

X marks the spot: how performance-based ratemaking (PBR) affected returns to wirescos in the UK

Returns to UK RECs have been resilient, despite substantial price cuts, stringent efficiency targets, and the windfall profits tax

June 2001



The introduction of performance-based ratemaking (PBR) in the UK and elsewhere sparked a dramatic change in how distribution utilities were run and regulated. PBR was imposed concurrent with the divestiture of the regional electricity distribution companies (RECs) in the UK. Instead of the traditional cost-of-service methodology, in which utility revenues were directly linked to actual costs, the form of PBR adopted in the UK allowed for rates to increase by inflation minus an efficiency, or X, factor. This X factor was set periodically by the regulator in conjunction with expert studies on the level of efficiencies that were achievable and on the relative efficiencies of similarly situated firms. The result has been to allow those firms which were able to beat the X factor in terms of efficiency gains to retain some of the savings until the next distribution price review, absent windfall profits taxes or other occurrences.

PBR in the UK is now entering its third “generation,” or regulatory period. Due to the sharpened incentives of PBR relative to cost-of-service regulation, the UK has seen a substantial improvement in electricity distribution productivity. Whereas electricity distribution sector productivity in the US has languished at 1.2% per annum, and few jurisdictions have exceeded productivity gains of 2% per year, the UK has seen annual gains of 3.5%. The price cap form of PBR, incorporating an X factor, is being adopted in an increasing number of regions, from the Netherlands to Canada. UK experience suggests that companies which adapt well to the regime can continue to make robust profits in the face of seemingly high initial round price cuts. However, those companies which are not prepared can face challenging times.

Brief history of UK wires businesses

The 12 RECs were carved out of the Central Electricity Generating Board and privatized in 1990. Since then, the industry has gone through a series of changes. Strong profitability, coupled with the expiration of the government’s “golden share,” or veto power, fueled a series of acquisitions of RECs. Record profits, in turn, triggered more aggressive efficiency targets and ultimately a windfall profits tax. As UK markets opened to full retail competition, many RECs chose to exit the low margin retail business, leading to a consolidation of retailers. The UK is one of the few jurisdictions to also have instituted competitive meter reading; some RECs have withdrawn from this business as well. In contrast, almost from their inception, many of the RECs showed an interest in vertical integration, participating in independent power projects (IPPs) and purchasing divested plant from the two major divested generating companies, PowerGen and National Power, now known as Innogy. In turn, both gencos have now purchased a REC.

Figure 1. Distribution service areas in the UK

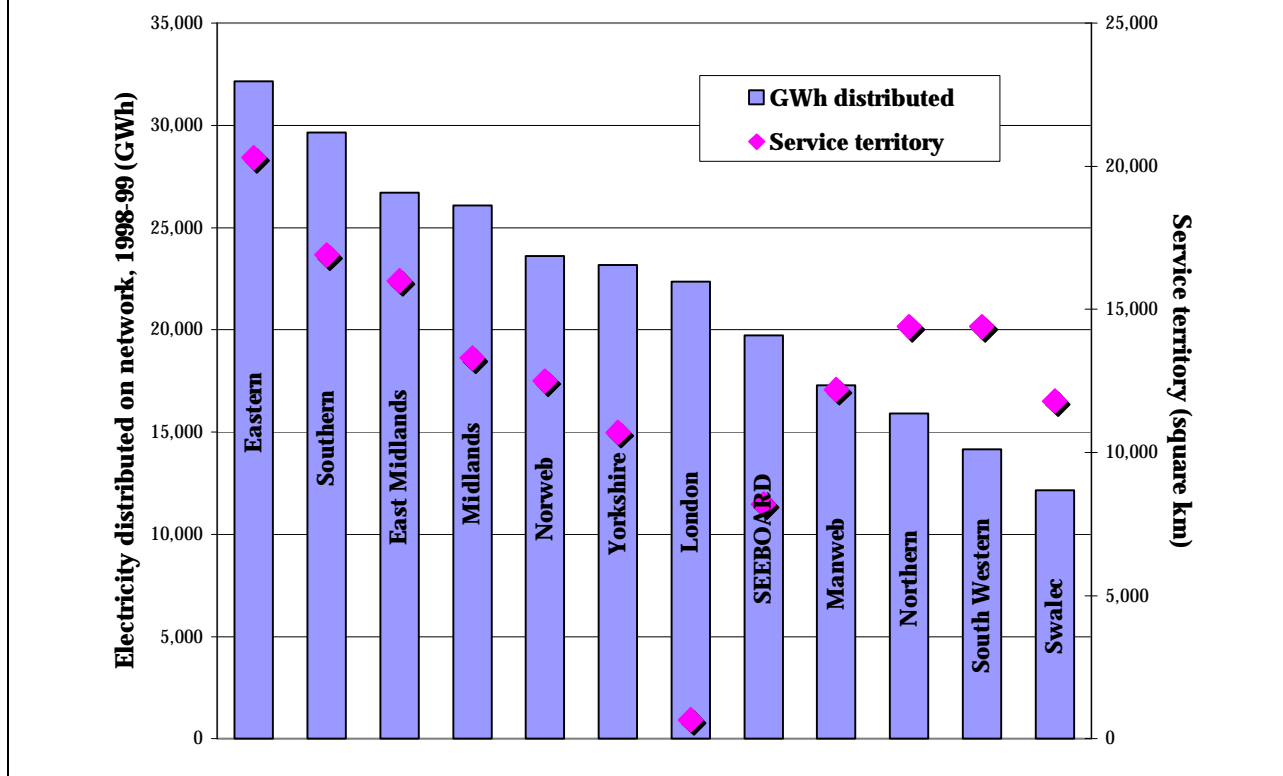


Figure 2 and Figure 3 below provide a high-level overview of the distribution systems operated by the RECs today, including general statistics on each REC's network. Eastern Electricity (today known as TXU Europe) owns the largest network and operates in the largest service territory, while Swalec (located in Wales, and now combined with South Western under the name Western Power Distribution) distributes the least amount of electricity. With the exception of London Electricity, whose territory is confined to the capital city and thus has the highest customer density, the service areas of the RECs are reasonably similar in geographic expanse.

Figure 2. Summary characteristics

		Eastern	Southern	East Midlands	Midlands	Norweb	Yorkshire	London	SEEBOARD	Manweb	Northern	South Western	Swalec
Electricity distributed	(GWh)	32,164	29,637	26,719	26,096	23,625	23,178	22,344	19,726	17,305	15,908	14,174	12,153
Service territory	(sq. km.)	20,300	16,900	16,000	13,300	12,500	10,700	665	8,200	12,200	14,400	14,400	11,800
Customers	(000s)	3,261	2,699	2,415	2,275	2,239	2,061	2,060	2,122	1,432	1,536	1,344	989
Overhead transmission lines	(circuit km)	35,116	27,828	24,049	24,078	13,923	15,817	41	12,266	21,477	17,265	29,277	18,658
Underground transmission lines	(circuit km)	55,168	44,912	44,053	35,758	44,825	39,739	30,261	32,736	23,947	26,861	18,699	14,357
Transformer Capacity	(Mva)	38,643	42,727	33,658	25,111	31,159	30,177	19,469	24,496	17,227	13,266	20,066	12,387

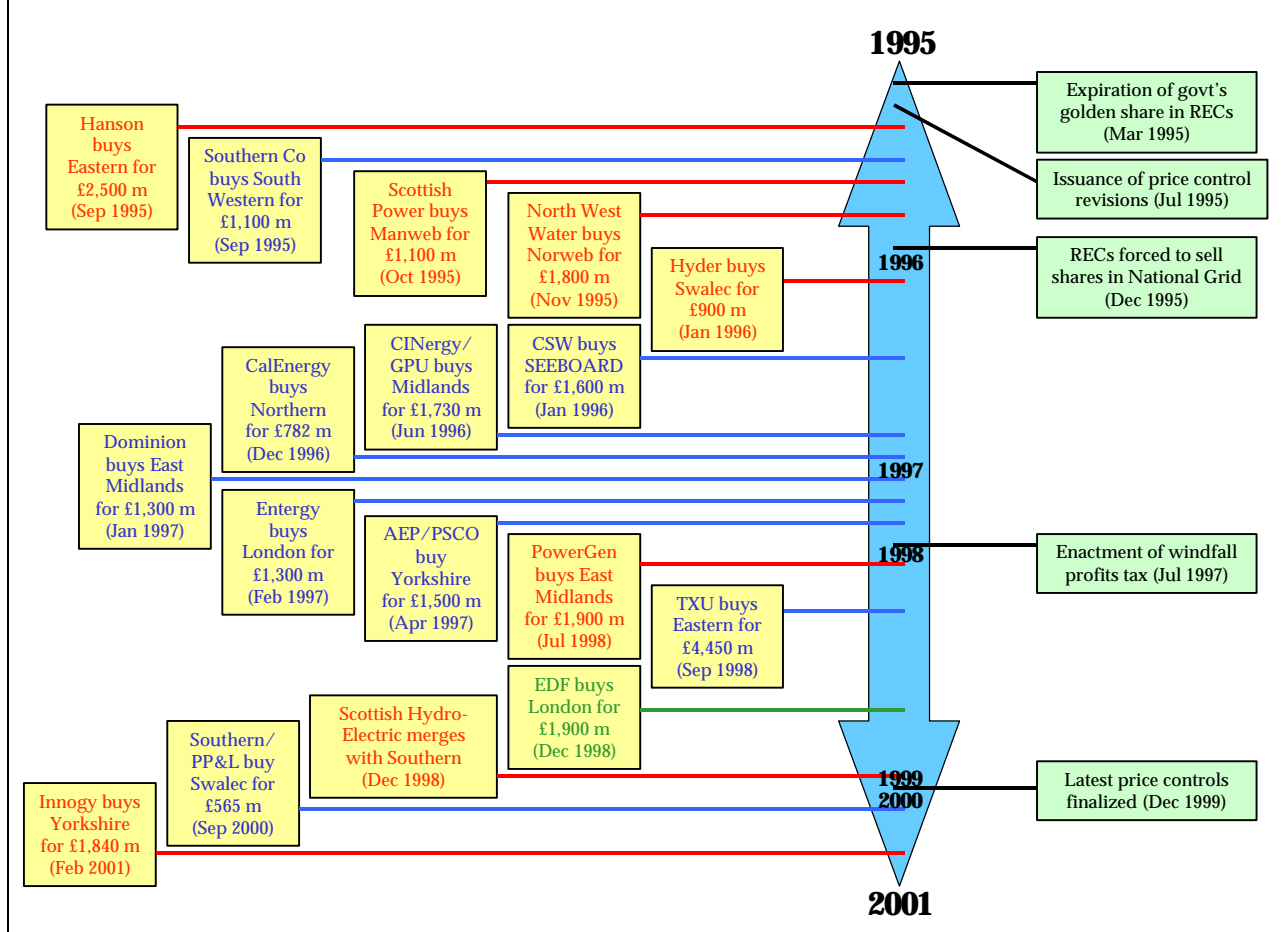
Figure 3. Overview of the RECs' service territories



Within two years of the March 1995 expiration of the golden share, every REC with the exception of Southern Electric had been bought out, and Southern eventually merged with Scottish Hydro-Electric in 1998. Seven of the eleven initial acquirers were US-based utilities. Nearly all the RECs subsequently exchanged hands at least one additional time, and the reshuffling has continued to this day, with E.On's recently proposed merger with PowerGen (parent company to East Midlands Electricity) and AEP's announced intention to sell SEEBOARD.¹

¹ According to analysts, potential suitors for SEEBOARD include Electricite de France, Scottish and Southern Electric, E.On, and Innogy, among others.

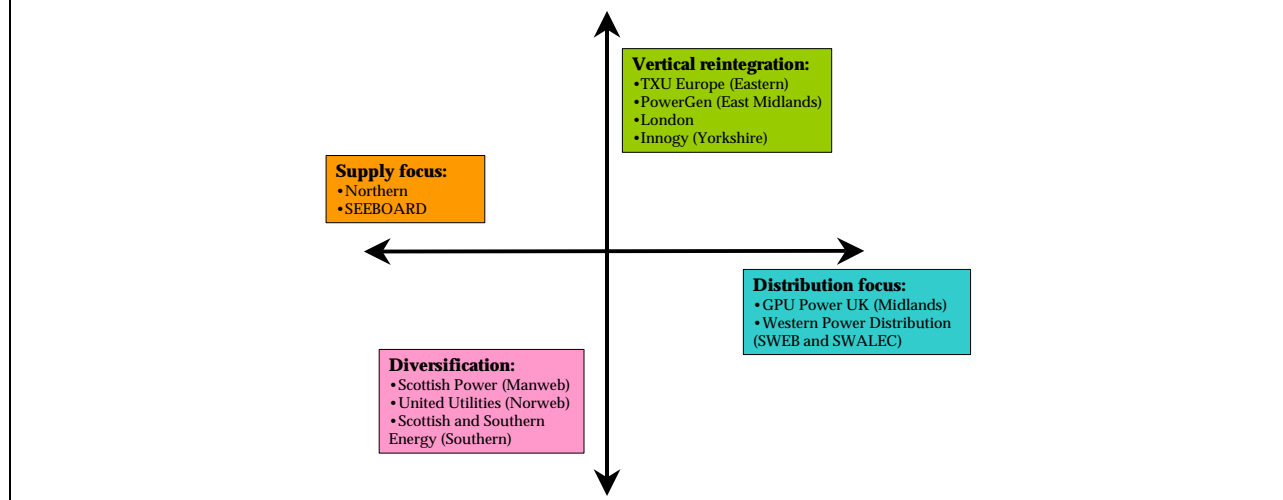
Figure 4. Timing of mergers and acquisitions in relation to key events



The current parent companies of the original distributors are pursuing a variety of strategies, such as horizontal expansion (through merger of distribution entities), re-focusing on the competitive supply business, or re-integrating and acquiring assets all along the value chain (power generation, gas supply, etc.). Others are experimenting with outside industries, such as telecommunications and financial services. Figure 5 provides an indication of the strategies of current players.

PowerGen (parent of East Midlands) and Innogy (parent of Yorkshire) have traditionally been the dominant generation owners in the UK, but their investments in the distribution sector and the supply business (PowerGen controls the supply business that originally belonged to East Midlands, while Innogy owns both Yorkshire's and Midlands' old supply businesses) have transformed them into virtually re-integrated utilities of the bygone era (excluding transmission– NGC is required to remain independent). TXU Europe entered the fray more recently, but its control of Eastern's distribution business, the supply businesses of Eastern and Norweb, and a sizeable generation fleet have established it as the third most influential electricity company in the country.

Figure 5. Indicative business strategies of RECs and their holding companies in the UK



Perhaps the biggest presence in the distribution sphere is Western Power Distribution (owned by PP&L and Southern Co.), which now controls both South Western’s and Swalec’s original distribution arms; this has effectively reduced the number of distribution companies to eleven. Further effective consolidation in the distribution business has resulted from the formation of 24seven, an entity that jointly manages the distribution networks of TXU Europe and London Electricity. Two other distribution companies (Manweb and Southern) have fallen into the hands of Scottish utilities that also own generation and supply interests in both England and Scotland. Another (Norweb) is owned by United Utilities, which has subsidiaries in the telecommunications, water, and energy services sectors. The remainder are owned by overseas firms with more limited interests in the UK market, including London Electricity (Electricite de France), Midlands (GPU), Northern (MidAmerican) and SEEBOARD (AEP). Notably, all foreign investors have an intimate knowledge of the power sector based on their position within their domestic markets.

Figure 6. Current ownership of original REC businesses

Original REC	Owner of distribution business	Owner of supply business	Owner of metering business
Eastern	TXU Europe/ 24seven	TXU Europe	Siemens
East Midlands	PowerGen	PowerGen	Siemens
London	Electricite de France/ 24seven	Electricite de France	Electricite de France
Manweb	Scottish Power	Scottish Power	Scottish Power
Midlands	GPU Power UK	Innogy	GPU Power UK
Northern	MidAmerican	MidAmerican	MidAmerican
Norweb	United Utilities	TXU Europe	United Utilities
SEEBOARD	AEP	AEP	Invensys Control Systems
Southern	Scottish and Southern Energy	Scottish and Southern Energy	Scottish and Southern Energy
Swalec	PP&L/ Southern	Scottish and Southern Energy	Hyder
South Western	PP&L/ Southern	Electricite de France	PP&L/ Southern
Yorkshire	Innogy/ Xcel Energy	Innogy/ Xcel Energy	Innogy/ Xcel Energy

The figure above describes the ownership of the constituent businesses of each original REC, as of January 2001. In all, four of the original supply businesses have been separated from their distribution counterparts: Midlands, Norweb, Swalec, and South Western. Furthermore, now that metering has become fully competitive and service providers are proliferating, three of the distribution companies have elected to sell off their metering units (Eastern, East Midlands, and SEEBOARD). In response to the evolving competitive marketplace, all the distribution companies and their parents have been branching into other industries. With the deregulation of gas supply implemented over the period 1996-98, nearly all the RECs that retained their electricity supply businesses have seized the opportunity to provide bundled gas and electricity service to end-use customers.

What is PBR?

Despite the frequent changes in ownership and strategy, the key revenue driver for RECs continues to be the evolution of PBR. Before examining how PBR has been applied in the UK, let us first explore the concept more generally.

In contrast to the typical cost-maximization objectives of a utility under cost-of-service regulation, PBR aligns the incentives of the utility with those of the regulator and the consumer. Under PBR, the focus shifts from cost accounting to productivity analysis. Structured properly, a PBR regulatory framework will mimic a competitive environment by shifting the firm's objective to profit maximization away from revenue maximization. Moreover, PBR addresses some of the information asymmetry problems faced under cost-of-service regulation. Under PBR, the regulator need not studied detail cost accounts and capital expenditures for each utility. Instead, utility management is left with the freedom to decide how to best optimize its resources, in order to meet the objectives set forth under PBR, such as quality of service targets, productivity gains, and other benchmarks.

A number of regulatory initiatives can be considered PBR. These include bonus schemes for utilities which meet specific targets, sharing bands established around a target ROE, and price and revenue caps. However, it is the latter set of mechanisms which provide the strongest incentives for utilities. Price caps, where prices rise by inflation minus a productivity factor in the form of RPI-X,² appear deceptively simple. Yet, the two explicit parameters, inflation and the productivity factor, are difficult to establish. Mis-specification of these parameters will diminish the effectiveness of the regulatory regime.

The inflation factor should correlate to the price inflation of inputs used by the utility in performing its service: labor cost inflation, materials price inflation, and equipment cost inflation. In many jurisdictions that have implemented incentive-based regulation, the CPI or other general inflation indices have been used. Despite the advantage of being easily accessible, empirical analysis using US data has shown that utility costs are not directly tied to general inflation indices. To the extent that the inflation index used overcompensates for price increases, the benefits which ratepayers should expect from the shift to performance-based rates are reduced. However, regulators have generally concluded that the costs of developing an

² RPI is the UK equivalent of the Consumer Price Index (CPI).

industry-specific inflation measure outweigh any potential benefits, and so have tended to continue using the broader indices.

Setting the X factor can be equally challenging. The X factor is designed to force utilities to meet minimum productivity growth levels, or to earn lower returns than expected. Growth in total factor productivity (TFP) represents the increase in output that is unexplained by the increase in input, equivalently it is the decrease in cost unexplained by changes in input prices. Drivers of productivity include cost gains on the operating side (overhead reductions); optimization between inputs (operating expenditures vs. capital expenditures); and growth in customer base, volume or throughput.

When determining a productivity target or X factor, regulators must predict achievable efficiency gains for the future. Generally, X factors are company-specific based on relative efficiency levels today and expectations for industry-wide productivity gains in the future. The first step in establishing such measures is to look at achieved historical productivity gains and likely future efficiency levels for the specific firm(s) and the industry. In addition to peer group benchmarking, X factors can also be derived using benchmarking techniques based on an hypothetical efficient firm or an “average firm” in the peer group; this form of PBR regulation is also known as yardstick competition. Under this method, the “average” firm will earn the base return, super-performers will earn higher returns, and under-performers will suffer financially.

Many issues can arise when determining productivity targets. Productivity benchmarking via input/output ratio comparison is considered subjective, because the outcome is highly dependent on chosen parameters and topology of peer group. Companies will claim unique circumstances, some of which may be justifiable. Thus, assessment of achievable efficiencies must correct for differing service territory characteristics, including the size of the utility network and number of customers; system geography (above ground or underground cables); population density (urban versus rural customer base); differentiation in customer base (industrial versus residential); and differentiation in customer service usage profile (weather, consumption efficiencies).

Robust mathematical techniques (e.g. frontier analysis using linear programming or econometric analysis) can be used to estimate total factor productivity and the relative efficiency levels of firms while accounting for unique circumstances and considering multiple input parameters (labor, capital, etc.) and multiple outputs (amount of throughput, reliability of service, etc.). Data Envelopment Analysis (DEA) is one of the preferred methods for calculating relative operating efficiencies of companies within a peer group. Under DEA, an “efficiency frontier” for the peer group is calculated; the frontier provides a yardstick against which to judge the comparative performance of all other firms that do not lie on the efficiency frontier. DEA also allows for decomposition of efficiency score into scale efficiency (e.g. the catch-up component) and technical efficiency (e.g. shift in the frontier).

Historically, regulators have generally under-estimated the minimum levels of productivity gains achievable, allowing utilities to earn superior returns over a short period of time. These returns are often subject to “clawbacks” as regulators adjust for previous failures. A clawback occurs when a regulator deems “super” profitability of a utility unacceptable and reclaims these

returns in subsequent review periods by drastically cutting prices or increasing the X factor substantially (on the basis of achieved productivity gains).

Difficulties in specifying productivity targets stem from a typical forecasting problem, which is that all models rely on historical data to some degree. Unfortunately, historical achievements are not necessarily accurate indicators of future achievements. Although sophisticated mathematical techniques can be applied to determining past levels of productivity growth, regulators can only use this information as a guide for setting the X factor. The X factor must take into account the levels of productivity which are achievable, the speed with which it can be achieved, the extent to which setting the X factor too high will result in immediate financial distress to utilities, and the potential for a political backlash if the X factor is set too low and results in increased profits without meaningful declines in rates to final consumers.

How has it been applied in the UK?

In the UK a price cap regime is employed, in which annual prices are allowed to increase by an inflation index net of a productivity target (X factor). In simple terms the formula for price in the upcoming regulatory period (P_1) is as follows: $P_1 = P_0 \cdot (RPI - X)$. Every five years, the regulator, Ofgem (the Office of Gas and Electricity Markets, a combined agency which took over the responsibilities of Offer, the Office of Electricity Regulation) re-analyzes the relative efficiency of the sector as a whole and of the individual companies and re-sets the price cap. This process involves calculation of the one-off price cut (change in P_0) and potential re-adjustment of the X factor. Although the X factor is nominally intended to represent the expected productivity improvement, the performance incentive is in actuality embodied in both P_0 and X, as Ofgem determines them in tandem. To date, X factors have been equivalent for all RECs, while the P_0 has varied across firms, tailored to reflect each distributor's level of cost-effectiveness and ability to attain further improvements.³

Prior to setting the P_0 and X factor for the coming five-year period, Ofgem estimates for each REC the revenue that would be sufficient to finance an efficient business, and then makes suitable adjustments to accommodate differences in the operating environments of each distributor. This revenue target consists of three components: (a) operating costs, (b) capital expenditures, and (c) dividends, tax and interest payments.⁴ To quantify potential future costs for a particular distributor, Ofgem considers each REC's own projections, the efficiency gains previously achieved by that distributor, as well as by its peers, and solicits the opinions of consultants. By balancing each distributor's projections against the regulator's vision of attainable cost reductions, Ofgem formulates an expectation of each REC's operating and capital expenditures over the next five years.

³ The large magnitude of the P_0 cut relative to the X factor satisfies the RECs' preference that the majority of the reduction be incurred in a single year, so that their financial profiles do not deteriorate throughout the five-year period.

⁴ Over the five-year projection timeframe, revenues are allowed to grow proportionally with load growth on the basis of today's expected growth in customers and actual throughput in the network (MWh). These two volume parameters are equally weighted in the determination of the revenue driver (50%/50%).

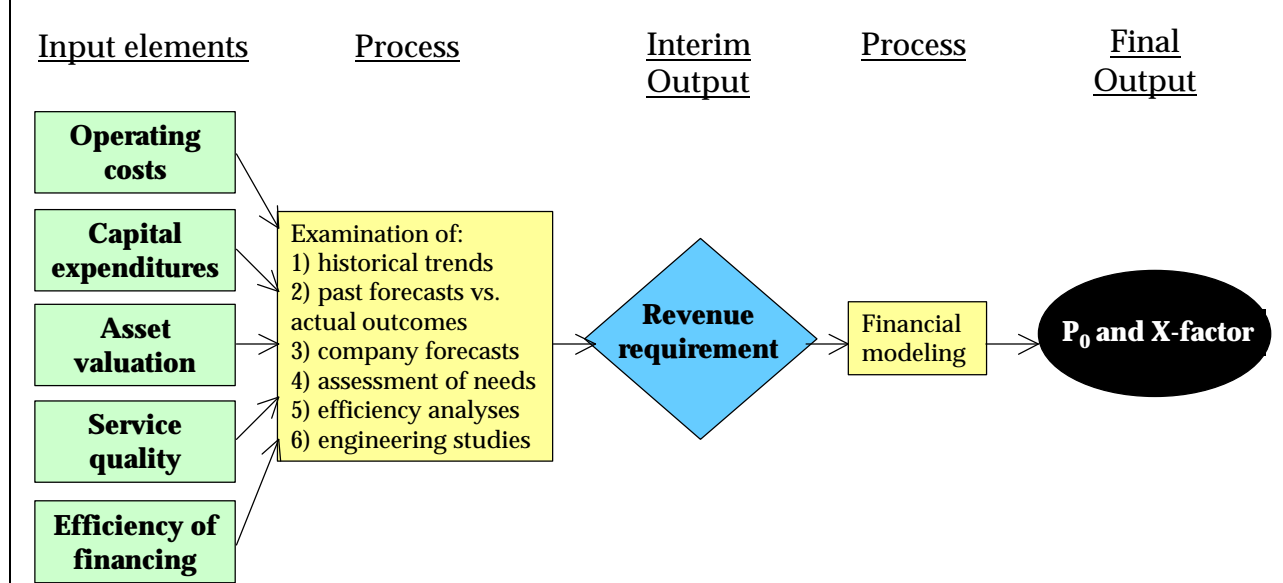
Valuation of a distributor's asset base is necessary for the determination of the dividends, tax and interest payment component. For assets acquired at the moment of privatization in 1990, Ofgem has traditionally used the flotation values of each REC as the starting point for valuation, adjusted to exclude non-distribution business segments and for subsequent changes in the cost of capital. Investments undertaken since the time of flotation are also taken into consideration, however Ofgem recently stipulated that only the actual network capital expenditure for the preceding five-year period can be financed, provided that this represented a prudent level of spending.⁵

In order to formulate a target return on the asset base, the regulator estimates a weighted average cost of capital (WACC) for the sector, with an allowance made for corporation taxes. A single WACC number is used across the board for all RECs. Historical evidence and previous precedent-setting regulatory reports are extensively used in determining the input parameters for the WACC calculation. During the most recent price control review, Ofgem's calculations resulted in a WACC of 6.5%, lower than the WACC used in previous price control reviews (7%). Several RECs criticized this decision, claiming that Ofgem relied too heavily on current market data and survey information in estimating the risk-free rate and equity premium, which they argued was too low in light of long-term averages. In the end, Ofgem prevailed, justifying the lower WACC on the basis of sustained lower government bond yields and reduced investor expectations of the equity risk premium.

In determining the revenue requirement, Ofgem's objective is to predict the total cash outlays required of distributors over the coming period to cover their costs of operation, assuming efficient management and steady-to-increasing service quality. After estimating the revenue requirement for each REC, the regulator can then determine an appropriate P_0 and X factor through financial modeling. The flowchart below illustrates on a conceptual level the regulatory process behind the development of the P_0 and X factors.

⁵ This marks a departure from previous framework, in which projected spending for the upcoming five-year period could also be financed (included in the asset base). To counteract any perverse incentives this might create to reduce investments in efficiency, Ofgem intends to adjust asset values in the next price control review (in 2004) on the basis of actual expenditures on a rolling basis.

Figure 7. Determination of P₀ and X-factor



In order to bring the regulatory regime into context, it is useful to examine how industry events over the past decade have impacted the regulatory process and vice versa. The early years of the distribution sector (1990 through 1994) were fairly uneventful. With the exception of London Electricity, all RECs were given negative X factors (see Figure 8), which implied that their prices could increase faster than the rate of inflation. Such initial X factors were justified using the need for investment in the sector and ignored the scope for cost-cutting. This fueled exceptional growth in operating profits for the distribution sector, as highlighted in Figure 9.

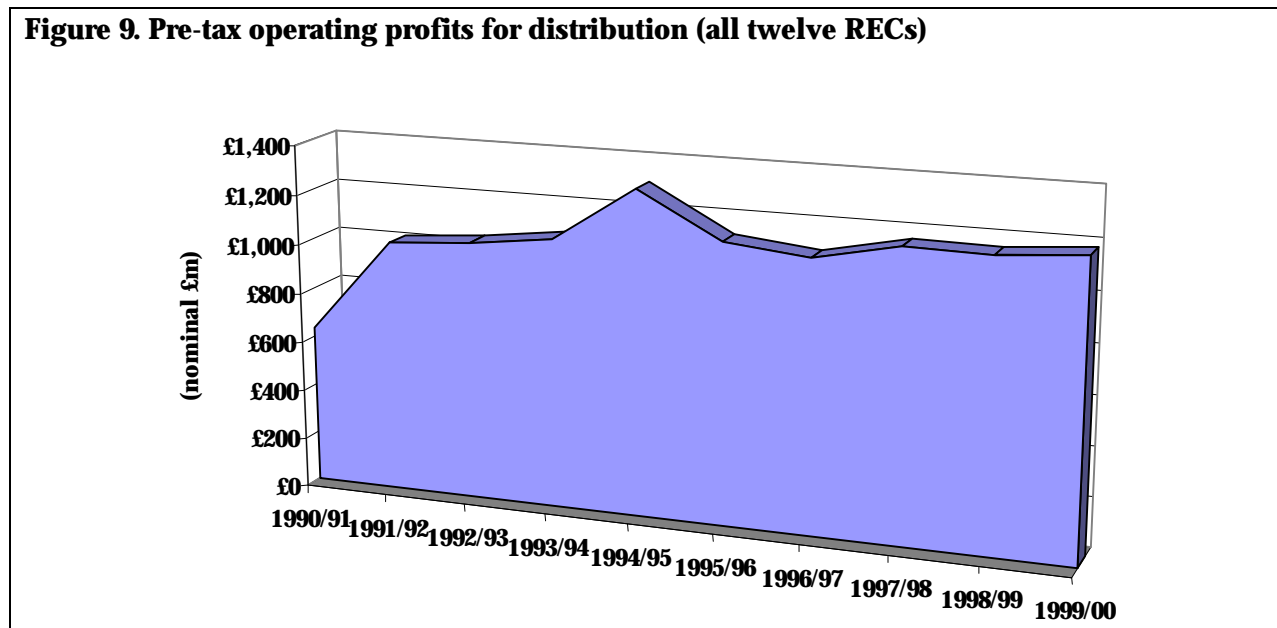
Figure 8. Approved P₀ and X-factors for the UK RECs

REC	1990-95	1995		1996-1999		2000-05	
	X factor	P ₀ cuts	X factor	P ₀ cuts	X factor	P ₀ cuts	X factor
Eastern	-0.25%	11%	2.00%	10%	3.00%	28%	3.00%
East Midlands	-1.25%	11%	2.00%	13%	3.00%	24%	3.00%
London	0.00%	14%	2.00%	11%	3.00%	26%	3.00%
Manweb	-2.50%	17%	2.00%	11%	3.00%	19%	3.00%
Midlands	-1.15%	14%	2.00%	11%	3.00%	23%	3.00%
Northern	-1.55%	17%	2.00%	13%	3.00%	24%	3.00%
Norweb	-1.40%	14%	2.00%	11%	3.00%	27%	3.00%
SEEBOARD	-0.75%	14%	2.00%	13%	3.00%	35%	3.00%
Southern	-0.65%	11%	2.00%	10%	3.00%	18%	3.00%
Swalec	-2.50%	17%	2.00%	11%	3.00%	25%	3.00%
South Western	-2.25%	14%	2.00%	11%	3.00%	20%	3.00%
Yorkshire	-1.30%	14%	2.00%	13%	3.00%	23%	3.00%

During the first price control review in 1994, the electricity regulator increased the pressure on the RECs by stipulating significant one-off price cuts, varying between 11% and 17%, and imposing a positive X factor of 2% for all companies. This led to profit declines for most

distribution companies in 1995/96, since distribution activities formed the basis for the majority of RECs' profits.

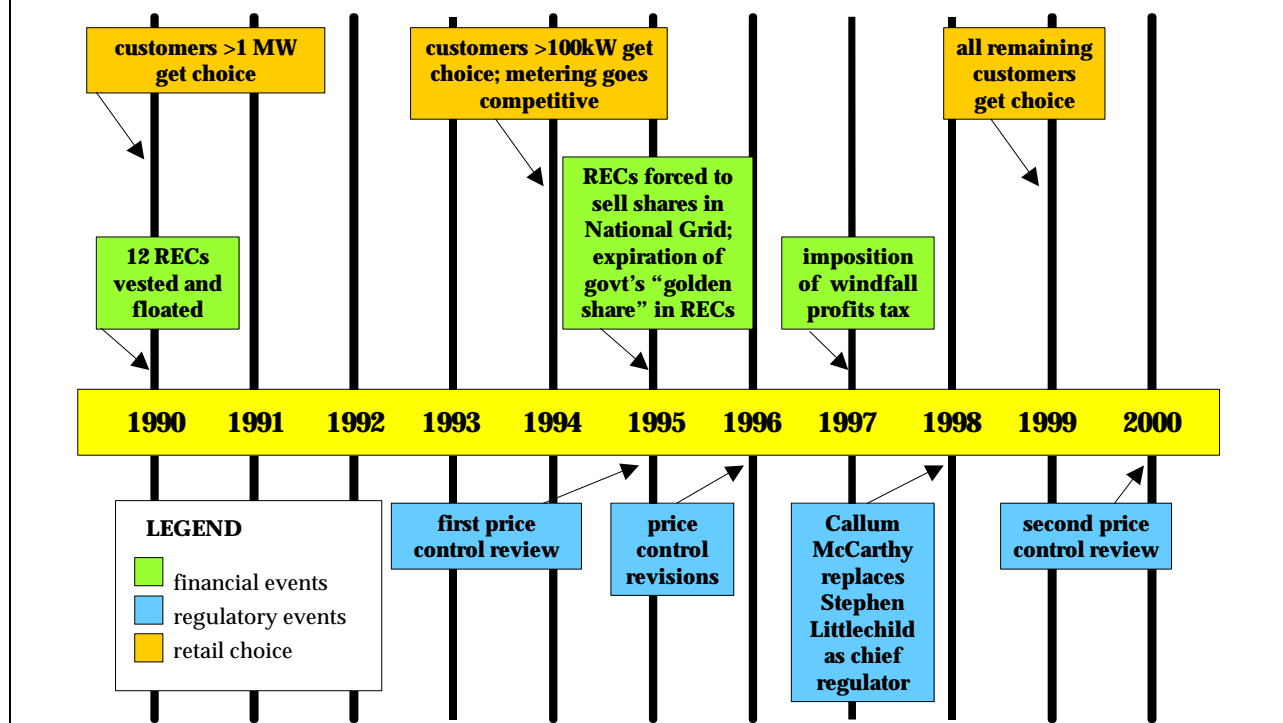
Figure 9. Pre-tax operating profits for distribution (all twelve RECs)



Price cuts did not reduce investor interest in the RECs. Enthusiastic takeover activity raised suspicions that that the sector was in much better position than anticipated prompting the regulator to reopen the review process.⁶ In July 1995, Offer adopted two changes in accounting principles, allowing the regulator to require an *additional* one-off price cut (achieved by revaluing the assets of the RECs downwards, on the basis that previous reviews had overvalued the assets of the electric distribution companies) and *raising* the X factor to 3% (by requiring the companies to absorb redundancy costs, e.g. expenses that are above “normal” costs). Since these measures had previously been employed by the Monopolies and Mergers Commission (MMC) in its investigations of Scotland’s Hydro-Electric, RECs had little basis for challenging them successfully.

⁶ One event stands out as the pivotal turning point in the regulator’s view of the sector. In late 1994, Trafalgar House announced a hostile takeover bid for Northern Electric, even though the government’s “golden share” had yet to expire. In response, Northern’s management prepared a defense proposal that included £500 million in benefits to its shareholders. The magnitude of this package indicated to the regulator that the firm was in better shape than it had revealed during the price review.

Figure 10. Key events in the UK electricity distribution sector



Additional penalties befell the UK distribution sector in the form of the windfall profits tax. The sale of the RECs in December 1990 was hugely successful: the value of the shares after initial offering rose sharply. However, the Labour Party accused the Conservative government of not obtaining a fair value in the sale of public assets. The windfall profits tax became one of the core elements in the Labour Party's strategy, and was passed into law on July 31, 1997 shortly after the party's ascension into power. This tax was designed to target privatized utilities (electricity, water, and telecommunications), with electricity companies shouldering approximately 40% of the burden.

A 23% tax, payable in two installments, was levied on each company's net implied value over the preceding four years (the difference between the aggregate post-tax profits earned by the company over the preceding four years and initial market capitalization). Some analysts criticized the final allocation of the tax for failing to distinguish between companies that were sold cheaply and those that increased their profits through gains in efficiency. Furthermore, companies that paid out large dividends to shareholders wound up with lower windfall liabilities, which contradicted the Labour Party's stated objective of reclaiming excessive shareholder gains.

The second distribution price control review commenced as scheduled in 1998, producing a series of final proposals in December 1999 that established significant price cuts to take effect in the 2000/01 fiscal year. The regulator focused on several critical issues facing the RECs: promotion of competition in domestic supply and metering, ongoing quality of supply concerns, and the implications of the impending separation of the supply and distribution

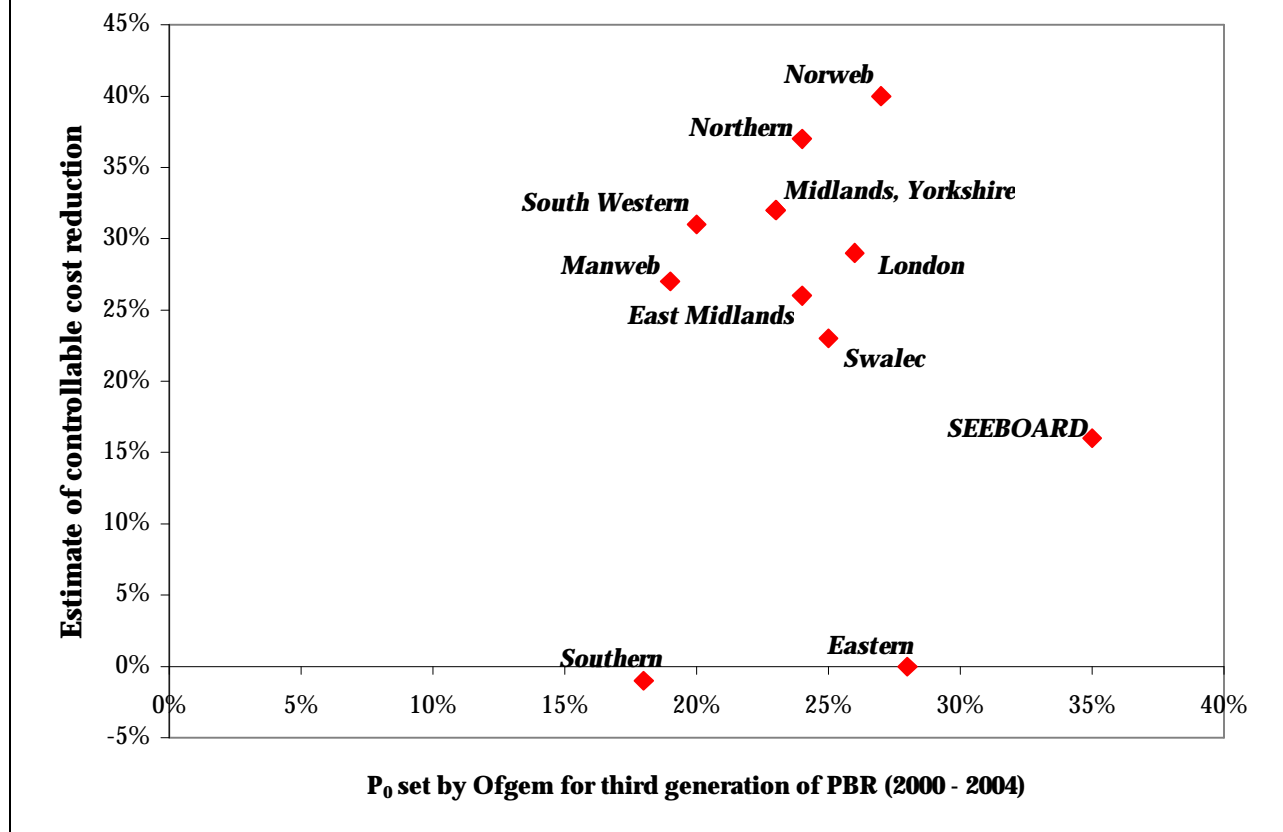
businesses⁷. Because all residential and small business customers were about to gain access to alternative electricity providers, Ofgem recognized that supply price controls needed to be relaxed in order to foster a vibrant competitive atmosphere. This effectively lent greater importance to setting appropriate distribution price controls, which prompted Ofgem to carefully scrutinize the distribution cost performance of the various RECs.

During the course of its price review, Ofgem uncovered a surprising degree of divergence in terms of management strategies and efficiency outcomes. Both Southern Electric and TXU Europe (Eastern) were identified as being on the efficiency frontier as a result of Ofgem's quantitative analysis of operating costs. Meanwhile, at the other end of the spectrum, several RECs, including Norweb, Northern Electric, and Yorkshire Electricity, would need to reduce controllable costs by over 30% by 2004 in order to align performance with their more efficient peers. Figure 11 plots each REC's efficiency level (i.e., scope for incremental cost gains as determined by the regulator's consultants) relative to final P_0 imposed by Ofgem.

Notably, there is no consistent trend between relative efficiency and the P_0 . Norweb, the least efficient distributor in this analysis, was given almost the same P_0 as Eastern, one of the most efficient companies. In the end, relative efficiency was only a portion of the equation underlying determination of the one-off price cuts. Other parameters, such as a company's financial position, capital expenditure plans, and quality of service, were used to develop the price controls. As the regulator noted in 1994 after the first price control review, price cuts are established relative to each REC's unique operating environment and demonstrated management efficiency, thereby implicitly taking into account how much of a price cut the REC can survive.

⁷ In May 1999, Ofgem first indicated its intention to compel the RECs to formally separate their supply and distribution businesses into distinct entities; this first stage required companies to physically separate their business units and maintain separate management and computing systems. This process intensified with the passage of the *Utilities Act 2000* in July 2000, which introduced a statutory prohibition against the same legal entity holding both electricity supply and distribution licenses. As a consequence, RECs that currently remain integrated will be forced to split by April 2002, although some shared services can be retained for a further three years provided there are no cross-subsidies or anti-competitive distortions.

Figure 11. Potential reductions in controllable operating costs versus awarded P_0

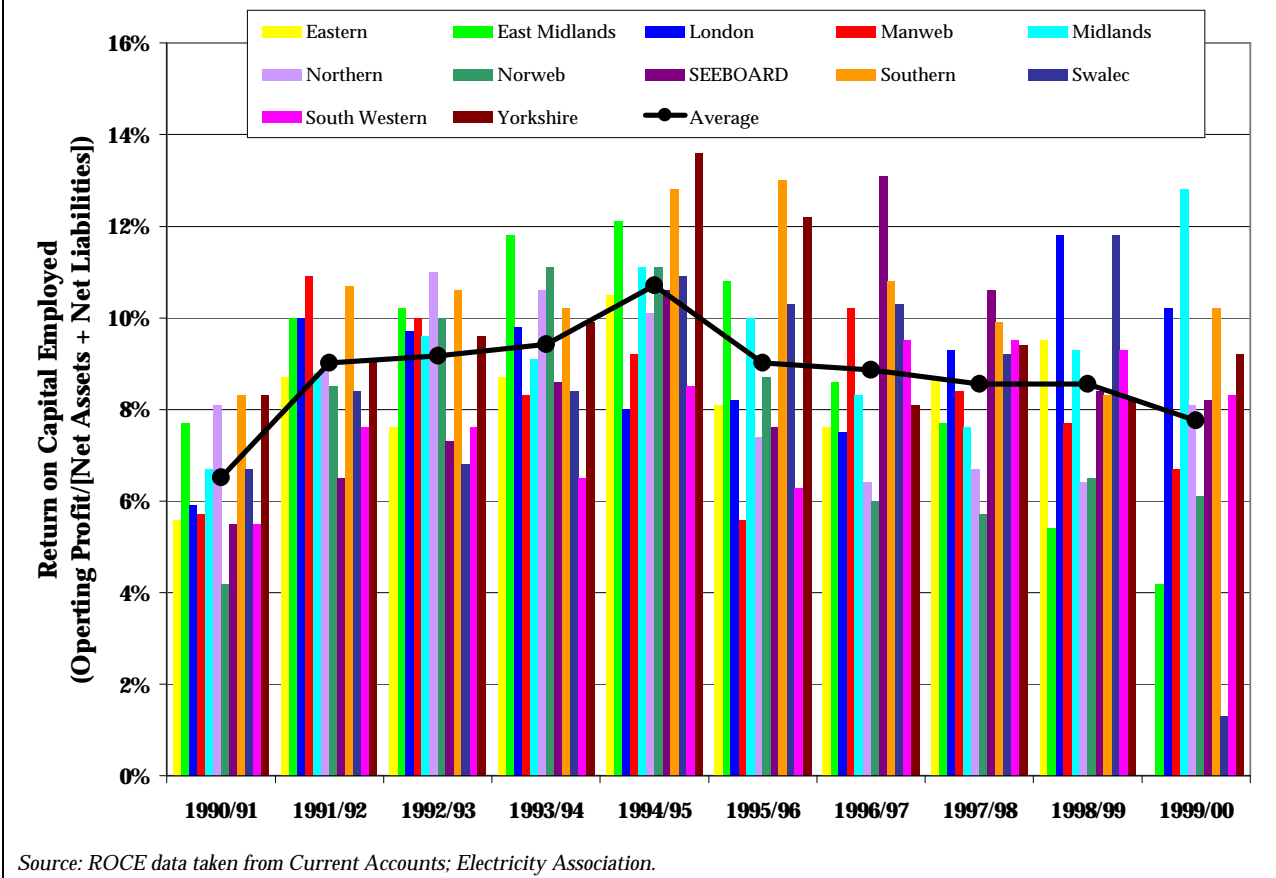


Company specific implications

Return on Capital Employed⁸ (“ROCE”) is a popularly used financial ratio in the UK and a useful proxy for return on total equity. As can be seen from Figure 12, there are only a few consistent “above average” performers in the industry, such as Southern and Yorkshire. Others have had their ROCE steadily eroded (East Midlands) or have had only occasional multi-year stints in which their ROCE was higher than the average. The industry has experienced an average 6% annual decline in ROCE since 1994/95. Nonetheless, the average ROCE of the industry has consistently remained above the weighted average cost of capital assumed by the regulator in its assessment, suggesting that RECs have been able to outperform the regulator’s expectations.

⁸ ROCE is calculated as pre-tax operating profit divided by total capital employed. In turn, capital employed is defined as net assets plus long term liabilities excluding provisions and deferred income.

Figure 12. Return on capital employed for UK REC's distribution business



A look at the pre-tax return on capital assets (ROCA)⁹ shows a similar pattern for the industry (see Figure 13). Congruent to the ROCE trend over time, ROCA on an industry-wide basis has steadily declined since 1994/95 (at which point it was above 10%). With an average decline of over 5% per annum, the average ROCA among the twelve RECs has remained around 8% in the last few years. Southern's ROCA is above-average across all years, 1990 through 1999. Surprisingly, given that neither has been a stellar performer from an efficiency perspective, Yorkshire and East Midlands have also exhibited strong ROCAs vis-à-vis the industry average. In contrast to Southern, which was deemed to be on the efficiency frontier, Yorkshire and East Midlands were judged to be substantially less efficient, with a potential for approximately 30% and 25% reductions in operating costs, respectively. Meanwhile, some RECs such as Norweb have both had a bad ROCA/ROCE track record and have been classified as very inefficient. They may be prime takeover targets, with ample room for improvement.

⁹ ROCA is calculated as pre-tax operating profit divided by capital assets (capital assets are net fixed tangible assets).
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Figure 13. Return on capital assets for UK RECs, 1990/91 through 1999/00

REC	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Eastern	5.6%	8.7%	7.6%	8.6%	10.3%	7.9%	7.1%	8.4%	9.0%	11.7%
East Midlands	8.0%	10.2%	10.5%	12.1%	12.5%	10.8%	8.8%	9.1%	4.0%	4.0%
London	5.8%	9.8%	9.5%	9.1%	7.8%	8.1%	7.2%	9.2%	11.7%	10.2%
Manweb	4.8%	8.9%	8.1%	6.7%	8.6%	7.4%	12.3%	9.1%	6.2%	6.9%
Midlands	6.9%	8.8%	9.5%	9.1%	11.3%	10.1%	8.3%	7.6%	9.3%	12.4%
Northern	8.3%	9.0%	11.2%	10.8%	10.4%	7.6%	6.1%	6.1%	6.7%	8.3%
Norweb	4.1%	8.2%	9.8%	10.8%	11.1%	8.8%	5.1%	6.2%	5.3%	5.0%
SEEBOARD	5.3%	6.2%	6.9%	8.1%	9.9%	7.1%	12.4%	10.1%	8.6%	8.5%
Southern	8.6%	11.0%	10.7%	10.2%	12.7%	13.2%	10.8%	11.0%	8.2%	10.0%
Swalec	7.0%	8.5%	6.9%	7.3%	9.4%	8.4%	8.4%	7.5%	9.6%	1.1%
South Western	6.3%	7.6%	7.6%	6.5%	8.3%	6.0%	9.4%	9.4%	9.3%	8.3%
Yorkshire	8.5%	9.3%	9.7%	9.7%	13.5%	12.0%	7.9%	9.3%	8.3%	9.4%
Average	6.6%	8.9%	9.0%	9.1%	10.5%	8.9%	8.7%	8.6%	8.0%	8.0%

Note: red font signifies that REC did better than industry average in that year

Source: ROCA data taken from Current Accounts; Electricity Association.

Clearly, there is no single relationship between returns and efficiency. As noted earlier, those utilities that are least efficient are sometimes given a smaller P_0 due to their financial profile and inability to capitalize on operating cost gains. At the same time, some of the most efficient players have faced large price cuts, given their ability to further motivate productivity gains. There are also distributors that are considered relatively inefficient and yet have still managed to attain relatively high returns. Examination of historical gross margins (operating profit over turnover) suggest that RECs have in fact weathered the price reviews fairly well. The lack of a sharp decline in gross margins in the years in which the one-off price cuts were imposed suggests that the RECs responded quickly to regulatory changes through immediate cuts in operating costs. Even in 1996/97, gross margins remained robust despite double-digit price cuts. However, many analysts believe that further improvement in margins is unlikely in the current environment.

The largest impact of the regulatory reviews is not necessarily felt on the bottom line, but on the balance sheet. Credit quality is a factor that is significantly affected by the regulatory reviews. Four RECs have had their credit ratings lowered by S&P since September 1999, whereas only two were upgraded, as seen in Figure 14. The downgrades were generally blamed on harsh price cuts imposed in December 1999, higher leverages (due to acquisition activities), and the reliance of some RECs on the more risky supply business. The upgrades (London and Swalec) can generally be attributed to acquisitions and the credit position of the new owners.

It is interesting to note the dynamic relationship between credit ratings, regulation, and bottom line/returns. Regulators need to understand how their actions, such as lowering the cost of capital and increasing price cuts, relate to ratings downgrades and ultimately to increases in the cost of capital. Stringent price controls can lead to downgrades which eventually raise the risk premium, flowing back into the regulator's future WACC calculations and resulting in higher end-user prices. Thus, credit agencies, over the longer term, act as a natural check on regulators.

This feedback effect is acknowledged by Ofgem (though on a very high level), but ratings agencies claim there is still not enough consideration by the UK regulator of credit quality.

Figure 14. Credit ratings of UK RECs, before and after latest price control review

REC	Ratings are for...	Sep 1999	Jan 2001
Eastern	Eastern Electricity	BBB+	BBB+
East Midlands	PowerGen (owner)	A	BBB+
London	London Electricity	BBB-	A+
Manweb	Scottish Power (owner)	A+	A
Midlands	Midlands Electricity	A-	A-
Northern	Northern Electric	A-	A-
Norweb	United Utilities (owner)	A	A-
SEEBOARD	SEEBOARD	A-	BBB+
Southern	Scottish and Southern Energy (owner)	A+	A+
Swalec	Hyder (owner until recently)	BBB+	A-
South Western	South Western Electricity	A-	A-
Yorkshire	Yorkshire Power Group	BBB+	BBB+

One way to compare the performance of the RECs is to review the data examined by Ofgem during the most recent distribution price control review. This provides insight into which companies are succeeding and which are not. Since the first price control review, Southern and Swalec (with the exception of 1999/00 for Swalec) have consistently outperformed their peers on an operating profit per customer basis. Since 1997, South Western and London have also shown a turnaround. In contrast, Northern, Norweb, and East Midlands have exhibited a declining profile.

Only Eastern Electricity and Southern Electric have consistently reduced their distribution costs throughout the decade, explaining why the efficiency analysis conducted by Ofgem's consultants in 1997 determined that only those two were currently operating on the "efficiency frontier"; that is, their chosen combination of productive inputs is yielding the greatest possible output.¹⁰ Several companies achieved impressive savings in 1994 through 1996 as the first price control review (and subsequent revision) compelled them to reduce their employment of labor and materials, but then showed little improvement over the rest of the decade.

¹⁰ This efficiency study involved detailed analysis of past cost reductions, engineering studies that benchmarked the cost of performing the primary distribution business activities, and an investigation of human resource costs, organizational structure, and IT costs. This supplemented Ofgem's own econometric analysis, which regressed the base costs of each REC on a composite variable consisting of number of customers (50% weight), units distributed (25%), and network length (25%). The constant term was interpreted as representing fixed costs. Adjustments were made to account for regional variation and operating environments to the extent possible.

Figure 15. Operating costs of UK REC distribution businesses, in nominal £m

REC	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	AAGR (1990-1995)	AAGR (1990-1999)
Eastern	£292	£303	£324	£331	£248	£325	£314	£287	£279	£236	2%	-2%
East Midlands	£221	£229	£227	£235	£309	£248	£240	£246	£299	£308	2%	4%
London	£260	£263	£255	£257	£288	£262	£252	£233	£210	£250	0%	0%
Manweb	£171	£172	£177	£193	£184	£209	£168	£168	£181	£182	4%	1%
Midlands	£242	£254	£253	£263	£254	£240	£241	£246	£237	£207	0%	-2%
Northern	£152	£168	£163	£181	£189	£189	£176	£172	£180	£172	4%	1%
Norweb	£257	£258	£239	£257	£269	£246	£259	£248	£273	£270	-1%	1%
SEEBOARD	£204	£225	£229	£225	£222	£216	£159	£170	£183	£201	1%	0%
Southern	£270	£277	£274	£293	£265	£225	£230	£218	£243	£236	-4%	-1%
Swalec	£134	£148	£149	£157	£164	£142	£122	£132	£115	£190	1%	4%
South Western	£156	£170	£177	£199	£205	£202	£150	£145	£164	£175	5%	1%
Yorkshire	£215	£233	£239	£255	£228	£212	£224	£207	£223	£206	0%	0%

In fact, a significant portion of the trend in operating costs can be attributable to fluctuating employment levels, portrayed in Figure 16.¹¹ Every company has cut its overall workforce progressively throughout the 1990s, with London Electricity, Norweb, Southern Electric, and Swalec achieving annualized reductions in excess of 10%. But most of these downsizings have occurred in the wake of the two price control reviews (which took effect in 1995/96 and 1996/97), a two-year period of steep price decreases in which companies such as Manweb and South Western slashed their employment rolls nearly in half. These internal restructurings are generally reflected in a muted fashion in the operating costs shown above, because of the lagged effect of retirement/compensation packages.

There is still considerable diversity across RECs in the number of customers per distribution employee (e.g. Yorkshire has ~639 customers/employee, whereas London Electricity has over 2,000 customers per distribution employee). Some of this is undoubtedly influenced by characteristics of the firms' operating environments that are beyond their control, such as the customer density of their service territories, but Ofgem sees further scope for labor force reductions at several of the RECs.

Figure 16. Employment levels at the UK RECs (company-wide)

REC	All employees										AAGR	% in distribution
	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00		
Eastern	10,001	9,877	8,415	7,003	6,403	6,113	6,953	7,124	6,864	6,180	-5%	N/A
East Midlands	7,382	8,243	8,684	7,914	6,458	5,099	4,604	4,500	N/A	N/A	-6%	N/A
London	6,691	6,581	6,258	5,532	4,908	4,404	4,435	4,070	2,127	2,130	-11%	46%
Manweb	5,483	4,623	4,533	4,604	4,582	3,245	2,975	2,330	2,167	2,150	-9%	82%
Midlands	7,729	7,643	7,370	6,207	5,815	5,114	4,864	4,845	5,094	N/A	-5%	N/A
Northern	5,528	5,364	4,826	4,714	4,456	3,882	3,601	3,417	3,488	3,738	-4%	49%
Norweb	8,203	7,917	7,977	8,255	8,247	8,195	4,103	2,669	2,649	2,508	-11%	79%
SEEBOARD	6,340	6,257	6,039	5,339	4,680	4,278	4,146	4,158	2,584	2,689	-8%	N/A
Southern	8,362	8,340	7,642	7,391	4,252	3,612	3,204	2,948	2,503	2,172	-13%	73%
Swalec	3,767	3,632	3,166	3,350	3,218	2,979	1,400	1,405	1,365	1,187	-11%	84%
South Western	5,676	5,553	5,569	5,400	5,005	3,254	2,821	2,681	2,609	N/A	-8%	N/A
Yorkshire	7,126	7,105	6,850	5,764	4,924	4,294	3,976	4,047	4,350	4,298	-5%	73%

¹¹ These numbers refer to total employment in all business units of the RECs (including distribution, supply, and any other components); breakdowns by unit were unavailable over the time series.

Since privatization, the electricity distribution sector in the UK has pushed the envelope in terms of productivity gains, much more so than anyone could have anticipated in 1990. One study found average total factor productivity gains of 3.5% per annum during the period 1990-1997,¹² and many believe that annual productivity growth has increased further since strict price cuts were imposed in the mid-1990s. According to some studies, there remains room for as much as a 25% reduction in controllable operating costs over the short- to medium-term on average. Even for the most efficient, analysis of electricity sectors worldwide suggests that there remains potential for annual efficiency gains of at least 1% over the longer term.

Though historically operating costs have been one of the most significant drivers of returns in the industry, it is unclear whether the utilities can really squeeze out the operating cost cuts that the latest price review demanded. This suggests that the primary mode for long term efficiency gains under a PBR regime may be in capital expenditure management. However, this will depend on a company's individual situation and whether it is more efficient for it to reduce capital or reduce labor and other operation cost-based elements.

Lessons for investors

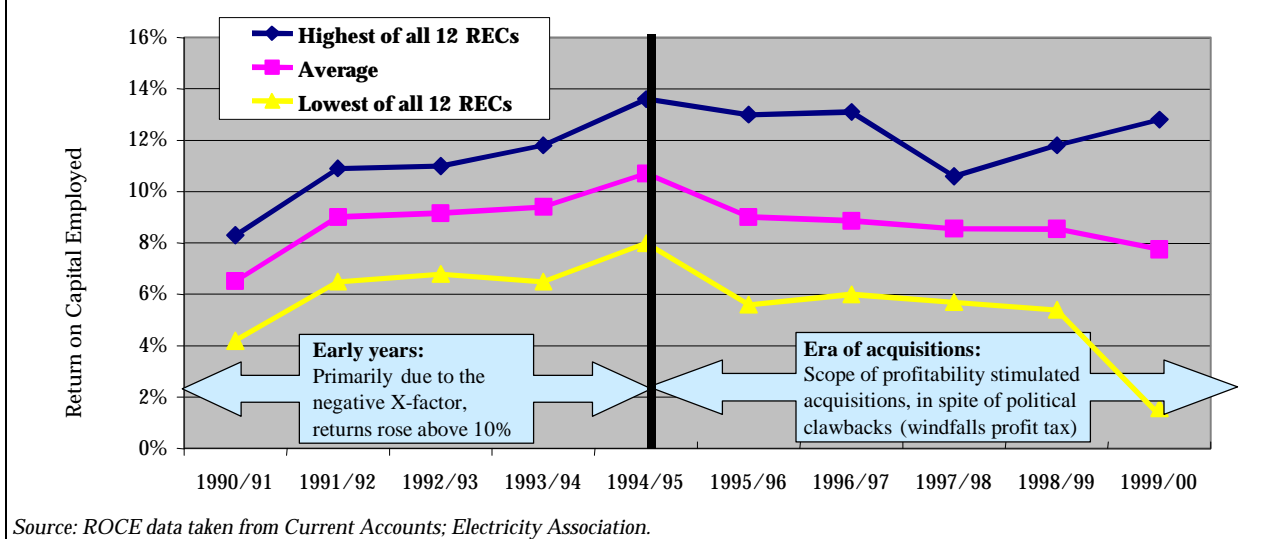
RPI-X style PBR is becoming more common around the world, despite the challenges embodied in determining X factors and estimating productivity growth. Worldwide experience suggests that, where PBR is applied in developed countries, regulators may impose stringent initial efficiency targets, while regulators in emerging economies tend to be more concerned about quality of service indicators. Application of aggressive RPI-X style ratemaking in the US would have a substantial impact on utility profits.

UK experience with PBR in the distribution sector can be segregated into two discrete periods based on a number of elements, including regulatory perspective, investor interest, and RECs' profitability. The first five years of PBR saw the RECs' valuations rise quickly. Pre-tax operating profit grew at an annual average rate of 12%, driven by the negative X factors as well as operating cost gains. By the mid-1990s, such profitability attracted the attention of investors, who were potentially attracted by the double digit returns and the virtually risk-free nature of the business. It was this same superb performance that also attracted the attention of the regulator in 1995 and brought about a more aggressive price control regime. Despite strong operating cost gains, pre-tax operating profit growth slowed in the last five years relative to the early 1990s, driving implied returns downward.

¹² London Economics, "Efficiency and Benchmarking Study of the NSW Distribution Businesses," February 1999.

This study employed a data envelopment analysis (DEA) modeling approach.

Figure 17. Overview of returns on capital employed for UK distribution sector over time



What are RECs expected to earn in the new millennium? Analysts believe that the industry will continue to be reasonably stable, at least until the next price control review in 2004-2005. However, with continuing regulatory pressures, the returns to distributors are likely to stay at the single-digit level, following the declining trend triggered by the regulatory scrutiny of the price review in 1995/96 and the windfall profits tax in 1997. The regulator has further verified this expected level of returns by utilizing a nominal post-tax equity return of 9% and a 6.5% weighted average cost of capital for the distribution companies in the latest price control review. It is unlikely that the regulator will push these returns substantially lower, given the need to retain investor interest in this capital-intensive sector.

Regulators worldwide are generally sophisticated, and understand the need to balance the desire to reduce rates to final consumers against the requirement of assuring continued investment in the electricity distribution sector. At the same time, investors need to be aware that the periodic review process can result in substantial one-off price cuts and stringent efficiency targets. Our experience suggests that in emerging economies, regulators will be more concerned about maintaining investment, and will offer softer efficiency targets in order to reduce the overall risk profile. But in developed economies, price cuts and efficiency standards can be substantial. The first generation of Dutch PBR featured X factors of 8-10% in some cases. But over time, both consumers and shareholders can be winners under PBR, with distribution charges declining in real terms while utilities are able to maintain comfortable risk-adjusted levels of returns.

Appendix: Author biographies

A.J. Goulding is president of London Economics International LLC, a global economics and financial consulting firm based in Boston specializing in the energy and infrastructure industries. A.J. leads the asset valuation and strategy practices for the firm. He has advised regulators and private investors on the implications of PBR worldwide, with recent engagements in Canada, Latin America, and the Caribbean. London Economics International

has advised on numerous complex swap-leasing transactions in Europe and Australia in which PBR is a key factor in determining future revenue streams.

Julia Frayer directs quantitative analysis and finance projects at London Economics International LLC. In her role as managing consultant, she has led projects looking at comparative efficiency levels for electricity and natural gas companies. She is also an expert on strategic bidding in wholesale electricity markets, and on applying real options valuation techniques. Julia has extensively studied PBR regimes around the world, with particular emphasis on the evolving Dutch regime.