

International Trends: Regulating the Electricity Distribution Industries of the World.



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1. Introduction

Restructuring of electricity businesses across the world is leading to developments in measures employed to monitor the prices paid and quality delivered by both competitive and non-competitive parts of the industry. In the competitive sectors, i.e. generation and supply, strong commercial incentives can naturally develop to drive down prices and improve quality. In monopoly sectors, the same commercial pressures do not exist, and instead efficiency pressures must be created through regulation. There is a fine balance that must be struck between reducing prices and improving quality, and it is an ongoing challenge that regulators and distributors across the world are facing up to. Customers are keen to see price reductions, but are not prepared to see deterioration in the level of service they receive. The form of regulation must therefore recognise the seemingly conflicting demands of price and quality.

These concerns have driven the development of new forms of distribution regulation, using increasingly sophisticated price controls. Incentive schemes have been designed to reward good performance (or penalise poor performance) depending on the outputs achieved. In order that these 'output' based performance incentives do not jeopardise longer term quality of supply, performance monitoring can be combined with additional controls on business 'inputs', to protect the long-term health of assets and avoid system deterioration.

IPA's staff has been at the forefront of developing regulatory frameworks across the World. This paper is based upon IPA's recent experience across the World, and more specifically the experience in South Africa, Lesotho and Mozambique.

2. The objective of regulation

Regulation is a tool that can be used to deliver improvements in a sector, but the form of regulation adopted must be carefully considered in order that it achieves what is required. Regulators generally have the overriding obligation to act in the best interest of consumers, in addition to other specific duties that may be placed on them by Government. Regulation normally forms an integral part of a reform process that has main objectives to:

- Increase efficiency and reduce costs;
- Maintain or enhance security of supply;
- Increase customer access and choice;
- Encourage private investment; and
- Ensure the long-term financial viability of the regulatee.

In African countries, such as Lesotho and Mozambique where IPA has recent experience, increasing electrification rates are an additional key driver for reform. Increasingly Governments are also looking to electricity regulators to take on more environmental responsibilities, such as in Ireland where protection of the environment is a higher legislative priority than the duty to protect the interests of rural customers, the disadvantaged and the elderly.¹

3. Routes to meet objectives

In most European countries these objectives can be realised through the introduction of competition to force price reductions through innovation and efficiency improvement, and through various forms of incentive based regulation designed to reduce prices and improve the quality and availability of supply.

Even in the monopoly activities, market based environmental mechanisms can be used and the price regulation will have to take into account the cost of meeting environmental targets.

In many emerging economies final price reductions may not be the driving factor, as tariffs are often already below cost reflective levels. In such countries regulation will aim to improve the commercial and technical performance of utilities to allow the utility to recover its efficiently incurred costs, eliminating subsidy (or making it specific and transparent) and improving financial stability whilst enhancing the quality of supply.

In countries where the utilities have a reasonable overall technical and commercial performance, such as New Zealand, regulation can recognise the benefits of allowing the utility to balance quality of service and price. New Zealand is regulated on the basis that distribution companies are compared against each other in respect to 3 basic indices: price, rate of return, and service quality. Any company that consistently scores poorly is subject to a detailed regulatory review of its business.

In many countries where regulation is newly established, the regulator is faced with a number of conflicting objectives in a sector that is going through significant change. For example, the Government may have privatisation as a key objective, with a view to improved technical and commercial performance. However, investors will be wary of businesses where there is no or only a limited regulatory history and where there is a requirement for significant investment in order to reach satisfactory performance levels. In such circumstances, regulation will need to focus on establishing cost reflective tariffs and improving revenues so as to enhance the financial and operating performance of the utility. It is also vital that the regulatory processes have a high degree of transparency, and be free from political intervention. These practices have proven effective in many of the countries where IPA has worked, including the present work in Lesotho.

4. Basic Forms of Regulation

There are two basic forms of regulation that can be applied to any business:

- **Input based** regulation; and
- **Output based** regulation.

The simplest form of input based regulation is **rate of return** regulation, where the business is permitted to make a specified rate of return on its assets. The company's investment plans and proposed prices are subjected to frequent and detailed reviews by the regulator, and the expenditure is subject to the approval of the regulator.

At the other extreme, output based regulation is not specifically concerned with the investments and assets necessary for the company to achieve its ultimate result, which is the delivery of electricity to customers. Providing basic rules are adhered to, **performance based** regulation provides a return to the company based on the results achieved by the business.

Between these two extremes there are a multitude of variations that have been adopted in different countries, depending upon the specific needs of each sector. One common variation is the "incentive based" framework that was initiated in the UK, whereby performance that was more efficient than the regulator's projections would permit companies to earn a return greater than that nominally permitted, provided output did not deteriorate. In practice this scheme set specific efficiency improvement factors (by allowing future revenue to rise by a term "RPI-X", where RPI is inflation and X an efficiency factor) and hence it is sometimes known as RPI-X regulation. In the UK this scheme led to both significant reductions in prices improvements in output quality.

It should be noted that the form of regulation applied can change over time to reflect changes of emphasis in the objectives of the regulator (for example in the cost-quality trade-off) and the level of sophistication appropriate for the regulator and company, taking account especially of the granularity and quality of data available.

It should also perhaps be recognised that all regulation contains forms of incentives -

some explicit, others less so. In rate of return regulation the incentive is mainly concerned with capital investment. If the set rate of return is high, the regulatee will have incentives to invest more, and if the rate of return is low, the regulatee will wish to defer or reduce capital investment. In performance based regulation the incentive is to match (or beat) the specific performance targets, mainly associated with operating costs.

Incentive based regulation allows the regulatee to retain the financial benefits from exceeding the target performance levels, until the next regulatory review when the gains can then be passed to the customer in the form of lower prices. This incentive works best when the period between reviews is not too short.

5. Identification of targets for regulation

The identification and setting of targets for regulation schemes is a complex and controversial subject. Schemes that have been used in different countries can be compared but this is not always helpful, as there are many variables that can be adjusted to achieve the desired regulatory result. The setting of price control targets must also consider political implications as well as the economics of the regulated business.

In an incentive-based scheme like that used initially in the UK there are three main components of a regulatory price control for networks businesses:

- Rate of return on assets;
- Initial price reduction; and
- Efficiency improvement factor.

The regulator may be keen to use the control to emphasise either: the additional (incentivised) efficiency improvements achieved since the last control (tending to be reflected in the one-off reduction); the expected scope for future efficiency improvements (tending to be reflected in the annual X factor); or the relative attractiveness of investing in a utility company (reflected by adjusting the allowed return).

Ultimately, these elements are used to define the forward looking revenue that the utility is permitted to recover via its prices

In an extreme case the regulator may also consider it appropriate to revise the company's effective asset value (asset value or asset lives). This happened in the UK where Transco (gas pipeline business) had the asset lives extended, reducing the short term annualised depreciation value of the assets, but arguably more closely reflecting their actual economic lives.

For performance-based regulation the selection of targets is generally more transparent. The base performance is normally set according to the outturn from previous years. The performance can be set with a deadband about the target point, with a defined scale of penalties and rewards dependant upon the outturn performance. Rewards and penalties are normally subject to a collar and cap arrangement to limit the financial exposure under the scheme. Statistical techniques can also be used to discount extreme values from the reported results. For example, for distribution system fault rates and customer interruptions, days when values fall outside two standard deviations from the mean can be considered to represent extreme events outside the normal operations of the business, and be excluded.

In setting regulatory targets and reviewing past performance benchmarking is often used to assess comparable businesses. In Britain there were strong cases made that some businesses were significantly different to others, and that benchmarking was of limited value and the same arguments are held across the World.

However, benchmarking is a favoured tool of regulators and, providing that high quality information is available, economists can devise increasingly sophisticated ways to compensate for differences between business. The process that led to the definition of the REDs in South Africa suggests that benchmarking will be a key tool in the future regulation of the sector.

In the UK merger and acquisition have reduced the value of benchmarking and comparators to the regulator and this is something that will need to be carefully considered in South Africa. In other countries however, benchmarking

exercises are still highly effective regulatory tools, especially where there are a large number of companies to be compared.

The electricity distribution sector in Finland for example has around 1,000 small companies and in Germany there are around 800 companies. Interestingly, the scale of the challenge means that regulators in both countries have tended to favour ex-post regulation of charges rather than the ex-ante setting of allowed total revenues that rely on forward efficiency projections.

There are a number of different methods available for benchmarking, and they are beyond the scope of this paper. However, the approaches basically consider either a form of averaging, or consider looking at the leading performers (frontier analysis).

It is perhaps worth commenting that however targets are set, it is important to recognise that they apply for one price control period only. Revenue targets are set according to a level of cost that an efficient business would expect to incur, and even very efficient businesses need an incentive to seek continued improvements in performance. If the regulator sets targets that become inappropriate with a change in circumstances, the regulator will be under pressure to take corrective action at the next control.

In extreme cases, it is important to ensure that if circumstances change dramatically, there is the possibility of an interim price control or price control adjustment mechanism, for example to ensure a company's financial stability.

6. Examples of regulation used across the world

Regulation across the world takes different forms according to the legal frameworks established, but also the personality of the regulators employed. This results in variations in approach adopted to meet very similar objectives.

Europe *UK*

Regulation in Europe was initially formed on the "incentive based" principles described above. This outwardly simple form of regulation was initially adopted in

the UK as it provided investors and management of the companies with a clear indication of what was expected to be achieved in terms of the financial performance of the companies. It provided a clear forward track of revenues to allow investors and management confidence in the businesses. Since the regulatory environment was new to all parties, there was strong political and commercial pressure to demonstrate the success of privatisation. This meant that the early price controls were set in a manner that both encouraged efficiency improvements and reduced prices, but at the same time minimised the overall impact on the operation of the businesses.

The incentive clearly worked, and efficiency gains exceeded all expectations. While this led to high profits by the regulatees in the early years of the incentive scheme, these benefits were then passed to the customer in subsequent reviews. Arguably, had the initial incentives been weaker, through the setting of tighter targets, the same efficiency gains may not have materialised.

Box 1

In the UK the regulator has moved from a relatively simple "RPI-X" incentive scheme to include additional schemes to incentivise technical performance improvements

Ofgem has recognised the importance of Distributor delivering an appropriate quality of supply, and initiated a project the Information and Incentives Project (IIP), following the conclusion of the last price control review in December 1999. This works to improve the level of service that distributors provide by linking certain quality of service measures to the revenue that they recover from customers.

Distributors have agreed to an incentive scheme that allows for financial rewards or penalties depending on the quality of supply performance in three key areas:

- number of interruptions to supply;
- duration of interruptions to supply; and
- the quality of telephone response

Distributors presently have 2% of their revenue linked to this performance scheme.

In another scheme distributors are rewarded at 2.6p/kWh for the marginal reduction in distribution losses below the average loss level over the past 10 years.

As all parties became more familiar with the regulatory environment, price controls became more targeted and forced greater efficiency improvements in the sector.

In recent years the regulator in Britain has started to move towards regulation that links revenue to the outputs that are achieved rather than the inputs that are expected. The revenue for distribution businesses are now linked in part to a rate of return regulation and in part to a performance based scheme (see Box 1).

Australia

Regulation in Australia is performed on a state basis and is similar to the UK in that it combines incentive-based and performance based regulation. The price control formula used has a specific term linked to the quality of supply achieved by the distribution business. The trend in Australia is to move more towards performance-based regulation, with proposals being made recently for quality of supply measures to be included in the controls for transmission businesses.

USA

The form of regulation in the USA is generally straight Rate of Return. This requires annual hearings to be held to review and approve the company's investment plans and operational expenditure. At these hearings the regulator invites customers to challenge the proposals. Its advantage is a high degree of transparency. Its major disadvantage is its litigious nature which leads to high costs of regulation, and reduces scope for innovation. During the last 10 years many states have moved to incentive based systems on the grounds that Rate of Return regulation causes utility companies to opt for new investment rather than to ensure the best use of existing investments.

New Zealand

As mentioned above regulation of distribution businesses in New Zealand is based on a comparison of the performance relative to their peers. Companies are assessed according to 3 basic indices: price, rate of return, and service quality, and ranked for each index. A weighted score is applied to each index to derive a total score for each company. If a company consistently receives poor overall scores it is threatened with a price

control, whereby the regulator will undertake a detailed investigation of the company's costs and business plans. It is the threat of a price control that ensures that distribution businesses balance their operations between quality of supply and price.

Finland

The approach to regulation in Finland is very similar to the approach adopted in New Zealand. The key difference between the New Zealand and Finland approach is that they use a retrospective, or ex-post form of regulation, whereas in other countries the price control is forward looking. Although there are increased company risks with the ex-post method (not knowing if revenue recovered will be later disallowed) the regulatory system is efficient and permits a team of less than 20 full time employees to regulate around 1,000 companies.

Mozambique

Regulation in Mozambique is in its very early stages, and there is little to report on the actual activities of the regulator. However, historically EDM has planned its business operations with the Government and these plans have had to consider the tariffs that the Government will permit. These plans are formalised in the "Contrato Programa" and form a defacto price control, specifying key factors such as electrification targets.

Former CIS

In the former Soviet Union prices for electricity were set as part of economic planning and were usually far below cost. Since independence many of the countries have reformed their electricity sectors with poor results. The reforms have been initiated to resolve specific problems in the sector, on the assumption that an investor will solve all of the problems (despite the best advice of international experts). Private money has come in, but without the promised actions of Government and regulator the companies are unable to operate the businesses as they intended and are pulling out. Ukraine and Azerbaijan are two examples of where the reform process has delivered no real benefits, but which has incurred significant costs. Tariffs have not been increased to a level to allow cost recovery, and subsidies are not forthcoming. This

means that sector income is far below cost and required investment levels.

Germany

At present, the electricity sector in Germany is not independently regulated. The Government carries out the regulation function directly, with companies subject to ex-ante appeal to the competition authority (the Bundeskartellamt) which conducts investigations of whether price levels are justifiable and has strong powers to fine offenders. The sector is characterised by high quality supplies, but with prices around double those of the UK. More recently Germany has announced plans for an independent, sector specific regulator to be introduced.

Comparisons...

Table 1 presents data for a number of utilities across the World. The table compares the network performance in terms of the quality of supply offered and the return on assets that distribution companies are allowed. The table shows that there is no hard and fast return on asset value that should be expected, and that even within countries (where the underlying economic conditions should be the same) there can be significant differences in the returns expected.

7. Affordability

There is a balance to be made between the need for distribution businesses to recover their costs and the ability of customers to pay for the electricity they need. Affordability of the poor is often a key issue for Governments, and in some cases this is managed through a cross-subsidy from better off customers being provided on electricity tariffs. However, there is a growing recognition that cross-subsidies inevitably lead to price distortion in the market and allocative inefficiency. Cross subsidies are difficult to implement in competitive markets and act as a barrier to other reforms.

The industry does not have to recover all of its costs through customer charges; governments have intervened by providing subsidies to certain classes of customer that they believe must genuinely be protected from the need to pay the full cost of the services they use. This compromise is one that is being seen as being necessary for the wider benefits of reforms

to be realised. Social protection is now recognised as an integral part of power sector reform, and research has shown that accurate targeting of vulnerable customers can be cost effective for Government, and need not adversely impact on the private sector, and quality of supply. Kyrgyzstan and Slovakia are currently designing effective social protection mechanisms which will provide support to those most in need based on ability to pay and willingness to pay. An ongoing project that IPA is completing in the Balkans is investigating the impact that poverty reduction mechanisms will have in the context of a regional electricity market.

Tariffs, and the need to increase them to allow the industry to be fully funded, form probably the single biggest issue for regulators and government when embarking on reform projects. Without tackling this at an early stage and solving the subsidy issues, reforms stagnate, or stall before they begin. Tariff design can be designed to minimise the impact on the poor: in Lesotho there is a very low rate for the first few units consumed (matched to the basic electricity requirements), which then increases with consumption. However, this implies cross subsidies and there is therefore a need to reconcile the conflicting interests of ensuring fair pricing, social protection and protecting the financial interests of the utility.

8. Ensuring liquidity

An issue that is closely linked to the protection of the poor is the protection of distribution system revenue. Liquidity is one of the most critical issues facing any business and has plagued most developing world distribution sector reforms. Without cash in the market, no reform will succeed.

Regulators have recognised the need for distribution businesses to protect their revenue through a number of different schemes. In the UK, there are a range of measures that companies are permitted to adopt, from the installation of prepayment meters through to disconnection. Of course the South African experience of prepayment meters shows that these devices are not infallible, but the combination of inspections, metering improvements and the use of legal action to punish theft of electricity has reduced

the levels of non-payment in many countries.

In Argentina, where the electricity sector has a mixture of relatively sophisticated market mechanisms, multi-national corporations as customers, but also customers who have extreme poverty, innovative approaches have been adopted to revenue collection and allocation of subsidies.

In Buenos Aires, the Provincial and National Government pays subsidies to distributors to compensate for unmetered consumption in the shanty towns surrounding the city. Each shanty town is metered as a single unit and the total consumption is compensated through the taxes due from the companies. This arrangement has a revenue neutral effect on the private operators and has not impacted negatively on the sector. Separating the social support factors from energy sales is being recognised as a key aspect of sector reform.

Non-payment is a problem throughout the world and is linked to the history and culture of each country. In the UK there is a tradition of payment and a legal system that recognises non-payment and interference with meters and other equipment as serious offences. In other countries there are traditions of electricity being provided by a state owned organisation as a public good, so that certain customers (government departments, hospitals, army, police, war veterans, pensioners etc.) have not traditionally been required to pay for their consumption. Solutions have been found in some cases, but there is no universal panacea to the problem.

9. Asset Value, and return on assets

There is a widely held view amongst leaders in government and industry embarking upon reform that their power sectors are intrinsically valuable commodities, and that their disposal should only be considered if it generates substantial cash. But an industry's worth is not the book value of its physical assets. In most accounting conventions it is the lesser of the income generating capability of the asset, its replacement cost with a modern equivalent asset, or the depreciated historic cost. The income

generating capability will depend upon the commercial environment in which the assets operate. The regulatory structure and the ability to predict future revenue is a key factor in determining the asset values. Regulators must be careful they do not make this argument circular in assessing asset values.

The individual assets may have little value despite the fact that they were installed at substantial cost. Their value comes from being operated together to provide a service in return for an income. If the income stream is insufficient to cover the cost of operation, maintenance and refurbishment, then costly assets have minimal value.

Many companies will show examples of how to value assets and these models are reasonable tools for establishing a baseline. However, it is important that utilities recognise that asset values calculated by such models may not reflect the "market value" for the assets, and that the revenue resulting from a reasonable return on that value may not be realised in practice if leads to unacceptably high prices.

Put simply, asset valuations and return on assets are tools to assist the understanding of a utilities revenue earning requirements: the revenue allowed will be determined by market conditions; and if it comes to a sale, the assets are only truly worth what somebody will pay for them. The physical value of the assets and the actual value are two different things - the later being dependant upon future earnings and therefore the regulatory framework.

On the other hand, if regulators consistently set asset values significantly below replacement cost, regulatees will have insufficient income and no incentive to replace life expired assets and quality of service will deteriorate. Once again there is a balance to be struck.

10. Trends and implications for South Africa

It is likely that regulation of distribution businesses in South Africa will contain specific incentives. However, we must learn from international experience that incentives are blunt instruments. When incentives are well structured and well

aimed they work with sometimes startling effectiveness, but this virtue can also be a problem. An incentive to cut costs that is not balanced by other duties – for instance to maintain security and quality of supply – can lead to a reduction in operational performance, albeit accompanied by an increase in financial performance. A reasonable balance must be found between such possibly conflicting objectives for sector participants.

In the UK the incentive based regulation scheme delivered real reductions in distribution charges in the order of 10-12% over a 10 year period, with ongoing improvements in quality of supply. However, in the early years a cautious approach was adopted and a similar approach should be considered for South Africa.

The problem of liquidity is as much a problem in South Africa as anywhere else in the World, if not more so. The regulator and Government must support REDs in combating non-payment and theft by giving the REDs the tools to tackle the problem, or alternatively give the REDs financial support. Unless a coordinated approach is adopted, there is a risk that some of the failures of reform experienced in the CIS could be repeated.

In a South African context it will be important for the Government and regulator to work closely with the REDs to determine the steps that can be taken to protect the poor, and to link this with the broader Government strategy for the disadvantaged.

11. Conclusions

The benefits of market reform have been recognised across the world, and there has been a general move towards reform of the electricity sector. A key part of the reform process is the role of the regulator. The definition of the role of the regulator, his objectives and obligations are vital to the development of the reform process.

The regulator can set objectives through incentives that are placed on distribution companies. These can be commercial incentives through rate of return regulation, or technical incentives through performance based regulation. Performance base regulation needs good

data sources, and the more sophisticated the control the more complex the data requirements.

There is a move from basic rate regulation towards more performance regulation across the world as markets mature, but incentives must be considered carefully. The setting of a target for one performance index may have an unexpected consequence for another part of the business. It is therefore important that for each market the optimum form of control be considered carefully, so that an appropriate level of complexity is selected to match the ability of the market to respond against the overall Government and regulatory objectives.

Whilst the regulatory framework may be complex, and there be many factors that are used to drive the price controls, there are two basic factors that influence customers: quality and price. Ultimately, it is these factors that also concern the regulator.

ⁱ Irish Government - Electricity Regulation Act, 1999, Condition 9.

Table 1 Comparison of performance and returns of companies in different countries

| Country | Availability CML/ SAIDI | Security CI/SAIFI per 100 customers | ROTA |
|--------------------------------|--|--|---|
| Britain | | | |
| North of Scotland | 99 | 128 | 8-9% ^I |
| South of Scotland | 69 | 68 | 8-9% ^{II} |
| England and Wales (average) | 60 | 76 | 8-9% ^I |
| London | 36 | 35 | 8-9% ^I |
| Republic of Ireland | 255 | 162 | Not known, but thought to be about 8% ^I |
| Australia - all DBs | 156 | 201 | |
| AGL | 86 | 143 | 12.3% |
| CitiPower | 41 | 68 | 14.2% |
| Powercor | 198 | 253 | 16.1% |
| TXU | 204 | 311 | 12.4% |
| United Energy | 66 | 131 | 12.5% |
| New Zealand | | | |
| Dunedin | 56 | 96 | 11.5% |
| PowerCo | 89 | 173 | 8.0% |
| Vector | 54 | 99 | 9.9% |
| United Networks | 81 | 153 | 10.0% |
| Singapore | 4 | 7.3 | Circa 8.5% |

^I The allowable return set by the regulator was actually 6.5%. The higher return demonstrates the ability of companies to respond to incentives

^{II} The allowable return set by the regulator was actually 6.6%. The higher return demonstrates the ability of companies to respond to incentives