An Evaluation of Incentive Regulation

for Electric Utilities

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Abstract

This empirical study examines the determinants and impacts of incentive regulations introduced by utility commissions in the late '70s and early '80s. Rewards for generating plant utilization and low heat rates were found to have been introduced in states whose firms exhibited relatively high managerial slack (or relatively higher costs). However, the empirical results did not find that the introduction of specific cost component incentives improved overall operating cost performance.

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I. INTRODUCTION

In recent years, a number of state regulatory commissions have established "incentive regulation" programs, to promote efficiency in electricity production. Unlike proposed price-cap regulations which provide firms with a comprehensive incentive to control costs, these narrow incentive payment programs condition financial rewards or penalties upon a specific measure of a utility's performance. A program included in our data base is defined by the Edison Electric Institute (1987) as one which "(i) is intended to improve regulated utilities' performance, (ii) evaluates utility performance against specific, pre-defined standards, (iii) provides incentives (rewards) or disincentives (punishments), depending on the utility's performance in relation to applicable standards," (p. 11).

These incentive payment programs take many forms and focus on different operating statistics: they reward utilities which experience high levels of base load generating unit utilization and availability, low heat rates (reflecting the efficient transformation of fuel into electricity), and keep fuel and purchased power costs below externally-determined indices. For example, the State of Florida adopted an incentive regulation entitled "Generating Performance Incentive Factor (GPIF)" in 1980.[1] The GPIF program sets the targets for many indicators including average heat rates, fuel expenses, and past performance records etc. by complex formulas estimated by several computer simulations of the utility system's economic dispatch. Rewards and penalties are imposed by comparing actual performance with pre-set targets. Since we focus on an *ex ante* decoupling of prices from cost components, *ex post* prudence/efficiency reviews and management audits are excluded from the programs examined here.

While the theoretical rationale for introducing incentive regulations is described elsewhere,[2] the

[1] For details, see Edison Electricity Institute (1987).

[2] For example, see Joskow and Schmalensee (1986) or Johnson (1985).

effectiveness of incentive regulation has not been empirically tested. The purpose of this note is to identify the determinants of regulatory initiatives in this area and to test the effectiveness of incentive payment regulations in lowering electricity production costs. The questions asked in this paper include:

1) What are the determinants of states adopting incentive regulations?

2) Did these incentive regulations accomplish their goal?

II. DATA

Annual data for 1973 - 1985 were collected from two sources: the Utility Compustat tape and the Edison Electricity Institute's *Incentive Regulation in the Electric Utility Industry - A Review of Commission Programs* (1987). Although the overall sample included 53 utility companies for a 15 year period (795 potential observations), due to the missing data for some years, only 490 observations were actually available for estimation in a pooled data set. The firms in the data set are listed in Table 1. Some descriptive statistics are reported in Table 2. Dropping the 14 firms with the most missing observations entirely from the sample did not materially affect the results, so we report the results for 53 firms.

III. THE DETERMINANTS OF INCENTIVE REGULATION: UTILITY PERFORMANCE

The first issue to be addressed when evaluating incentive payment regulations for electric utilities is the appropriate measure of utility performance. The actual measures which state commissions are using vary, so a unique index is impossible to obtain.[3] Two proxies for utility performance have been utilized here: management slack and generation heat rate.

Selten (1986) and Abdel-khalik (1988) propose 'management slack' as an efficiency measure of

[3] For details, see Edison Electricity Institute (1987).

utility's performance, defined as

$$S_i \equiv (C_i - C_i^*)/C_i \tag{1}$$

where S_i is the managerial slack of firm i, C_i is log operating cost of firm i, and C_i^* is the predicted value of log operating cost for firm i. S_i is the relative deviation of that firm's operating cost from industry-wide average operating cost (at that output level). High S_i would indicate that the firm's performance is relatively inefficient, if all firms faced the same input prices and had available the same technologies. Since a firm's generation mix at a given point of time depends on past and projected demand growth and input price projections, operating costs can differ for reasons other than managerial slack. However, we expect utility commissioners to compare costs of firms they regulate with those of comparable firms. Relatively high costs will trigger regulatory innovations (Joskow, 1974).

Also, the heat rate, defined as the energy input in BTU used for 1 kwh electric generation, has been widely used as a measure of operating efficiency.[4] Higher heat rate has been interpreted as inefficient performance. Of course, heat rates will differ across firms due to many factors, including average age of generating units (reflecting technological differences and historical demand growth patterns), generating mix (base load vs. peaking capacity -- where the mix depends on seasonal and daily demand patterns), and environmental regulations in place when capacity investments were made. Thus, heat rates may not be a good proxy for relative efficiency.

Besides these proxies for utilities' performance, other variables can affect commissions' decisions on the adoption of incentive regulations. First, we need to determine whether a commission's adoption of incentive regulations depends on the firm's managerial slack or on heat rates, or both.

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[4] For example, Abdel-khalik (1988) and Landon (1985).

To test which one is the better proxy, the following Probit MLE model is estimated.

$$I_i = \alpha_0 + \alpha_1 S_i + \alpha_2 H_i + \alpha_3 MAR_i + \alpha_4 LOADF + \alpha_5 GEN_i + U_i \tag{2}$$

where, I_i = 1 when firm i is regulated by an incentive program

= 0 when firm i is not regulated by an incentive program

S_i = the managerial slack of firm i (based on three years)

H_i = the heat rate of firm i

$MAR_i \equiv$ (Total Revenue - Total Cost) / Total Cost

= firm i's margin

LOADF $\equiv$ total generation / (system capacity * 8760)

= the load factor of firm i

GEN_i = log of total generation of firm i.

A problem in the estimation of equation (2) is the endogeneity of S_i. S_i is endogenous in the sense that the adoption of incentive regulations will affect utilities' managerial slack. To avoid the endogeneity bias, observations are deleted in the following cases:[5]

1) For incentive-regulated firms, data are used only for the three years preceding incentive regulation. For example, if incentive regulation starts in 1980, the firm's annual data for 1978, 1979 and 1980 are used. The firm is dropped from the sample in 1981 and beyond.

2) For non-incentive regulated firms, data after 1980 are deleted for estimating equation (2) since incentive regulation lowered industry average cost--so that the non-regulated firms will have higher measured managerial slack. 1980 is chosen because it is the mean of the starting

[5] The remaining sample contains 156 observations.

year for payment incentive regulations. Note that non-incentive regulated firms are included in the sample for the estimation of the operating cost equation.

The variables MAR, LOADF and GEN are included in equation (2) since other factors can also trigger institutional innovations. We postulate that commissions will tend to adopt incentive regulations if the electric utility has high prices relative to costs. In our model, higher margin does not necessarily mean high cost of inefficiency because the margin is defined as "(revenue/cost) - 1" and the average revenue varies more than the average cost in our data set. Thus, the margin is more affected by the price (as approximated by average revenue) than the average cost (efficiency).[6] Rate hearings can take a very long time to lower prices, while the introduction of an incentive which targets generating unit availability or heat rates can occur relatively quickly. The incentive regulation can provide a mechanism for sharing further cost savings as well as for penalizing inefficiency.

Also, if a utility already has a high load factor, there is less opportunity for cost savings via rate design changes which induce alterations in consumption patterns. Regulators would then press for cost reductions via explicit incentive programs. In addition, we hypothesize that a large electric utility (GEN) has greater political visibility. Furthermore, economic savings for large firms will be greater for equal percentage cost reductions. So we expect the signs on all three variables to be positive. As noted earlier, the expected signs of α_1 and α_2 are also positive.

The slack index, S_i (defined in equation 1) is obtained from the following operating cost function.

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[6] A reviewer noted that regulators might impose incentive payment regulation on firms with higher costs and low profits -- in order to provide an incentive for cost reduction and an opportunity for increasing the realized return on rate base. Thus, incentive regulation could be a disequilibrium phenomenon related to the change in a firm's managerial slack relative to the industry average or to a change in the margin (holding all other factors constant). In such a situation, a continuing level of slack represents an improvement over what might have been a deteriorating trend. We interpret intervention as an equilibrium phenomenon, so relatively higher price-cost margins tends to trigger regulatory intervention. We did not investigate the impacts of changes in the explanatory variables.

$$C_i = \beta_0 + \beta_1 GEN_i + \beta_2 GEN^2 + \beta_3 GEN^3 + \beta_4 RESCAP_i + \beta_5 LOADF_i$$
$$+ \beta_6 HYR_i + \beta_7 NUCR_i + \beta_7 YEAR_i + V_i \tag{3}$$

where, C_i = log of the operating cost for firm i

$RESCAP_i$ = the reserve capacity of firm i

$\equiv$ (System Capacity - Peak Demand) / System Capacity

HYR_i = log of the percentage of electricity produced by hydroelectric generation

$NUCR_i$ = log of the percentage of electricity produced by nuclear plants

$YEAR_i$ = time variable (year), 1973-85

The estimated parameters for the scale (GEN) variables will indicate the shape of the cost function -- the extent of scale economies. High RESCAP can be interpreted as reflecting a disequilibrium capacity situation--both level and mix. During this period, most electric utilities had forecasted substantial demand growth. When forecasts were not realized, firms were left with excessive reserve margins. Hydro (HYR) and nuclear (NUCR) ought to be associated with lower operating costs. The year was included to capture upward shifts in the cost function -- reflecting wage inflation, rising fuel costs, and environmental expenses occurring during the second half of the sample period.

The results of the cost function (3) are as follows:

$$C_i = \underset{(5.85)^{**}}{17.22} - \underset{(-5.35)^{**}}{5.59\ GEN_i} + \underset{(5.58)^{**}}{0.68\ GEN_i^2} - \underset{(-5.19)^{**}}{0.02\ GEN_i^3} + \underset{(1.80)}{0.41\ RESCAP_i}$$
$$+ \underset{(1.26)}{0.32\ LOADF_i} + \underset{(0.938)}{0.009\ HYR_i} - \underset{(-4.80)^{**}}{0.02\ NUCR_i} + \underset{(19.86)^{**}}{0.09\ YEAR_i} + V_i \tag{4}$$

Adj. $R^2 = 0.81$ $\qquad$ $F = 254.76$ **

where the numbers in parenthesis are t-values and * (**) indicates the coefficient is significant at 5% (1%) level. In (4), all the significant coefficients have expected signs and the model has good explanatory power (adjusted R-squared is relatively high). Unless the model is seriously misspecified, alternative specifications are not likely to affect our results.[7]

Using S_i obtained from (4), the results obtained for equation (2) are the following:

$$\begin{aligned} I_i = - \underset{(-1.14)}{2.84} + \underset{(2.42)^{*}}{277.10\, S_i} - \underset{(-1.11)}{0.14\, H_i} + \underset{(2.85)^{**}}{1.14\, MAR_i} + \underset{(3.52)^{**}}{9.39\, LOADF_i} \\ - \underset{(-1.72)}{0.27\, GEN_i} + U_i \end{aligned} \tag{5}$$

LR (Likelihood Ratio) = 20.034**
Correct Prediction = 114/156 = 73.1 %

Equation (5) implies that state commissions adopt incentive regulation programs when the utilities under their supervision exhibit high managerial slack. The other relevant variables have the expected signs except GEN_i although it is not significant. The insignificant coefficient on GEN_i indicates the size of electric utilities is not a key factor in the decision to introduce incentive regulations.

In (5), the managerial slack is the better proxy for utilities' performance than heat rate. So, S_i will be used as a proxy for electric utilities' performance in further estimation. Is the slack a proxy for performance or a predictor of commissions' decision? In the analysis, commissions are assumed to be efficient. In other words, they can precisely evaluate their utilities' performance. This assumption is unavoidable in this kind of empirical study because the utilities' performances are not

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[7] To compare our results with other cost estimates, we re-estimated (4) without the cubic term. Explanatory power drops, but the results are similar to those obtained by Atkinson and Halvorsen (1986). The re-calculation of S_i from this alternative specification does not change our conclusions.

directly measurable. With this assumption, a good predictor of commissions' decision is, at the same time, a good proxy for utilities' performance.

IV. EFFECTIVENESS OF INCENTIVE REGULATIONS

The second question in evaluating incentive regulations is whether or not they have been successful. To test if the cost component incentive regulation programs have achieved their goals, an ordinary dummy test can be conducted using the following equation.

$$S_i = \gamma_0 + \gamma_1 D_i + \gamma_2 MAR_i + \gamma_3 LOADF_i + \gamma_4 RESCAP_i + \gamma_5 GEN_i + E_i \qquad (6)$$

where $D_i = 1$ if the firm is under an incentive regulation

$D_i = 0$ if the firm is not under an incentive regulation.

All the sample years are utilized in this test.

The parameter of interest is γ_1 in equation (6). If γ_1 is significantly negative, the adoption of narrow incentive regulations has reduced the level of the utilities' slack. Thus, the hypothesis is $H_0{:}\gamma_1{=}0$ vs. $H_1{:}\gamma_1{<}0$.

However, the equation (6) cannot be estimated by OLS since D_i is an endogenous variable. D_i is endogenous in the sense that the adoption of an incentive regulation depends on the level of the managerial slack of the electric utilities. To obtain consistent estimators, the following simultaneous equations model is considered.

$$S_i = \gamma_0 + \gamma_1 D_i + \gamma_2 MAR_i + \gamma_3 LOADF_i + \gamma_4 RESCAP_i + \gamma_5 GEN_i + E_i \qquad (6)$$

$$D_i = \delta_0 + \delta_1 S_i + \delta_2 HEAT_i + \delta_3 MAR_i + \delta_4 LOADF_i + \delta_5 GEN_i + W_i \qquad (7)$$

where E_i and W_i are bivariate-normal and are independent of all the exogenous variables. This simultaneous equations system can be called a "limited dependent simultaneous equation system" since the dependent variable in the second equation is a binary variable. Note that both equations are exactly identified.

Two alternative consistent estimation methods are available for the above simultaneous equations model. First, Maddala and Lee (1976) and Barnow et al. (1980) suggest the following two-step estimation procedures. The system (6)-(7) can be rewritten with the reduced form of the equation (7) as (8):

$$S_i = \gamma_0 + \gamma_1 D_i + \gamma_2 MAR_i + \gamma_3 LOADF_i + \gamma_4 RESCAP_i + \gamma_5 GEN_i + E_i \qquad (6)$$

$$D_i = \theta_0 + \theta_1 HEAT_i + \theta_2 MAR_i + \theta_3 LOADF_i + \theta_4 RESCAP_i + \theta_5 GEN_i + \pi_i \qquad (8)$$

Note that E_i and π_i have a bivariate normal distribution.

In the first step, the so-called inverse-Mill's ratio is computed from the equation (8), where the inverse-Mill's ratio is defined as:

$$\lambda_i(\hat{\theta}/\sigma_\pi) \equiv \phi_i(D_i-\Phi_i)/((1-\Phi_i)\Phi_i) \qquad (9)$$

where $\theta' \equiv [\theta_0\ \theta_1\ \dots]$, $\sigma_{\pi 2}$ is the variance of π_i, ϕ is the standard normal density function, and Φ is the standard normal cumulative distribution function.[8] Although the inverse-Mill's ratio contains the unknown parameter $\hat{\theta}/\sigma_\pi$, it can be estimated by the probit MLE of the equation (8). In the second step, consistent estimators for the equation (6) can be obtained by OLS after adding to the equation (6) the inverse-Mill's ratio computed from the equation (8) as an additional regressor.

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[8] For more details, see Maddala (1983) or Barnow et al. (1980). Vella (1989) also gives a general explanation of the use of this kind of generalized errors as an additional regressor.

An alternative consistent estimation proposed by Amemiya (1978), Heckman (1978), and Lee (1979) is the following.[9] First, estimate the equation (8) by probit MLE to obtain the predicted values of D_i, which are the predicted probabilities of the adoption of incentive regulation. Then, use the predicted value as an instrumental variable for D_i in the equation (6) to get consistent estimators for γ_j's. In this study, both estimation methods are used to test $H_0 : \gamma_1 = 0$ vs. $H_1 : \gamma_1 < 0$.

V. ESTIMATION RESULTS

The profit MLE applied to the equation (8) gives the following results:

$$\begin{aligned} D_i = &- \underset{(-3.434)^{**}}{6.4506} - \underset{(-1.315)}{0.1211}\ HEAT_i + \underset{(2.256)^{*}}{0.3877}\ MAR_i + \underset{(3.586)^{**}}{5.7033}\ LOADF_i \\ &+ \underset{(1.840)}{1.5897}\ RESCAP_i + \underset{(2.937)^{**}}{0.2827}\ GEN_i + \pi_i \end{aligned} \tag{10}$$

LR (Likelihood Ratio) = 36.728**
Correct Prediction = 337/409 = 82.4 %

Note that this is the reduced form equation which is used as an intermediate result. Though the structural parameters can be recovered from these reduced-form parameters, it is not necessary to do since the equation of interest is the equation (6).

The two step estimation suggested by Maddala-Lee (1978) and Barnow et al. (1980) results in:

$$\begin{aligned} S_i = &- \underset{(-1.777)}{0.0021} + \underset{(0.022)}{0.00002}\ D_i - \underset{(-13.207)^{**}}{0.0019}\ MAR_i - \underset{(-3.441)^{**}}{0.0039}\ LOADF_i \\ &+ \underset{(-0.033)}{0.00002}\ RESCAP_i + \underset{(6.949)^{**}}{0.0005}\ GEN_i + \underset{(0.392)}{0.0002}\ IMILL_i + E_i \end{aligned} \tag{11}$$

Adj. $R^2 = 0.3781$[10]

[9] The estimation method presented here is a simple version of Amemiya (1978), Heckman (1978), Lee (1979).

[10] Note that the R^2 in the two-step estimation does not have the same implications as in OLS because a 'constructed' variable (inverse mill's ratio) is included in the second stage regression.

The hypothesis $H_0 : \gamma_1=0$ vs. $H_1 : \gamma_1<0$ is not rejected even at 10% significance level in (11). This implies that the incentive regulations during 1973 - 1985 did not achieve the goal of reducing the managerial slack of utility companies. We can also see in (11) that the slack is lower in more profitable (higher margin) utilities, in high load factor utilities, and in smaller utilities. These results seem reasonable. The results indicate that the reserve capacity of the utility does not affect the level of managerial slack. This outcome may arise because slack is defined only in terms of operating costs.

The alternative IV method produces a similar result. The estimated equation is:

$$\begin{aligned} S_i = & -\underset{(-1.038)}{0.0013} + \underset{(0.843)}{0.0008\ D_i} - \underset{(-13.305)^{**}}{0.0020\ MAR_i} - \underset{(-3.387)^{**}}{0.0047\ LOADF_i} \\ & - \underset{(-0.260)}{0.0002\ RESCAP_i} + \underset{(6.148)^{**}}{0.0005\ GEN_i} \end{aligned} \tag{12}$$

Adj. R^2 = 0.3650[11]

The hypothesis H_0 is not rejected with IV method. Most of the parameters have the same sign in both methods with an exception of RESCAP. The significance of explanatory variables are very similar in both methods.

VI. SUMMARY AND CONCLUSIONS

The goal of specific target incentive payment regulations in electric production during 1968-1987 appears to be the reduction of managerial slack. However we did not find that the slack was significantly reduced by narrow incentive regulations. A possible explanation is that by focusing on specific categories or determinants of cost, regulators induce utilities to devote excessive resources to ensuring that a narrow goal is reached--so no net cost savings are realized (Joskow and

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[11] This conventional R^2 does not exactly measure the explained portion of the total variations since D_i is an endogenous variable.

Schmalensee, 1986, p. 38; Berg and Tschirhart, 1988, p. 517-519).

One area for further research is investigating the duration of incentive programs. Some state commissions discontinued their incentive regulation programs after several years. Our simultaneous model only tested whether the existence of a program in that year had an impact -- yet some of these programs were subsequently discontinued. By comparing these discontinued programs with the continuing programs, one can better evaluate the impact of incentive regulations. It would also be instructive to analyze the precise types of regulation in greater detail -- some types may have impacts even if, on average, current incentive regulations fail to have measurable impacts. Similarly, patterns within and across states could be examined. Although these are important questions, it is almost impossible, at this moment, to empirically analyze these issues because of data limitations.

Another direction for research is the introduction of political and administrative factors into the model. For example Nowell and Tschirhart (1990) examined the determinants of state adoption of PURPA, finding that political and interest group strength affect the probability of adopting the cost-of service standard. Such factors could be introduced into the model. In another study of regulation, Mathios and Rogers (1989) examined the impacts of different types of intra-state long distance telephone regulation. They found that price-cap regimes lead to lower prices than rate-of return regulation. However, their reduced form model does not take into account potential similaneity problems regarding the determinants of states adopting different regulatory policies. The present study of electricity regulation attempts to avoid that problem.

Joskow (1974) noted how regulatory innovations were introduced during economic dislocations (the advent of inflation and new environmental laws). Similarly, we can identify early incentive regulations as stemming from concerns with managerial slack. Our inability to find an impact of cost component regulation suggests that either the factors affecting performance are not adequately captured in our model specification, or that this particular type of regulatory innovation has failed to achieve its goal of increased efficiency. If incentive regulation is to be adopted, more comprehensive schemes (such as price caps) might warrant greater attention.

Table 1
Organizations in the data set

CUSIP	COMPANY	PERIOD OF INCENTIVE REG.
25537	American Electric Power	74 - present*
40555	Arizona Public Service Co.	84 - present
41033	Arkansas Power and Light	81 - present
125896	CMS Energy Corp.	N/A**
144141	Carolina Power and Light	78 - 81
152357	Central and South West Corp.	N/A
154051	Central Maine Power Co.	N/A
155033	Central Power and Light	N/A
155771	Central Vermont Pub. Service	N/A
202795	Commonwealth Edison	N/A
207597	Connecticut Light and Power	79 - present
210615	Consumers Power Co.	78 - 83
257470	Dominion Resources Inc-VA	N/A
264399	Duke Power Co.	78 - 81
277173	Eastern Utilities Assoc.	81 - present
370550	General Public Utilities	N/A
449495	I.E. Industries Inc.	N/A
452092	Illinois Power Co.	N/A
462416	Iowa Electric Light and Power	N/A
462470	Iowa-Illinois Gas and Elec.	N/A
462524	Iowa Public Service Co.	N/A
542671	Long Island Lighting	N/A
591894	Metropolitan Edison	80 - present
595832	Middle South Utilities	N/A
598319	Midwest Energy Co.	N/A
629140	Nipsco Industries Inc.	N/A
644001	New England Electric System	81 - present
644188	New England Power	81 - present
653522	Niagara Mohawk Power	82 - present
664397	Northeast Utilities	81 - present
665772	Northern States Power-MN	N/A
694308	Pacific Gas and Electric	83 - present
695114	Pacificorp	N/A
708696	Pennsylvania Electric Co.	80 - present
709051	Pennsylvania Power and Light	80 - present
717537	Philadelphia Electric Co.	85 - present

* 'present' means 1987.
** N/A: no incentive regulation

Table 1 (continued)

CUSIP	COMPANY	PERIOD OF INCENTIVE REG.
723484	Pinnacle West Capital Corp.	N/A
736506	Portland General Corp.	N/A
736508	Portland General Electric Co.	80 - present
744482	Public Service Co. of N. H.	82 - present
771367	Rochester Gas and Electric	83 - present
805898	Scana Corp.	N/A
837004	South Carolina Elec. & Gas Co.	N/A
842400	Southern Calif. Edison Co.	81 - present
842587	Southern Co.	N/A
880591	Tennessee Valley Authority	N/A
906548	Union Electric Co.	N/A
927804	Virginia Elec. and Power Co.	N/A
929305	WPL Holdings Inc.	N/A
958587	Western Massachusetts El. Co.	81 - present
976656	Wisconsin Electric Power Co.	N/A
976657	Wisconsin Energy Corp.	N/A
976843	Wisconsin Public Service	N/A

* 'present' means 1987.
** N/A: no incentive regulation

Table 2
Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std Dev
TOTCOST	490	48.3390	5248.11	816.9042	758.9922
TOTREV	490	67.9790	7010.36	1334.54	1304.68
LOADF	490	1E-6	0.7489999	0.5919634	0.0922528
SYSCAP	490	458.0000	31140.01	7292.27	6333.17
TOTGEN	490	149.3470	127891.00	25369.40	25117.93
FUELC	479	1.2800	2385.81	386.1040	440.1368
AVGCOST	435	0.3220	5.6910	1.4116322	0.7365138
HYDRO	483	2.4180	21709.91	1530.95	3004.02
NUCLEAR	461	1.4210	45943.21	6730.32	7195.56
PEAK	490	389.7000	22739.20	5777.99	5117.12
MARGIN	490	-0.3728167	2.2972386	0.6528850	0.5285379
SLACK	490	-0.0221175	0.0039609	-0.000382883	0.0016818
RESCAP	490	-0.3975024	0.4245142	0.2153656	0.0865336
HEAT	427	3.0113734	13.2471452	10.6502513	0.8431240

TOTCOST:	total operating cost (millions of $)
TOTREV:	total revenue (millions of $)
LOADF:	load factor = total generation / (system capacity*8760)
SYSCAP:	system capability (thousands of KW)
TOTGEN:	total electric generation (millions of KWH)
FUELC:	fuel cost (millions of $)
AVGCOST:	average cost per million BTU
HYDRO:	electric generation from hydro (millions of KWH)
NUCLEAR:	electric generation from nuclear (millions of KWH)
PEAK:	peak demand (thousands of KW)
MARGIN:	margin = (total revenue - total cost) / total cost
SLACK:	managerial slack (defined in Section III)
RESCAP:	reserve capacity = (system capability - peak demand) / system capability
HEAT:	heat rate = energy input measured in BTU / total electric generation

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