-specific factors and random effects seem to dominate most of the predictions. Two methods were used to test for the presence of the random effects associated with the benchmark.

Dependence on the Base Year

The first method for evaluating the benchmark considered the calculated difference between actual O&M and the index predictions given various base-years. These calculations were performed separately for the four major investor-owned utilities in Florida, as well as for averaged Florida and SEE data. The results indicate that substantial disparities exist between predictions when different base-years are chosen.

A specific example of how the error associated with the benchmark declines as the base-year approaches the test-year (1986) can be seen in the calculations made for the Florida Power & Light shown in Table 1. If a 1979 base-year is chosen, the predicted O&M for 1986 is $111.5 million under actual O&M expenditures for that year. If, however, a 1985 base is used, predicted O&M is greater than actual O&M by $25.1 million. Table 1 summarizes the results of our 1986 benchmark error calculations using base-years between 1979 and 1985.

Table 1: Error of 1986 Benchmark for Florida Utilities (Millions $)

	Base-year						
	1979	1980	1981	1982	1983	1984	1985
FP&L	111.5	109.8	84.7	29.5	0.6	-10.7	-25.1
FPC	32.5	27.9	23.8	12.0	8.6	12.5	-5.9
TECO	31.6	34.3	27.9	12.9	4.5	2.6	-4.8
GPC	11.8	11.3	5.5	6.1	2.8	4.1	-0.6

These results can be viewed in absolute terms, or as a percentage of he utilities' actual O&M. They show an almost perfect downward trend in the benchmark's error as the base and the test year approach one another. Figures 1 through 7 show the absolute error of the

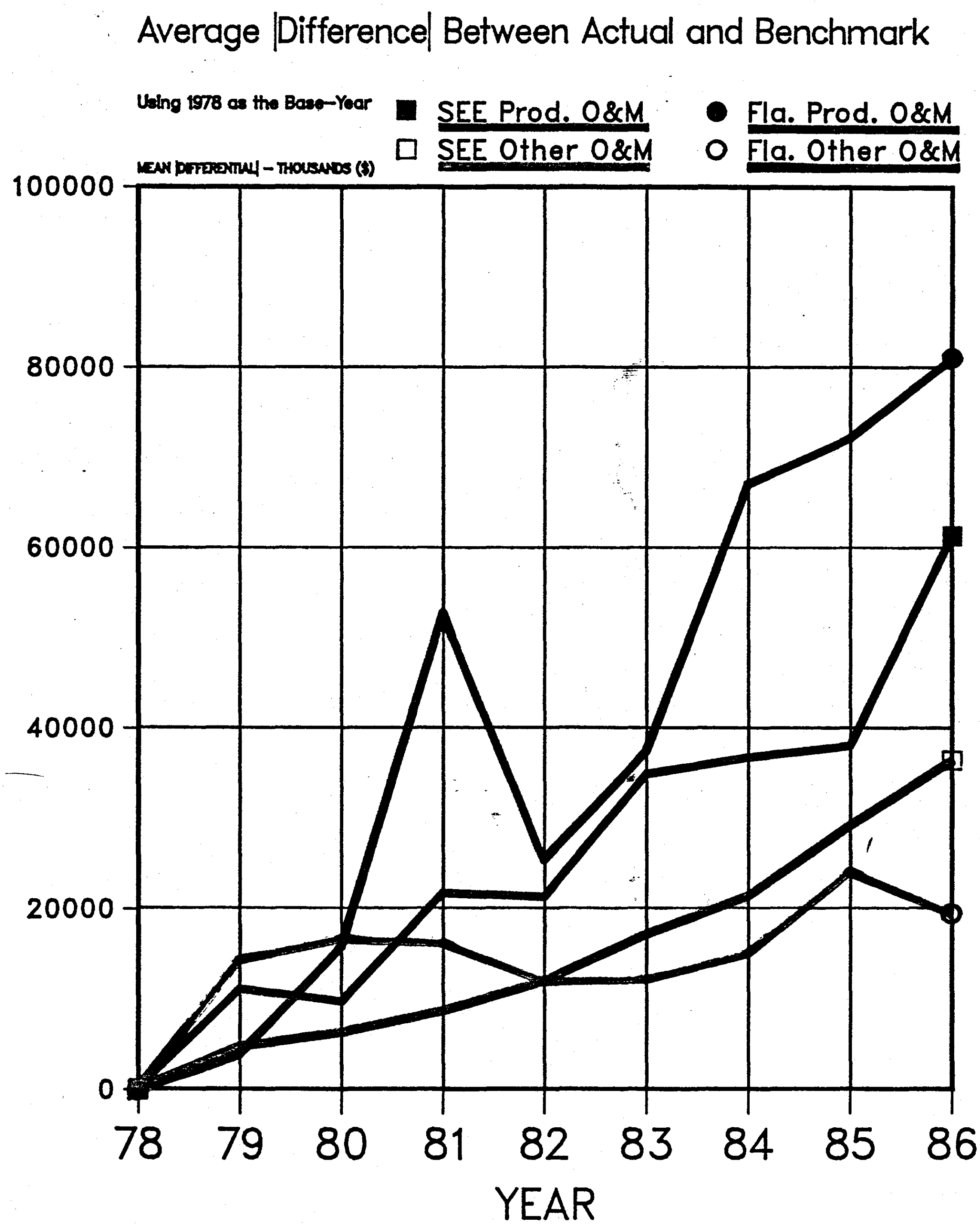


Figure 1. Analysis of Base Year

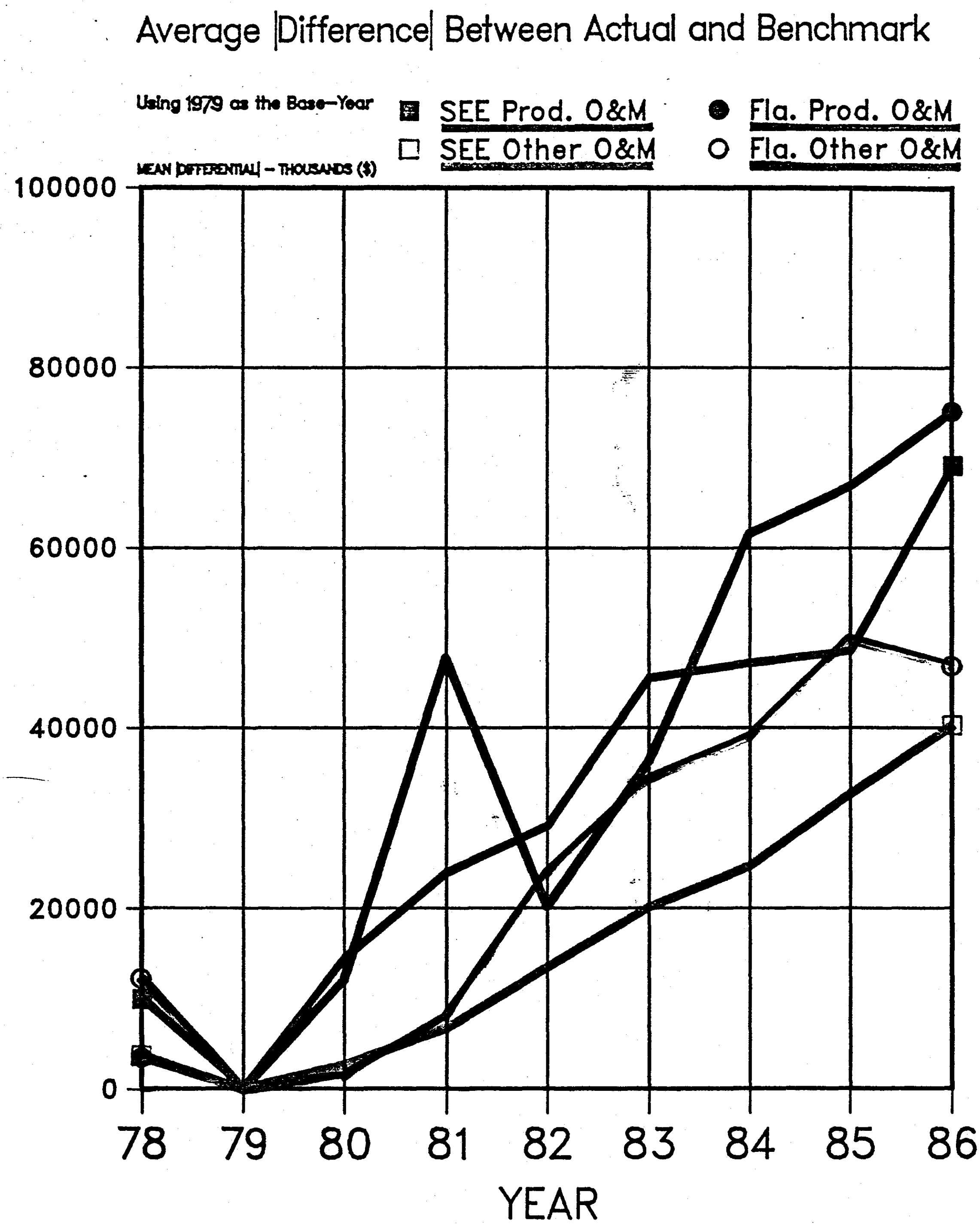


Figure 2. Analysis of Base Year

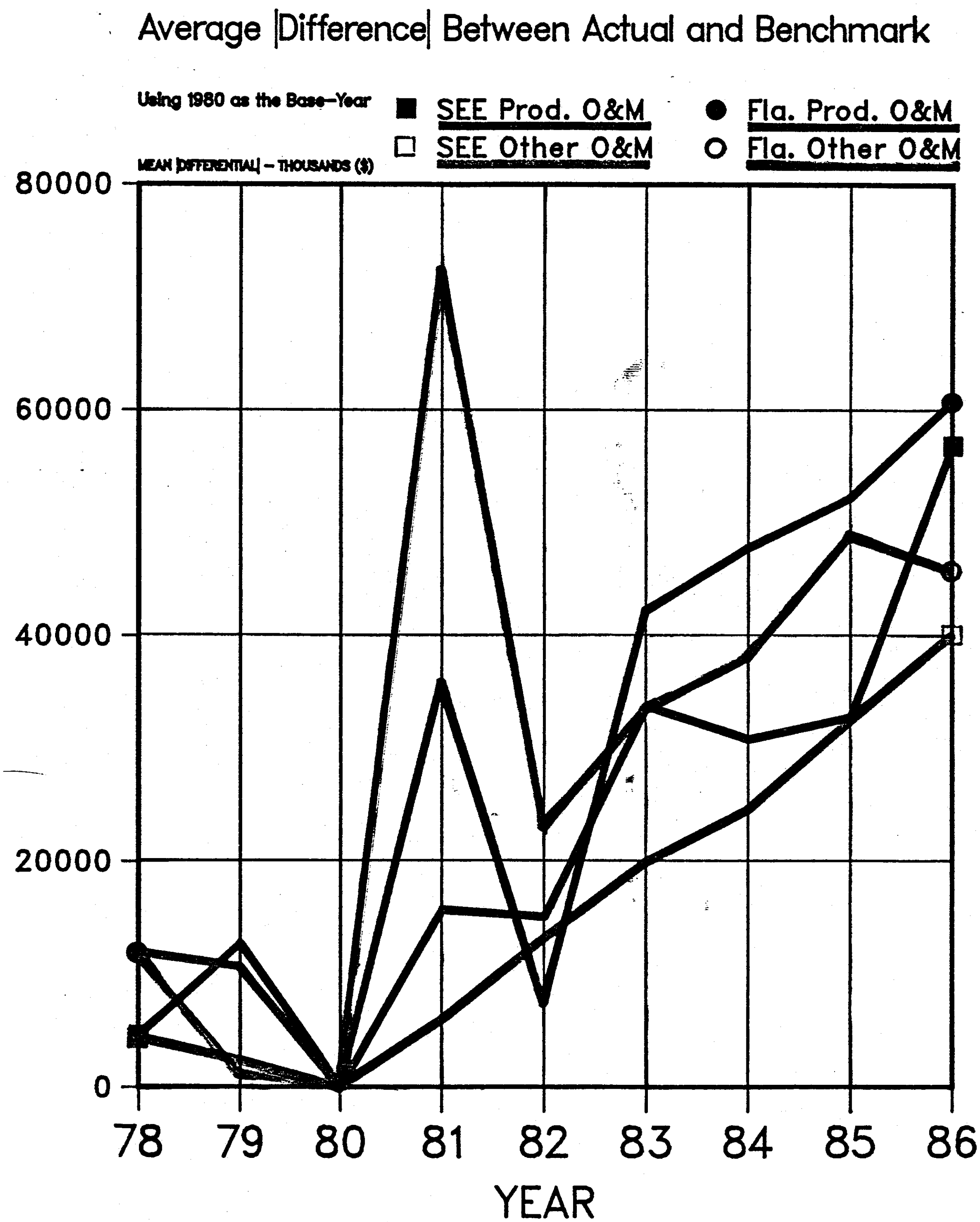


Figure 3. Analysis of Base Year

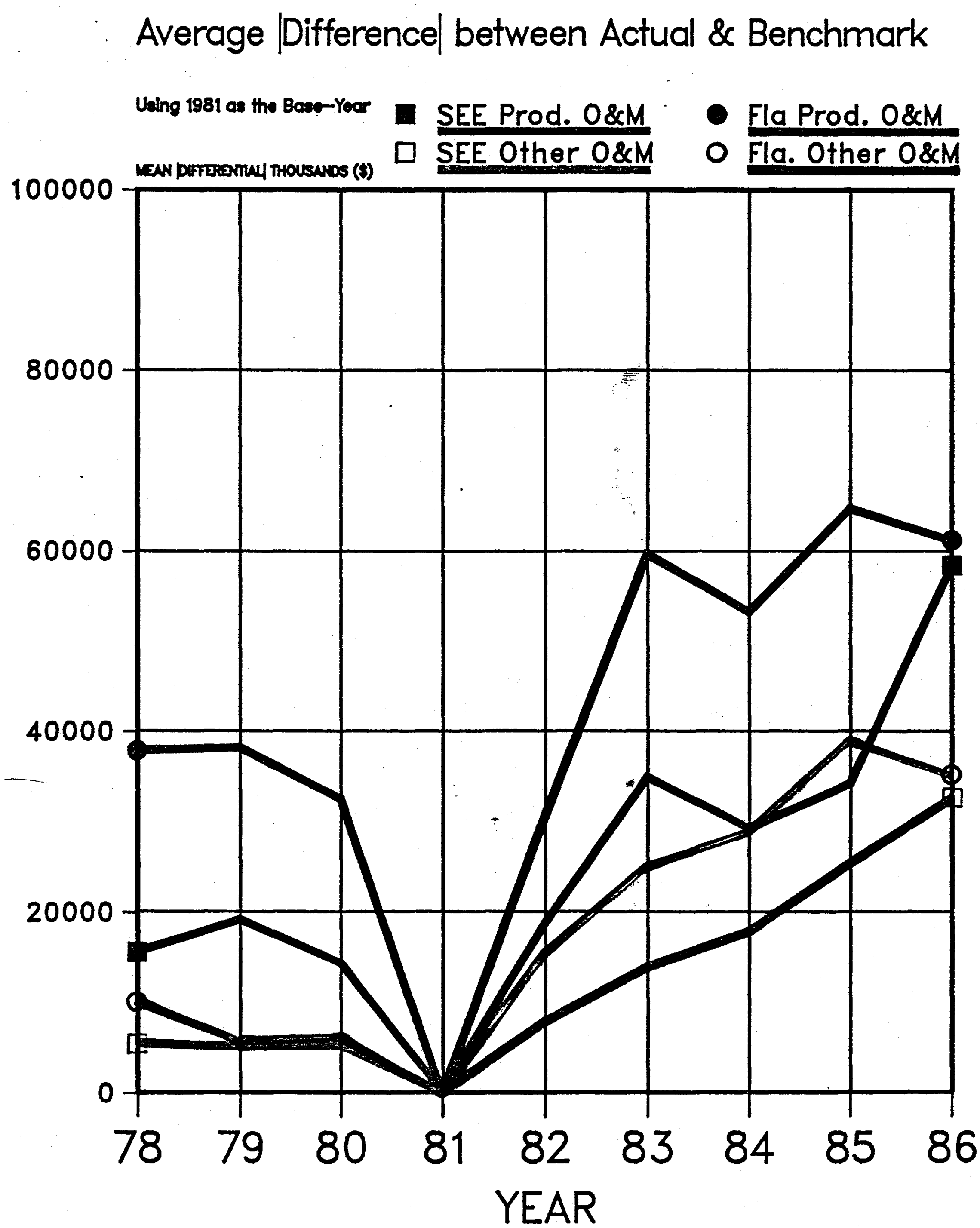


Figure 4. Analysis of Base Year

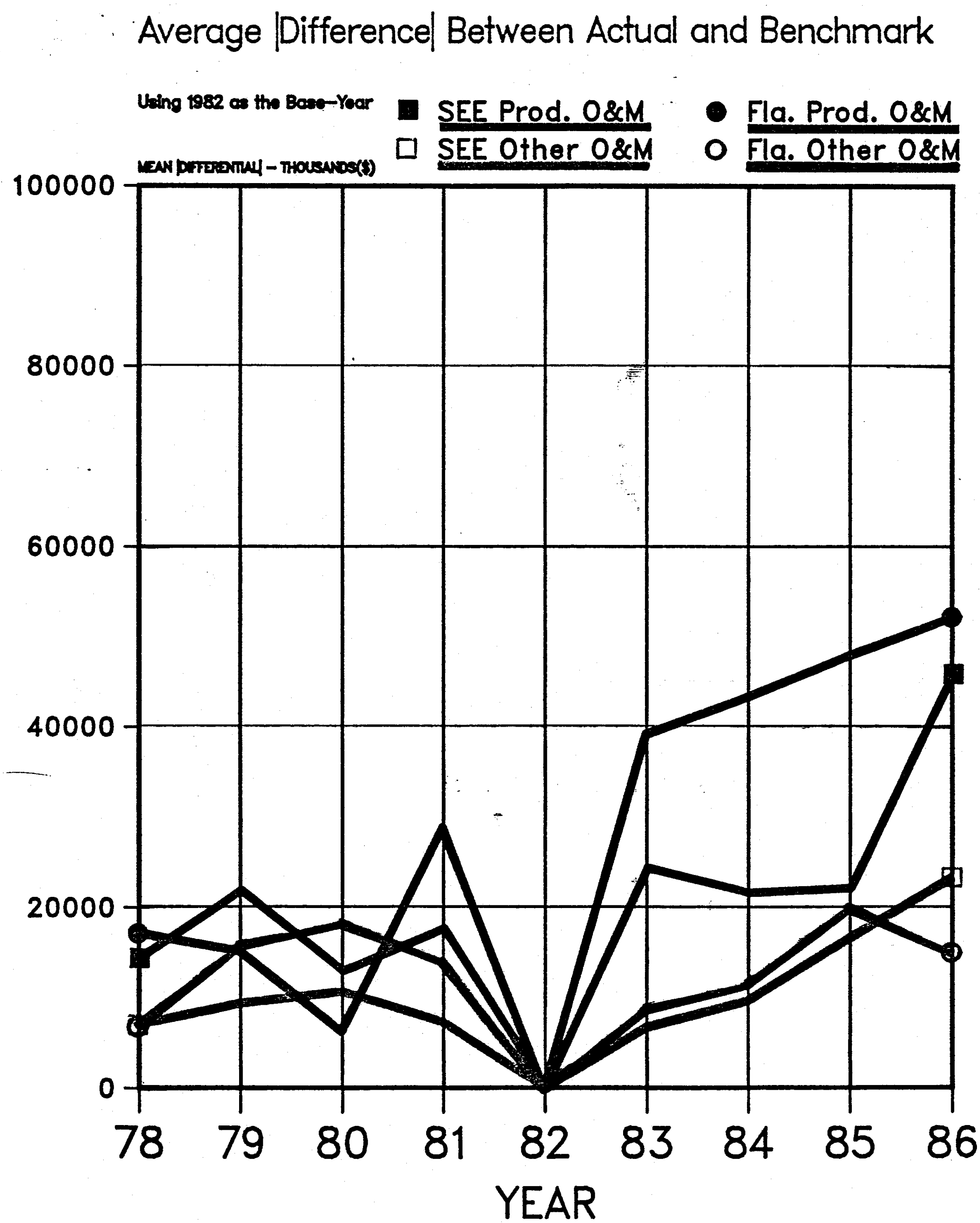


Figure 5. Analysis of Base Year

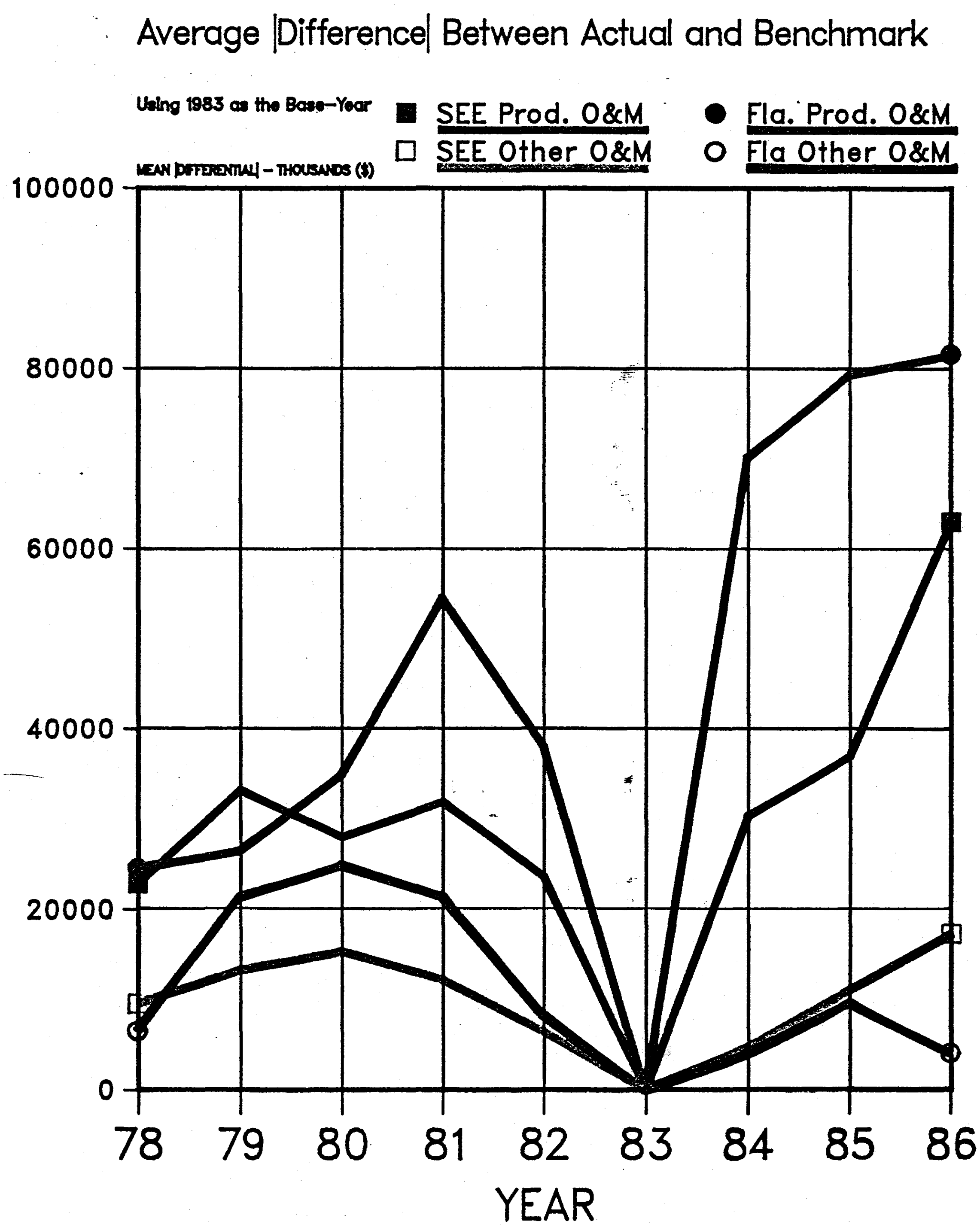


Figure 6. Analysis of Base Year

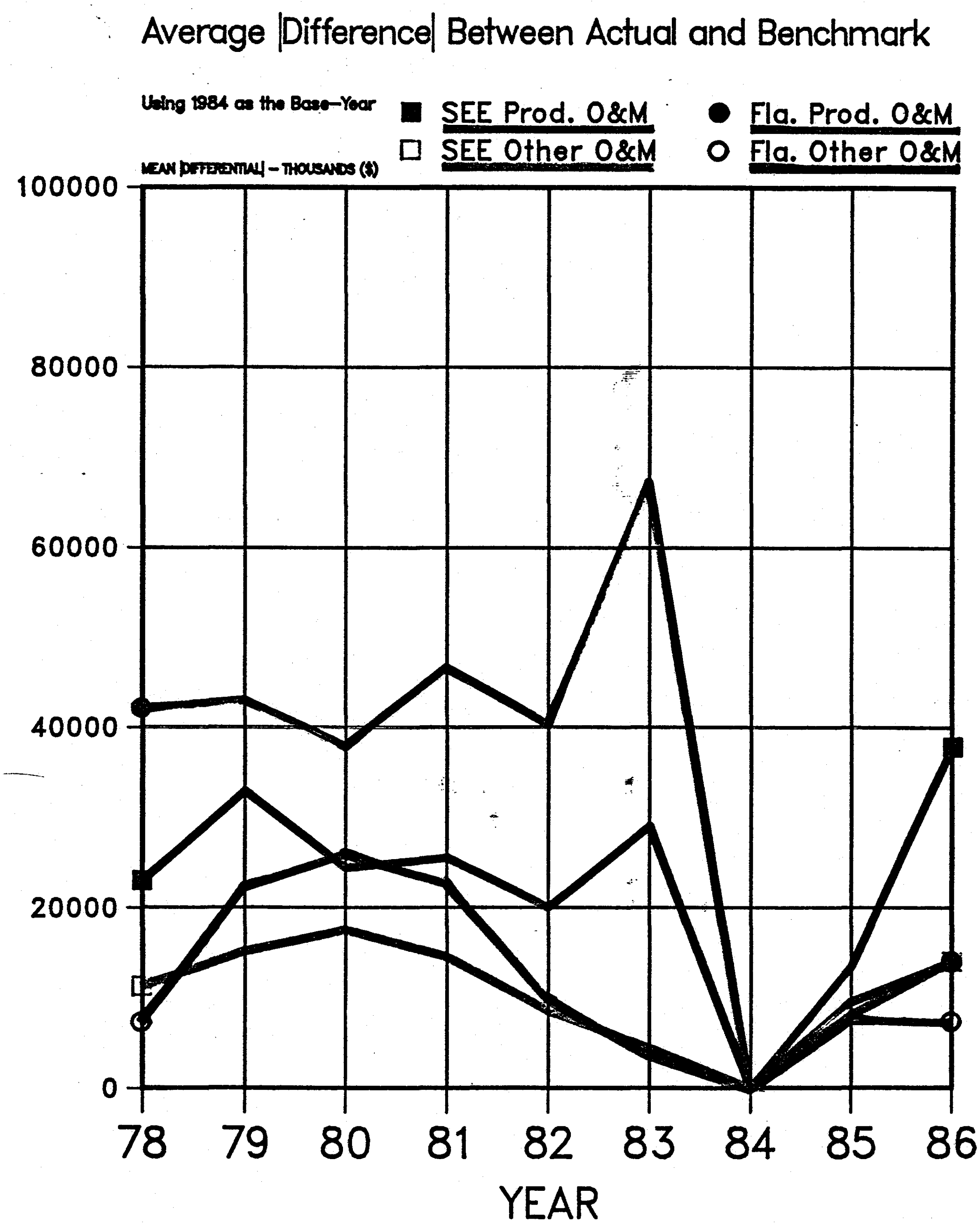


Figure 7. Analysis of Base Year

benchmark over time when calculated using average O&M data. These figures show that over time, factors not accounted for by the index compound the inaccuracy of the benchmark.

Cross Section Patterns and the Inflation Index

The second method to test the comprehensiveness of the predictor variables uses regression analysis. If changes in the number of customers and the CPI represent the major cost pressures for O&M, then predictions from cross-sectional models should differ only by the compound inflation for the period. Here we explain the natural log (Ln) of non-production O&M by the Ln of average number of customers.

The O&M data from 25 Southeastern Electric Exchange members were used to fit two ordinary least squares models: for the 1979 and 1986 fiscal years. Compound inflation for the period between 1979 and 1986 was then added to the 1979 model. The resultant estimates are shown in Figure 8. This exercise indicates that changes in CPI-Total and changes in number of customers account for under one-half of the changes in non-production O&M. The bottom line of Figure 8 gives O&M predictions based on the number of customers served, using the 1979 model. The top line indicates the predictions based on the 1986 model. Two measures of inflation were incorporated into the analysis -- the CPI-Total and the CPI-Services. The CPI-Services (the top of the two center lines), comes closer to the actual 1986 patterns, but still leaves part of the increase in O&M unexplained. The CPI-Total index is much less satisfactory. Reasons for this disparity will be discussed later in the report.

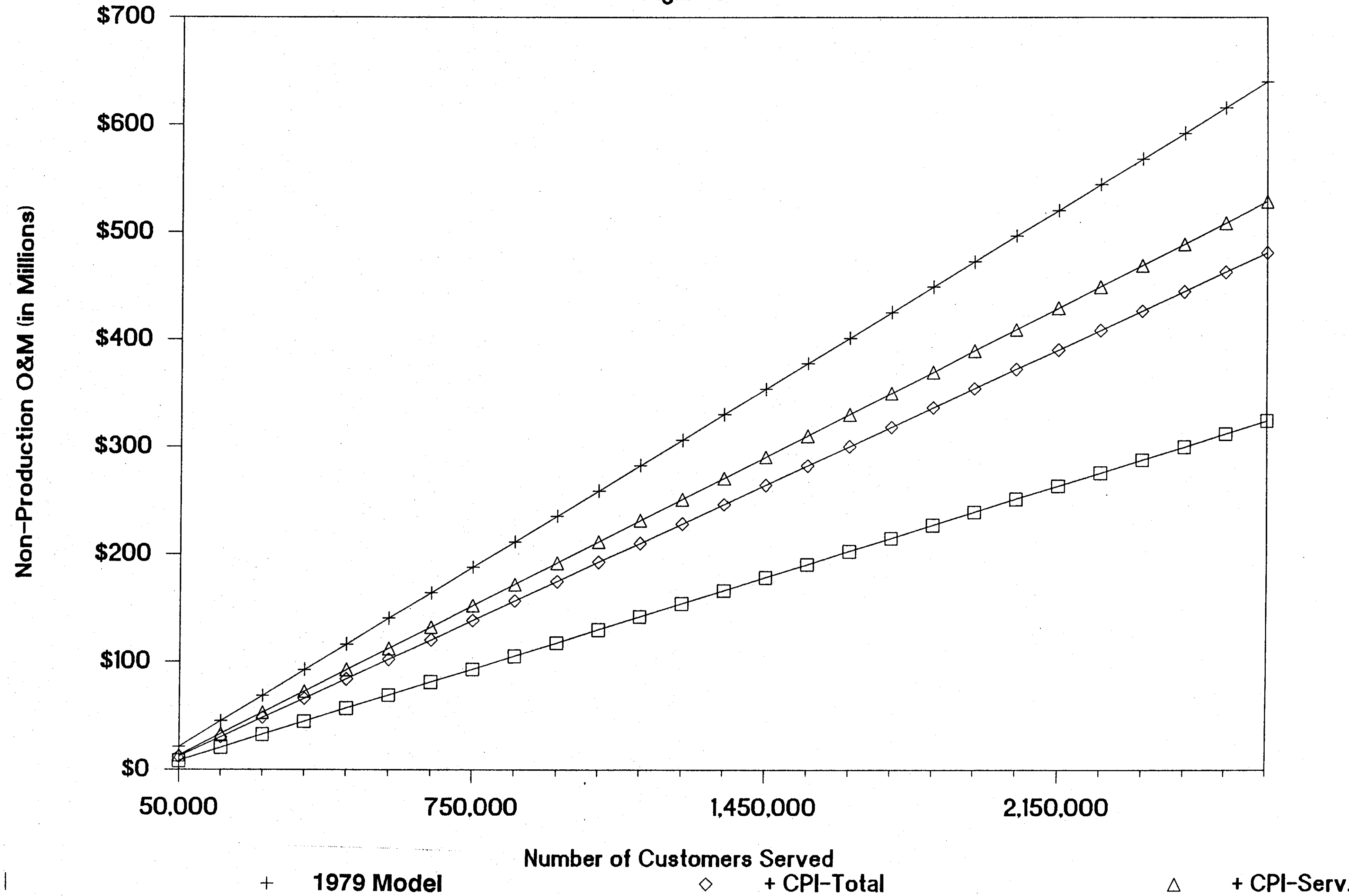
The use of an index to screen increases in O&M appears to be dominated by other effects. These effects reflect factors incorporated neither in the index nor in the commission's choice of base-years. As a result, the usefulness of the benchmark declines as the base-year becomes more distant from the present.

The Accuracy of the Benchmark

The benchmark consistently under predicts actual O&M expenditures in each O&M

Resultant Linear Approximations

Figure 8



category across the SEE utilities. A matrix given in Appendix 2 shows the errors associated with the 1986 benchmark (as a percent of actual) when 1979 is used as the base-year. Summary statistics for this table are given below:

Table 2: Summary Statistics: Errors as a Percent of Actual 1986 O&M for 26 SEE Utilities

Category	Mean Error	Variance
Production	64.89%	144.8%
Transmission	17.08%	6.3%
Distribution	8.26%	3.0%
Accounting	12.19%	4.3%
Service & Informational	28.95%	22.8%
Sales	-586.52%	50,186.1%
Administrative & General	27.75%	3.0%
Total Non-Production	22.28%	2.0%

The inaccuracy (and inconsistencies) of the benchmark can be partially attributed to the choice of base-years (see Appendix 3 for further discussion); however, the correlation between the CPI and O&M expenses is also questionable. The CPI is a *broad* measure for price-level fluctuations experienced by the average consumer and only to a certain extent reflects cost increases facing the electric utility industry. However, the CPI is still used "Since no one price index consistently tracks the rate of change in the different functional O&M accounts." (Okonkwo, p. 19, 1986) We tested the CPI-Total's performance (and with several other indices) using Spearman's rank correlation coefficient. From this test, two inflation factors (the CPI-Medical Services and the CPI-Services) were found that consistently ranked better than the CPI-Total across the seven functional O&M categories. This held across the SEE and the four Florida Firms (see Table 3). We also approached this question using regression analysis.

Let us consider the implied relationship between the change in the index and the change in O&M. To show how accurately the inflation/inflation-customer growth indices track movements in actual expenditures we compared the slope parameters obtained through regression analysis with those implied by these indices. Log linear models were generated using time-series data (1970-1986) for firms in the SEE. The explanatory variable for production O&M was CPI-Total over the test period; while the explanatory variables for non-production O&M were CPI-Total **and** The Average Number of Customers per month (figure for the year, FERC form 1, p. 301, line 15, col. e.). If the index is the sole determinant of the growth in O&M, it should satisfy the equation,

% change in O&M = % change in Index,

for at least some of the firms, some of the time. The implied relationship is 1:1 in the log-linear version of the Benchmark Model.

The actual errors associated with the benchmark predictions generated above point towards a substantial discrepancy in this equality. But, the regression results give a better idea how far the actual movements are from this implied relationship.

For the production O&M models, all parameters are significant (at the 95.5% level) and of the same sign. The mean of the estimated parameters in the production O&M models for the 24 firms is 2.16 (S.D. = 0.59).* Therefore, on average, a 1 percent increase in the CPI-Total is associated with a 2.16 percent increase in production O&M. For the non-production O&M models, disparities arose for the *sign* and *significance* for the two independent variables. For 12 out of 25 firms,** the slope parameter for **number of customers** is insignificant (at the 95.5% level). Also, in 5 of the 25 models the **CPI-total** is insignificant. Of the significant variables wide variations in the calculated parameters indicate that, when applied across the SEE,

*Twenty-four firms are used in this portion of the analysis due to minimal power production (Florida Public Service company), 1979 merger with Arkansas Power Company (Arkansas Missouri Power), and data inconsistencies (Delmarva).

**Arkansas Missouri Power and Delmarva were not included due to above mentioned reasons.

Table 3
Correlation between Expense Growth, Customer Growth, and the Four Best Inflation Indicators

The inflation measures tested were:

1. CPIu - Total (CPITOT)
2. CPI - Medical Services (CPIMED)
3. CPI - Services (CPISER)
4. CPI - Non Durable Goods (CPINDG)
5. PPI - for finished industrial goods (PPIFGD)
6. PPI - Total (PPITOT)
7. PPI - Machinery And Equipment (PPIMEQ)
8. PPI - Fuel Related Products, Power (PPIFRPP)

Results for the SEE:

Correlation Coefficient

Expense Category	Customers	CPIMED	CPISER	CPITOT
Production	.798	.474	.475	.473
Transmission	.828	.452	.451	.447
Distribution	.894	.439	.438	.434
Sales Expenses plus Customer Service & Info	.682	.399	.389	.374
Accounting	.862	.467	.465	.462
A&G	.810	.513	.510	.504

Results for the Florida Firms:

Expense Category	Customers	CPIMED	CPISER	CPITOT
Production	.730	.5935	.594	.587
Transmission	.902	.521	.521	.517
Distribution	.957	.375	.375	.372
Sales Expenses plus Customer Service & Info	.688	.640	.621	.597
Accounting	.926	.464	.463	.463
A&G	.885	.491	.489	.484

inflation and number of customers served do not adequately explain for non-production O&M over time.

Even though the models have high explanatory power, the values of the coefficients varied across firms, bringing into question the usefulness of the benchmark methodology, with the implied 1:1 relationship between the index and O&M. The production and nonproduction equations for the four Florida firms are presented in Tables 4 and 5. The benchmark is based on α_1 and α_2 (when appropriate), both being equal to one: a one percent increase in CPI (or number of customers served) causes a one percent increase in O&M expenses. The key result of the regression analysis is that the actual coefficients differ across firms.

Alternative Explanations for Changes in O&M

The make-up of the CPI index, rapid growth and seasonality of residents (number of connections and disconnections), environmental protection requirements, increased nuclear safety requirements, aging of plant and equipment, uncollectible accounts, operating changes, land use planning, net generation, the geographic and demographic conditions, as well as the mix of customers served, have caused O&M to increase at a greater rate than would be predicted. Many factors affect O&M expenditures besides the CPI inflation and number of customers served (see Appendix 3). In past rate hearings, utility testimony has reflected substantial discontent with the continued use of the indexing methodology. As has been seen, screening O&M using only one or two broad factors, while easily understood, has severe limitations.

Concluding Remarks

The predictions made by the current methodology reflect the shortcomings inherent in chosen base-years and the indices used. Predictions derived from the benchmark method were dominated by other effects across firms and over time. These other effects hinge to a great extent on the chosen base-year. However, variations can also be explained by the numerous environmental and operational factors complicating the O&M decision.

Table 4
Regression Equations for Florida Firms
(1970-1986)

Production O&M Model (T ratio)

$\log Y = \alpha + \beta \log X$

	α	β	R^2
Gulf	-3.20 (-3.75)	2.40 (4.93)	.94
FPC	-4.54 (-5.90)	2.85 (19.66)	.96
FP&L	-1.82 (-1.27)	2.47 (9.18)	.85
TECO	0.33 (.46)	1.86 (13.77)	.93

where Y = production O&M expenses and

X = CPI - Total inflation figure.

Table 5
Regression Equations for Florida Firms
(1970-1986)

Nonproduction O&M Model (T ratio)

$\log Y = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2$

	α	β_1	β_2	R^2
Gulf	-11.20 (-6.23)	1.44 (14.70)	1.11 (5.87)	.998
FPC	-2.99 (-.73)	.50 (1.23)	1.39 (5.31)	.987
FP&L	-11.20 (-6.23)	1.11 (5.87)	1.44 (14.70)	.988
TECO	-14.05 (-2.22)	1.47 (2.27)	1.13 (3.22)	.987

where Y = Production O&M expenses;

X_1 = CPI - Total inflation figure; and

X_2 = Average number of customers served.

Regulators cannot wait for others to design optimal schemes for encouraging cost-containment. Perfection will be achieved neither by current regulatory arrangements nor by new incentive programs. However, we would like to be able to avoid the more obvious limitations of traditional regulation. Since adoption of alternative mechanisms could result in greater incentives for cost minimization, such programs should be given some priority by both utilities and commissions. Regulation need not be a zero-sum game: customers can obtain lower prices and utilities can receive higher profits if incentives for efficiency gains yield lower costs.

Bibliography

Martin L. Boughman and Drew J. Bottaro, "Electric Power Transmission and Distribution Systems: Costs and Their Allocation," *IEEE Transactions on Power Apparatus and Systems*, May/June 1976, 782-790.

Paul L. Chernick, "Power Plant Performance Standards: Some Introductory Principles," *Public Utilities Fortnightly*, April 18, 1985, 29-33.

Dennis Goins, "Can Incentive Regulation Improve Utility Performance? The Inherent Danger of a Simple Answer," *Public Utilities Fortnightly*, January 10, 1985, 20-23.

Valentine Okonkwo, *Operation and Maintenance Indexing*, Tallahassee, Florida: Florida Public Service Commission, April 1986.

Richard Schmalensee, *The Control of Natural Monopolies, Lexington Books, 1979.*

Mark Smith, "Report to New York Public Service Commission, Office of Research," 1985.

Appendix 1

(a) Computing The Benchmark For Production O&M

The current O&M benchmark methodology used by the Florida Public Service Commission (FPSC) treats non-fuel production O&M separate from all other O&M accounts. A base-level production O&M amount is derived from a historic 12 month period. This production O&M excludes all fuel accounts, Purchased Power, and Environmental Conservation Cost Recovery. Data were not available on Environmental Conservation Cost Recovery (ECCR) expenses. The base-level for production O&M is multiplied by the compound inflation rate over the period between the base-year and the test-year. The inflation rate is measured by the CPI-Total. The compound rate can be derived by taking the yearly inflation rates, adding 1 to each, and multiplying them together. Alternatively the compound inflation rate can be calculated by taking the CPI index during the test-year and dividing by the CPI index during the base-year.

Justification of new production facilities for inclusion in the rate-base is handled by separate testimony and review during a rate-case. If the production facility is deemed necessary, and included in the rate-base, corresponding O&M expenses are included. It is believed that, excluding these jumps in O&M, prudent management should be able to justify all increases in O&M above the CPI rate of inflation. The results of the study point towards major discrepancies with this approach.

(b) Computing The Benchmark For All Other O&M

The FPSC takes the summation of Transmission O&M, Distribution O&M, Customer Accounting expenses, Customer Services and Informational expenses, Sales expenses, and Administrative & General expenses (A&G); and multiplies this total (labeled here as OTHER O&M) by a compound factor that is composed of compound inflation and compound customer growth for the period between the base-year and the test-year. This index is computed by multiplying the inflation factor used in the escalation of production O&M, by the compound growth factor. The growth factor is derived by multiplying 1 plus the percent change in the Average Number Of Customers Per Month (% change between Number For Year, and Number For Previous Year,-- FERC Form No. 1 page 301, line 10.) for all years between the base and the test-year. Alternatively, this index can be computed by taking the product of the two quotients, test-year CPI/base-year CPI, and test-year Average Number Of Customers Per Month/base-year Average Number Of Customers Per Month.

Appendix 2
Errors As a Percent of Actual 1986 O&M
By Catagory (based on 1979 Base-year amounts/and compound inflation
or compound inflation plus customer growth)

	production	transmis-sion	distrib-ution	Accounting	Service & Info.	Sales	Administrative & General	TOTAL
Alabama Pr	40.01%	44.70%	37.08%	40.25%	88.42%	-0.2460	0.3405	0.3960
Appal Pwr	23.10%	38.67%	14.85%	4.64%	58.18%		0.1268	0.1825
Ark Pwr&lt	158.84%	10.12%	-0.13%	7.91%	-84.64%	1.0000	0.2325	0.1422
Balt G&E	84.77%	-37.42%	1.13%	8.77%	19.72%		0.2642	0.1411
CP&L	52.97%	15.41%	19.12%	20.35%	40.32%	0.2160	0.2977	0.2517
CTRL LA EL	26.83%	41.80%	14.83%	38.10%	-66.76%	-97.8160	0.2407	0.2249
DUKE	56.82%	16.25%	15.06%	14.15%	53.95%		0.3653	0.2756
FLA POWER	40.44%	-3.31%	-17.09%	-7.34%	90.02%	0.9470	0.1971	0.1901
FLA PUB UTIL	608.56%	47.46%	-6.44%	-6.09%	90.88%	-4.8229	0.2645	0.0868
FLA PWR&LT	57.29%	21.17%	8.18%	2.11%	73.43%		0.1722	0.1779
GA POWER	32.59%	34.75%	28.64%	62.08%	82.48%	-2.0324	0.2423	0.3635
GULF POWER	34.04%	29.57%	13.60%	20.52%	11.81%	1.0000	0.1644	0.1904
GULF STATE	39.00%	-13.51%	-0.66%	19.40%	-14.44%	0.9045	0.4982	0.2982
KINGSPORT	34.08%	18.94%	20.27%	8.05%	17.69%	1.0000	0.1085	0.1531
LA PWR&LT	115.35%	41.04%	0.53%	22.59%	-31.93%	-1.4064	0.5774	0.4218
MISS POWER	10.02%	12.45%	26.80%	55.92%	47.76%	0.6772	0.5462	0.4892
MISS PR&LT	17.44%	25.41%	3.66%	6.13%	-19.93%	0.5361	-0.0727	0.0209
NANTAHALA	-45.10%	31.38%	-7.47%	-15.82%	2.59%		-0.0508	-0.0538
NEW ORLEANS PS	112.72%	-27.85%	-27.17%	9.19%	-15.68%	-6.9975	0.5326	0.2638
POTOMAC ED	-77.08%	-18.99%	-0.81%	-18.64%	22.41%		0.0912	0.0017
POTOMAC EP	9.79%	-15.25%	-19.01%	-21.18%	44.63%	0.6088	0.2402	0.0454
SAVANNAH	16.01%	65.85%	51.65%	25.45%	73.87%	0.2904	0.4605	0.4575
SCE&G	55.96%	17.13%	16.39%	5.12%	32.22%	-0.0523	0.5297	0.3798
TAMPA ELEC	35.92%	0.05%	3.27%	15.14%	87.27%	0.6197	0.2541	0.2812
VEPCO	81.78%	31.26%	10.13%	-12.01%	19.58%		0.3142	0.1883
Mean	0.649	0.171	0.083	0.122	0.290	-5.865	0.278	0.223
Variance	1.448	0.063	0.030	0.043	0.228	501.861	0.030	0.020
Std Deviation	1.203	0.251	0.173	0.208	0.477	22.402	0.172	0.141

Appendix 3
Factors Affecting O&M Expenditures

Seasonality and Accounting Practices. Yearly O&M expenditures vary due to the nature of the expenses, the time lags between the performance/expensing of O&M and, managerial actions to cut O&M in order to maintain returns.

Large ticket O&M expenses, like turbine and boiler overhaul, have substantial impact on a single year's production O&M expenditures. Likewise, line rentals, tree trimming, or other non-production O&M expenditures fluctuate between years causing substantial variations in the other O&M accounts. Unavoidable variations of these types as well as major projects coming on line during the time between base-year and test-year, affect the outcome of any indexing methodology. The amount unjustified by an index approach would be significantly greater if the index was applied to a leaner O&M base.

Another problem exists when the choice of one twelve month base over another reflects O&M incurred but not expensed during that period, or vice-versa. The impact of accounting lags effect the level of O&M expenses as do the variations in the expenses themselves.

Compensated with incentive packages for maximizing shareholders wealth, executives may opt to delay some O&M expenses if returns have declined too much. The impact of a previous revenue decline is thus compounded for the future.

Net Generation. Net generation does not directly coincide with increases in numbers of customers served. But, the level of generation affects O&M requirements. Problems arose when companies were net sellers of electricity (off-system). The separation of O&M cost between the general consumer and the buyers of off-system power becomes difficult. Power is sold off system when demand is low and there is excess generation capacity -- when marginal cost are low, thus compounding this problem.

Classification of Customers. A level of mix of customers impacts O&M. Residential customers are more expensive to serve per MWH due to dispersion, hook-up cost, and distribution capital necessary to provide electric services. Most large industrial customers: require one set of transmission lines entering the plant, are geographically centered, and are not as transient as the residential customer. Military, student, and seasonal customers within a service area cause hook-up / disconnections to rise.

Geographic Characteristics. O&M on a per customer basis is higher if the service area is sparsely populated. This is not reflected in the average number of customer factor of the current index. The cost of servicing the lines, sub-stations, production facilities, as well as the cost of meter reading, reflect the geographic and demographic conditions of the service area.

Nuclear Power Generation and Environmental Concerns. Subsequent to the Three Mile Island accident, the Federal Nuclear Commission (FNC) increased safety and personnel requirements for all nuclear facilities.

In addition to nuclear safety regulations, environmental concerns have increased pollution control requirements causing O&M to increases faster than inflation. The cost of clean air and water, as a public good, should be borne by the users of electricity since profits to utilities are regulated by the Commission.

Other Factors. O&M associated with maintaining older plants (as well as numerous other variables) has been researched in a study presented to the N.Y. Public Service commission (See Appendix A, of report by Marc Smith, NY Public Service Commission, Office of Research). This study concludes the average age of plant investment has a statistically significant impact on O&M expenses. The impact of aging equipment was also brought out by W.H. Brunetti in testimony given at FP&L's 1984 rate case. Not only will the environmental impact of older plants be greater, but the corresponding O&M required for the previous level of service will rise. Average age of poles, car fleets and substations (to name just a few items effected by age) determines how much O&M is required regardless of what the inflation index predicts.