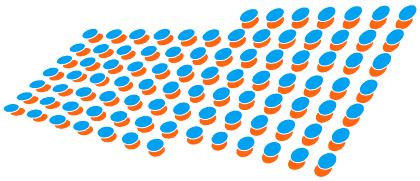

EnergyAustralia™

The Form of Price Control

This report was prepared with the assistance of Economic Insights Pty Ltd

12 November 1999

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THE FORM OF PRICE CONTROL

1 OVERVIEW

This paper is a qualitative assessment of forms of price control that could be used to regulate prices for electricity distribution and franchise retail businesses. It encompasses analysis of incentives with respect to economic efficiency, competition, effective and efficient regulation, environmental and commercial objectives.

The key focus of the paper is a comparison of the incentives under price cap and revenue cap forms of price control. Under price capping revenue is directly linked to volume of sales, thereby creating volume risk. However, there is no volume risk under a pure revenue cap. The incentives created in relation to volume risk (or lack of) underpin the differences in commercial behaviour created by the different forms of regulation.

Under price capping the incentive created is to sell more energy to earn more revenue. Higher volumes reduce the unit cost of energy, enabling even further sales. This provides incentive to achieve appropriate prices and incentives to achieve scale economies thereby improving allocative and productive efficiency. Under a pure revenue cap there is no volume risk and no incentive to push throughout. The only area where margins can be improved under a pure revenue cap is through reducing costs by restricting output to maximise profits.

The key finding of the assessment of price controls is that the current versions of the hybrid revenue cap for distribution and gross margin for retail businesses stifle drivers to achieve optimal economic efficiency. The current hybrid (fixed and variable revenue) approach substantially restricts the achievement of efficiency associated with volume expansion and ultimately creates incentives for sub-optimal investment and bypass. It also places too much emphasis on cost recovery as opposed to incentives to achieving efficient cost levels. At the extreme, economic literature has shown that fixed revenue caps lead to a higher price and lower level of output than even an unregulated monopoly.

Electricity networks face an increasingly competitive environment. In competitive unregulated markets the essence of competition is the rivalry over market shares and this requires the ability to expand volumes. Competitive neutrality is an increasingly important criterion for effective economic regulation. The convergence of energy markets places an imperative on establishing competitive neutrality between the gas and electricity markets. The adoption by IPART of different forms of regulation for the gas and electricity markets ignores competitive neutrality in the energy markets.

To the extent that the distribution and retailing market becomes more contestable, the existing hybrid revenue approach will be inconsistent with the best means of facilitating effective competition.

The current hybrid arrangements may indirectly contribute to environmental objectives through restricting electricity output (at the expense of efficient output levels). But the arrangements do nothing in terms of creating incentives to adopt efficient demand management practices. It is a well accepted economic principle that separate instruments and separate policies are required for each significant economic or social problem. The key environmental problem with respect to electricity is considered to be the greenhouse impact.

Separate policies and policy instruments are well underway for dealing with the problem at an economy-wide level. At a micro level there may be scope for interventions to deal with information or other market failures that lead to inappropriate choices about energy options.

A hybrid revenue option which has cost recovery, efficiency and environmental objectives is not likely to lead to an optimal outcome because of the lack of clear focus of the one regulatory device. In addition, moving towards a price cap approach with less focus on costs is considered to be less demanding in terms of information requirements as well as being more conducive to the achievement of economic efficiency.

In short there are two main policy objectives to be addressed. One is to supply any given level of electricity demand in the most efficient way. The second is to ensure the socially desirable level of electricity demand. It is generally sensible for separate policy instruments to be used to target separate objectives. In this case a revenue cap is being used to meet two major policy objectives, and in the process comprising the extent to which either objective is being met.

Incentives created under a revenue cap are in conflict with normal commercial behaviour and economic efficiency based on scale economies. These are the main but not the only reasons for introducing price capping as the preferred form of price control.

The paper begins with a brief discussion of the criteria for assessing price controls. It then outlines a general economic framework for assessing the key effects for the main forms of price controls that are relevant in most regulatory situations. The existing arrangements for the retail and the network monopoly businesses are then examined in more detail based on the general framework. As the existing arrangements have been largely motivated by demand management concerns, a separate analysis is provided on addressing these issues. The final section contains a brief review of overseas experience.

A summary of the assessment with respect to each of the main price or revenue control options is provided in Table 1.

TABLE 1: ASSESSMENT OF PRICE CONTROL OPTIONS

Price Control Measure	Efficiency			Competition	Regulation	Environment
	Allocative	Productive	Dynamic			
Price basket	Incentives for tariffs to converge to efficient prices (with appropriate weights). Most effective with a small and stable number of prices. Enables price adjustments which benefit both firm and customer.	Strong incentives to reduce costs and maximise scale efficiencies. Utility earnings may be variable, but lower risk of price volatility for customers. Supports incentive system focussed on efficient costs rather than actual costs.	Loss of flexibility if formula can not accommodate new products and prices. Can be addressed with separate baskets for new products. Incentives for prices to converge towards efficient prices. Bypass is not an issue.	Strong incentives to compete but some complications with new products/services. Facilitates competition in new geographic areas.	Simplicity of operation. Use of historical data greatly reduces regulatory cost burden. Limited impact of variations between forecast and actual demand. New products create complications.	Greater freedom to stimulate demand may lead to higher energy consumption. Regulation of distribution prices is not the best means to achieve environmental goals.
Revenue-yield	Incentives for inefficient prices.	Incentives to reduce costs.	Considerable flexibility to respond to new market developments, as new tariffs and products can be rolled into the control. Unexpected loss of large low-cost customer can compel inefficient price changes.	Considerable scope to compete through price, but allocative inefficiencies associated with incentives for inefficient prices.	Regulator does not need to set prices. However, prices are set before volumes are realised, so ex ante revenue is uncertain. Unexpected volume changes create complications. Controls can be light-handed but entail inefficient prices, or heavy-handed entailing significant costs and inflexibility.	Similar to price basket.
Fixed revenue	Worst option in terms of incentives to set monopoly prices and restrict output. Strong incentives to reduce quality.	Incentives to achieve X-efficiencies but not efficiencies related to expansion of volumes. May be lower cost of capital through transfer of risk to customers.	Large economic inefficiencies as firm can not respond to non-price driven increases in demand. No incentive to avoid uneconomic bypass.	Dramatic reduction in incentives to compete. Reduced incentives to retain marginal customers and achieve allocative and productive efficiencies.	Needs volume forecasts and correction mechanisms. Simpler to regulate than hybrid, but risk of intervention very high if forecast volumes not well-based.	By restricting volumes to less than the unregulated monopoly outcome, emissions are reduced. However, no incentives for efficient demand side management.
Hybrid revenue controls (current arrangements)	Allocative inefficiency as incentives to stimulate demand are muted. Incentives for inefficient prices.	Restricts achievement of efficiency associated with volume expansion and competitive rivalry. May be lower cost of capital through transfer of risk to customers.	Reduced incentive for efficient investment. Risk of load-shedding leading to unit costs and prices higher than an efficient outcome.	Price competition is restricted, with adverse impact on productive efficiency. Restricts competition in new geographic areas.	Hybrid arrangements require considerable information, normally well in excess of that required by the tariff basket option.	Output and therefore emissions less than with tariff basket. However, no incentives for efficient demand management.

2 CRITERIA FOR ASSESSING THE FORM OF PRICE CONTROL

IPART will likely base its recommendations for the form of price control for the distribution business regulation on the National Electricity Code and requirements under section 15 of the IPART Act. The criteria are summarised in Box 1.

BOX 1 NATIONAL ELECTRICITY CODE AND IPART CRITERIA FOR DETERMINING THE FORM OF REGULATION

The Terms of Reference for this review require the Tribunal, *inter alia*, to base its recommendations on the National Electricity Code. Consistency with the objectives and principles of economic regulation stated in the Code is therefore a key consideration in selecting the form of control. In summary, the Code requires that the regulatory regime seek to:

a) establish an efficient and cost-effective regulatory environment
b) establish an incentive-based regulatory regime which
   (1) provides an equitable allocation between network users and network owners of efficiency gains reasonably expected to be achievable by the network owners.
   (2) provides for a sustainable commercial revenue stream which includes a fair and reasonable rate of return to network owners on efficient investment, given efficient operating and maintenance practices.
c) prevent monopoly rent extraction by network owners
d) create an environment which fosters an efficient level of investment within the network sector, and upstream and downstream of the network sector
e) create an environment which fosters efficient operating and maintenance practices
f) create an environment which fosters efficient use of existing infrastructure
g) give reasonable recognition to pre-existing policies of governments regarding the network asset values, revenue paths and prices
h) promote competition in upstream and downstream markets and promote competition in the provision of network services where economically feasible
i) ensure reasonable regulatory accountability through transparency and public disclosure of regulatory processes and the basis of regulatory decisions
j) achieve reasonable certainty and consistency over time of the outcomes of regulatory processes, recognising the adaptive capacities of Code participants in the provision and use of network assets
k) accept reasonable and well defined regulatory discretion which permits an acceptable balancing of the interests of transmission network owners.

The Tribunal will base its report on the provisions of the Code. In addition, the Terms of Reference require the Tribunal to report on matters to be considered under section 15 of the IPART Act. This section sets out the factors that the Tribunal must consider in making determinations on electricity pricing matters referred to it. In summary it requires the Tribunal to consider:

a) the efficient costs of providing the relevant services
b) the protection of consumers from the abuse of monopoly power
c) the appropriate rate of return and payment of dividends to the owner
d) the impact of pricing policies and required capital expenditure on capital structure and funding requirements
e) the promotion of competition in the supply of electricity services
f) standards of quality, reliability and safety of services
g) the social impacts of its determinations and recommendations
h) the impact of pricing policies on ecologically sustainable development and considerations of demand management and least cost planning.

These considerations are broadly compatible with the Code objectives. The IPART Act refers specifically to environmental and social factors. Although the code refers more generally to the "public interest", this encompasses environmental and social factors.

Source: IPART 1999

The National Electricity Code emphasises economic efficiency, competition and regulatory effectiveness but also refers more generally to the "public interest" which encompasses environmental and social factors. The criteria in the IPART Act encompass various aspects of economic efficiency but also include specific consideration of social impacts and environmental effects including considerations of demand management and least cost planning.

Attempts to specifically address social and environmental considerations under the IPART Act, above all other considerations, will introduce complications and conflicts when IPART has limited regulatory tools. First best policy would assign responsibility for objectives not associated with economic efficiency to other agencies or policy instruments. However concern about environmental effects was the main reason why the hybrid revenue cap and fixed margins regulation was adopted. As stated by IPART:

Setting a cap on overall revenue or margins rather than average prices greatly reduces the link between revenues and sales of electricity. This significantly reduces the incentive to promote electricity sales and increases the range of demand management and energy efficiency options which are commercially feasible. (IPART 1996, Overview p 10).

Under the IPART Act, there is a requirement to focus on environmental issues as well as economic and other issues. Under the National Electricity Code the emphasis for regulating of the distribution businesses focuses more on commercial and economic issues.

The remainder of this section defines key aspects of criteria with respect to efficiency, competition, effective regulation and social and environmental considerations. Subsequent sections define key options and assess these options according to the criteria.

2.1 ECONOMIC EFFICIENCY

The basic forms of economic efficiency can be defined as follows —

- **Allocative efficiency** refers to producing the level, mix and quality of services that are of maximum benefit to society.

- **Productive efficiency** refers to producing at minimum cost. This means ensuring that the cost and productivity of inputs are consistent with efficient practice.

- Productive and Allocative efficiency have both static and dynamic aspects. **Dynamic efficiency** refers to activities and decisions that ensure efficient outcomes over time.

Key aspects of efficiency to consider when assessing the form of price control are —

- the control of the monopoly outcome of higher prices and lower outputs (and associated higher profits) compared with the competitive outcome (this encompasses situations where inefficient prices lead to uneconomic bypass);

- incentives to produce at inefficient (high) cost levels;

- incentives to alter the mix and quality of services relative to an efficient outcome;

- incentives to alter the mix and level of investment relative to an efficient outcome.

Properly defined the efficient outcome should also take account of environmental impacts that are detrimental to society. Social impacts require separate consideration and valuation of the impacts on different segments of society. This is difficult because it requires value judgements about whether the same dollar effect is more important for one segment of society than another. Social and environmental effects are considered separately to (other) economic efficiency effects.

There is a strong theoretical and empirical basis that competition is generally the best means of ensuring the various aspects of efficiency. However the existence of natural monopoly and the problems in markets where there are just a few competitors temper the form of regulation and competitive arrangements that are desirable.

The form of price regulation may restrict the nature and extent of competition. This highlights the importance of the **competitive neutrality** aspects of incentive regulation. IPART refers to this as neutrality between alternative options for meeting customer needs.

Although "competition" is identified as a separate criterion it is important to recognise that it is a means to the end of achieving economic efficiency. This means that there is overlap in the effects that are reported with respect to each option.

2.2 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

As noted the efficient outcome should also take account of environmental impacts that are detrimental to society. However this is normally very difficult in practice as is the evaluation of social effects.

Key factors to consider are —

- the seriousness of the problem relative to any conflicts with other efficiency considerations;
- the roles of other agencies and policies in addressing social and environmental problems; and
- the directness and effectiveness of the measure in addressing the particular social and environmental problem.

As environmental considerations have been a critical factor in the adoption of the current controls this paper will focus more on environmental effects than social effects.

The IPART Act requires the Tribunal to consider "the impact of pricing policies on ecologically sustainable development and consideration of demand management and least cost planning." This does not mean that it should necessarily consider environmental effects as the key factor in choosing a particular price option. There are other agencies that have key responsibilities for the environment but it is IPART that is the key regulatory agency with respect to other aspects of economic efficiency related to the electricity industry in New South Wales. In this respect IPART needs to be fully aware of the potential conflict between achieving certain environmental (demand management) objectives and other aspects of economic efficiency that are damaged by a particular regulatory option that is adopted. As discussed previously, the National Electricity Code places greater emphasis on achieving economic outcomes as is appropriate for distribution businesses.

2.3 EFFECTIVE REGULATION

Consistent with the National Electricity Code and the approach of IPART, effective regulation requires —

- transparency of processes and decisions;
- reasonable certainty and consistency over time;
- reasonable and well defined regulatory discretion;
- efficient administration and low regulatory cost;
- minimal opportunities for disputes and gaming.

The problems and costs associated with the public utility monopoly approach are well recognised. But there is a danger that enormous social costs could be incurred when regulation is ineffective. These costs entail the direct costs associated with running a regulatory agency and regular reviews and the indirect costs if the regulatory arrangements create significant incentives for an inefficient level and mix of economic activity and investment.

3 ASSESSMENT OF KEY PRICE OR REVENUE CONTROL OPTIONS

3.1 PRICE BASKET

A "weighted price" or tariff basket" approach entails setting a weighted average of prices for individual components within a specified basket of services rather than on an unweighted average basis. Under the tariff basket, the allowed revenue received from each additional unit sold varies by the actual tariff for that unit rather than an unweighted average tariff (as occurs under an average price or revenue yield approach).

A pre-determined average is specified at the start of the control period. The weights for each tariff are normally the shares of revenue or quantities in prior years, with the weights moving over time. Within the limits of the price level defined by this formula, the firm would be able to change the price structure.

Simple example:

Service A: revenue shares equal to 2/3 for a $0.04/kWh service
Service B: revenue shares equal to 1/3 for a $0.02/kWh service

Allowed price per unit is $0.034/kWh - the weighted average of the two services. Individual prices could adjust provided the weighted average is not exceeded.

The allowed price level would be adjusted by a formula that is related to the development of prices outside the firm's control and to a productivity factor (a CPI-X factor).

The tariff basket approach has been adopted for telecommunications in the UK and US. The Victorian Office of the Regulator General has flagged adopting the tariff basket approach in a Discussion Paper prepared for a meeting in June.

ALLOCATIVE EFFICIENCY

Economic literature provides supporting arguments for tariff basket controls having the advantage of creating incentives over time for tariffs to converge to efficient prices (ie Ramsey pricing). There are numerous authorities that demonstrate this property (see Vogelsang 1988 and references provided in Citipower 1999).

As will be discussed later, under average price caps there is an incentive to push sales of high margin services (by lowering their price) and discourage low margin services (by increasing the price) in order to a earn higher overall revenue from the regulated price cap. Since each unit earns the same average price cap the utility is inclined to sell the high margin service. While this is profit maximising behaviour under this set of rules it is inclined to result in allocative inefficiency i.e. prices where the efficient mix of services is distorted.

The tariff basket overcomes this perverse incentive by only allowing a weighted not average increase. In order to achieve efficient prices, the weights need to be proportional to the quantities that would be sold at efficient prices (Green and Pardina 1999, Citipower 1999). If this condition holds efficient prices will be chosen by the company since they will be consistent with profit maximisation.

Tariff baskets work well when there are a small and relatively stable number of prices (Green and Pardina 1999 and Green 1997). Gaming and manipulation of the basket is more likely with several products. However this is not viewed as a problem within network services.

Tariff basket regulation enables the firm to adjust prices to demand conditions in a way that is beneficial to both the firm and customers. This is because under tariff basket regulation consumers can always buy the same basket as in the previous year for the same or smaller cost and also have the option of purchasing a different basket while firms can still adjust prices, within the constraint of the tariff basket.

PRODUCTIVE EFFICIENCY

There are strong incentives to reduce costs through X-efficiency improvements as well as maximising scale efficiencies. Utility earnings may be more variable than under revenue cap controls. This is due to the volumes being more variable than forecast. However there is a lower risk to consumers of price volatility compared with revenue control options.

Compared with other options, price caps can be more readily incorporated into an incentive system focussed strongly on efficient costs. Provided there are not too many products in the basket, price control approaches provide the opportunity to design a system that would provide the strongest incentives to achieve productive efficiency.

DYNAMIC EFFICIENCY

The main disadvantage of tariff baskets is that the formula can be too rigid unless it can be adjusted to introduce new products and prices. For the distribution business this would not appear to be a significant problem. In any case, new products could be handled with separate baskets.

Under the threat of bypass and loss of revenue, the tariff basket approach creates an incentive for the utility to retain the bypass proponent as a customer. The utility will have an incentive to price at the marginal cost. Under a pure revenue cap there is no such incentive as prices to other customers can be readily raised. A loss of volume will not impact on the total revenue.

This forces the utility to try to maintain the customer in order for the customer to contribute to fixed costs. Overall, tariff baskets create incentives for prices to converge towards marginal costs. This contributes to dynamic efficiency by deterring uneconomic bypass.

Of all the price and revenue control methods the tariff basket approach leads to the most efficient outcomes.

COMPETITION

There are strong incentives to compete with efficient prices but some complications occur if there are new products/services. As noted this can be handled with separate baskets.

New geographic markets do not pose any constraints with tariff basket controls thereby facilitating geographic competition (inset networks).

REGULATION

Simplicity of operation is one of the greatest advantages of the price basket approach. The use of past historical data on prices and weights greatly reduces the regulatory cost burden. In addition there are no under or over recovery balances to administer.

Since there are incentives to offer efficient prices and provided the cap is not too tight variations between forecast and actual demand conditions will have minimal implications compared with other options. The risk for the utility is that volumes fall below forecast thereby reducing revenue.

ENVIRONMENT

The tariff basket approach is not designed to meet direct environmental objectives. Since this form of control drives efficient output it has the potential to lead to greater consumption of energy ceteris paribus.

However, as argued elsewhere in this section there are better options for dealing with environmental and demand management concerns than through the form of price control.

3.2 REVENUE-YIELD

Under a revenue-yield control, a cap is placed on the average revenue per unit and this is allowed to vary by a CPI-X component. The average revenue is calculated by dividing total revenue by total output. There must therefore be an homogeneous measure of output.

Under the control the revenue of each individual unit is not regulated provided the overall average revenue is less than the maximum. This provides considerable flexibility in setting prices. This type of approach is currently applied in Victoria. However, ORG has flagged the adoption of a tariff basket approach.

ALLOCATIVE EFFICIENCY

The allocative efficiency incentives created are poor. All volumes receive the same average price cap. As profits are not controlled (at least until the next review period) this means there will be an incentive to lower prices for more profitable customers and raise prices for less profitable customers. In other words there are incentives for relative prices to diverge from marginal costs.

This creates a distortion whereby the mix of services will move towards the high margin service thus creating more demand for that service.

PRODUCTIVE EFFICIENCY

As with most forms of price control there are incentives to reduce costs.

DYNAMIC EFFICIENCY

New tariffs and products can be rolled into the control (more easily than under the tariff basket) giving considerable flexibility to respond to new market developments.

The unexpected loss of a large amount of customer volume, say through bypass, can lead to violation of the average price constraint. This could compel price changes for other customers that are inefficient. This does not occur under the tariff basket approach.

COMPETITION

There is considerable scope to compete through price but there are allocative inefficiencies associated with the incentives for inefficient prices.

REGULATION

The main advantage is that individual prices do not have to be controlled by the regulator.

However, a key disadvantage is that prices have to be set in advance by the firm, but the average revenue can only be checked when volumes are known. This requires forecasts of volumes and correction factors to reduce or recover excess or inadequate revenue. This creates a considerable regulatory burden and adjustment could lead to greater price volatility than with a tariff basket. There would also be scope for gaming in relation to the forecasts.

Unexpected changes in the volume mix can complicate the administration of the control.

The control will also be complicated if constraints are required to combat the incentive to lower prices for more profitable customers since profits are not controlled.

The cost of administration and regulatory intervention would depend on the extent to which adjustments would be made if volumes or profits were different to those assumed in formulating the control.

Revenue-yield controls can be applied in a light-handed way (entailing the scope for inefficient prices) or in a heavy-handed way (entailing significant regulatory costs and inflexibilities).

ENVIRONMENT

The situation is similar to a price basket control.

3.3 FIXED REVENUE CAP

A fixed revenue or "pure revenue" cap sets a maximum revenue that may be collected over a certain period of time. The revenue cap operates as both a ceiling and a guarantee of revenue. If actual revenue earned is different to the regulated revenue cap then there is an adjustment in the following year.

ALLOCATIVE EFFICIENCY

A fixed revenue cap entails the worst outcome in terms of incentives to set monopoly prices and restrict output. Crew and Kleindorfer (1996) show that with an absolute revenue cap the price and quantity combination will be worse than the unregulated monopoly outcome.

The intuitive proof is as follows. If the regulated revenue is greater than or equal to unregulated monopoly revenue then the monopoly price and output will occur since this is consistent with the unregulated profit maximisation outcome and will be preferred to other outcomes and allowed by definition.

If the regulated revenue is less than unregulated monopoly revenue the monopoly price will not be feasible. In this situation prices must rise above the unregulated monopoly level and volumes decline below the unregulated monopoly level so that revenues decrease. In other words there is a move further away from the preferred unregulated outcome to meet the regulatory constraint. In order to achieve lower revenues volumes must decline proportionately more than prices rise such that revenues fall. This occurs because demand in the relevant region will be elastic (a condition for an unregulated profit maximising monopoly outcome) so that prices must rise if revenues are to fall.

The outcome is worse than an unregulated monopoly since output is less and prices are higher.

It is noted that there are incentives to reduce quality under price and hybrid revenue controls however fixed revenue controls may contain stronger adverse incentives with respect to quality because there is no scope to increase profits through volume expansion.

PRODUCTIVE EFFICIENCY

There will still be incentives to achieve X-efficiencies through the application of the (CPI - X) term but not to achieve efficiencies that are linked to an expansion in volumes. The realisation of economies of scale by maximising the throughput of the electricity network is an important source of productive efficiency. The pure revenue cap represents the worst outcome because it completely restricts the ability to achieve more efficient use of the network by maximising throughput and lowering unit costs.

To the extent that revenue caps lower earnings volatility they reduce risk and the cost of capital. However much of this reduced risk is transferred to consumers through higher prices as they lose from the restrictions on scale efficiencies.

DYNAMIC EFFICIENCY

With an absolute revenue constraint the firm is not able to respond to non-price driven increases in demand. This is likely to entail large economic inefficiencies to the extent that the value of ***unmet demand*** was in excess of the marginal cost of supply.

There is also no incentive to avoid uneconomic bypass since lost revenues can be recouped with higher prices. This is to the detriment of all customers and the bypass proponent. This issue is explored further on.

COMPETITION

When revenues are capped there is a dramatic reduction in the incentives to compete. There will also be reduced incentives to retain marginal customers to the extent that prices can in any case be increased for captive customers. This in turn reduces the incentives to achieve productive and allocative efficiencies.

REGULATION

Volume forecasts and correction mechanisms are needed. There may be disputes and strong incentives for gaming with respect to the forecasts.

The method is normally simpler than hybrid revenue options to regulate. However the risk of regulatory intervention is very high where forecast volumes and volumes justified by non-price driven demand diverge.

ENVIRONMENT

By restricting volumes to less than the unregulated monopoly outcome certain environmental objectives are indirectly met. However the control does not create any incentives to undertake efficient demand side management. This issue is discussed further in section 5.

3.4 HYBRID (FIXED AND VARIABLE) REVENUE CONTROLS

Hybrid revenue controls contain a fixed revenue component combined with variable components that reflect annual revenue drivers. The fixed and variable components can correspond to fixed and variable cost components.

Hybrid revenue controls contain a number of adverse elements associated with fixed revenue controls.

The current arrangements in NSW constitute a hybrid revenue control. More detailed assessment of the specific controls in NSW is provided in the following section.

ALLOCATIVE EFFICIENCY

Depending on the form of the control the incentives to increase revenue by stimulating demand are muted. To the extent that some unmet demand would have paid more than the marginal cost of supply there will be allocative inefficiency.

There will be an incentive to provide services to high profit customers as opposed to expanding in accordance with marginal costs. There will be incentives to lower prices for high profit customers and increase them for low profit customers. The scope for this will depend on the form of the control and any side constraints.

PRODUCTIVE EFFICIENCY

Since the control discourages the use of energy, productive efficiency will not be achieved if there are unexploited scale economy efficiencies.

Hybrid measures reduce earnings volatility by more than price controls but less then fixed revenue controls. This may be reflected in a lower cost of capital. However this may not be true if revenue changes do not track costs well. Depending on the form of the control lower risk to the firm could be offset by higher price risk to customers and consumers lose to the extent there are unexploited scale efficiencies.

DYNAMIC EFFICIENCY

As noted by IPART the arrangements reduce the incentive to supply volumes. Hence they reduce the incentive to invest. In addition the arrangements create an incentive to shed load since there are reduced incentives to supply volumes per customer. This can entail higher unit cost and higher prices than an efficient outcome.

Under the hybrid approach there is no incentive to avoid uneconomic bypass by lowering prices to marginal costs.

COMPETITION

By restricting the scope to compete on price, competition is restricted and this in turn has adverse implications for productive efficiency. This issue is discussed in the next section.

REGULATION

Hybrid arrangements require considerable information with respect to the appropriate coefficients and forecasts for the control equation. It is considered that this information is normally well in excess of what would be required for a tariff basket approach.

The information requirements depend on the form of the equation. Usually customer numbers, volumes and other indirect indicators of marginal costs are required. If a number of customer categories are specified there are considerable administration costs in tracking actual numbers in each category.

If the formula is supposed to cover the costs of non-price driven demand and the equation is a poor representation of such costs the risks of regulatory intervention and associated costs will be high.

ENVIRONMENT

Hybrid controls restrict output more than tariff basket controls and this may be consistent with environmental objectives.

However the control does not create any incentives to undertake efficient demand side management.

3.5 RETAIL GROSS MARGIN

The current arrangements regulate revenue at the distribution level and a gross profit margin at the retail level. The regulation of gross margin allows the pass through of the costs of electricity purchases, network charges and NEMMCO fees. As full retail contestability is due to start in January 2001, the regulation of franchise retail prices is less of an issue than the regulation of monopoly network services (assuming no ongoing price regulation post-contestability).

The gross margin approach limits the risk of changes to exogenous costs since they are passed through at actual cost or deemed cost (i.e. electricity purchases).

ALLOCATIVE EFFICIENCY

Depending on side constraints there will be profit incentives to reduce prices and increase services for high profit customers and increase prices and reduce services for low profit customers.

PRODUCTIVE EFFICIENCY

The control of a margin as opposed to control of a final price reduces the risk for the retail business but may also diminish the incentive to achieve productive efficiencies if there is a large fixed component in the gross margin formula.

4 EVALUATING THE CURRENT ARRANGEMENTS IN MORE DETAIL

4.1 DESCRIPTION OF THE CURRENT ARRANGEMENTS

The current price control arrangements for electricity entail a hybrid revenue equation for distribution and profit margin equation for retailing.

The maximum network revenue caps are currently regulated by a formula that contains a fixed component, components to represent customer driven demand, a volume component, a component for kilometres of line for rural distributors, a loss adjustment factor and a CPI-X factor.. The revenue level is first determined based on current costs including allowable cost of capital components. The coefficients are set to recover this revenue. Annual revenue is then allowed to change in line with the formula.

The revenue drivers in the formula are supposed to reflect non-price driven changes in costs.

There are also side constraints on individual customers' bills which greatly restrict the scope for individual price increases.

4.2 EVALUATION

The main motivation for a hybrid revenue control rather than a revenue-yield or price basket control was based on demand management concerns. As argued in the section below there are better theoretical and practical ways to deal with demand management concerns.

Accordingly this section focuses on the adverse economic efficiency incentives and regulatory costs associated with the current arrangements.

DISTRIBUTION BUSINESS

ALLOCATIVE EFFICIENCY

The incentive to provide the level of output consistent with the level in an unregulated competitive market is muted because there is very limited scope to stimulate demand with lower prices. The fixed component and the customer number components of the equation dominate the revenue cap calculation and greatly restrict the incentive to use price to stimulate demand.

An additional distortion to allocative efficiency incentives relates to the incentive to shift between customer segment brackets to take advantage of the greater contribution to profitability within different brackets. There would be incentives to increase prices for low profitability brackets and reduce prices for high profitability brackets to take advantage of the relative weights implicit in the coefficients. The side constraints would restrict the ability to adjust prices but there is still a profit incentive to facilitate movement between customer segments.

There may also be incentives to distort prices within brackets or offer complementary services to take advantage of relative profitability of the different customer segments.

Since large customers make a much greater contribution to revenue (and profitability) compared with small customers, there would be incentive to lower prices and provide other subsidised services to large customers and higher prices to small customers. This means that prices will diverge from efficient prices and are likely to be inequitable (in terms of the impact on the income distribution).

PRODUCTIVE EFFICIENCY

The existing arrangements give significant (albeit indirect) emphasis on cost recovery. If cost recovery is the objective more accurate measures of long run marginal cost could be applied at a lower administrative cost. However a price control option would give more emphasis to efficient costs. Under the hybrid revenue cap the CPI-X efficiency factor is also applied but revenue is allowed to increase in line with certain drivers that are related to cost, so the incentives to contain costs are less than with a price control.

DYNAMIC EFFICIENCY

The formula is intended as a surrogate for the long run marginal cost of supply of distribution services. However the long run marginal costs are based on planned approaches not market based pricing signals. This creates a problem in terms of investment incentives. Since the incentives to supply volumes per customer are greatly muted, there may be incentives to not meet demand.

Electricity usage is not strongly related to the costs of running the network. Typically the need to augment the distribution network relates to the need to meet peak demand in the summer period. Additional capital expenditure at the points of maximum stress is required to maintain the safety and reliability of electricity supply. A peak demand component to reflect such costs would be superior to the energy component in the equation.

This reinforces the point that the arrangement reduces the incentives to build appropriate load and even creates incentives to shed load.

COMPETITION

As argued above hybrid controls restrict competition relative to price controls to the extent that volumes are restricted. In addition, there is little incentive for uneconomic bypass to be mitigated by a network utility. An economic bypass proposal is one where the proponent can avoid the network at a cost less than the network's marginal cost for providing a service to that customer. An uneconomic bypass option occurs where the proponent goes ahead with bypass even though it will cost more than the network's marginal costs. Under the pure revenue and hybrid approaches there is little incentive for the network to negotiate prices to marginal cost because either:

- the revenue can be recouped from other customers; or
- as under IPART's arrangements the 'discount' or price reduction is taken off the revenue cap.

(As discussed earlier, this problem does not occur under a price cap approach because revenue is linked to sales. Instead prices converge to more economic prices).

There is a further aspect of competition that needs to be considered with respect to competitive neutrality between the electricity and gas markets. IPART has established different regulatory regimes for the gas and electricity markets. The price cap regime in the gas market is a deliberate attempt by the regulator to allow greater sales in gas to reduce per unit costs.

In the access determination for AGL's distribution network, IPART states that:

"Probably the most effective way for AGL to reduce under-recovery, will be to increase tariff market penetration. It is likely that the cost of gas will be reduced once competition reforms upstream are underway … thereby providing lower costs for AGL and an increased margin to offset the under-recovery" [1]..

IPART's intention in electricity however is to reduce the perceived bias against load management through the use of the revenue cap approach. The consequences of IPART's decisions in the gas and electricity markets are to distort competitive neutrality between the electricity and gas businesses. This divergence of regulatory approaches in converging markets where gas receives more favourable commercial incentives is inappropriate, especially since it appears that this issue should be one of government policy rather than an economic regulator's discretion. IPART's Draft Decision on the Access Arrangement for AGL Gas Networks Limited National Gas Systems in NSW, price caps are again adopted as the form of price control. This continues to give AGL a commercial incentive to grow the gas market thereby reducing unit costs.

The endorsement to push sales given by IPART to AGL places the electricity industry at a competitive disadvantage as it is not able to pass on the benefits of volume expansion to customers through lower prices to the same extent.

To create competitive neutrality in the energy market, IPART needs to recognise the impacts of the different treatment of the form of price control and that the National Electricity Code allows price caps to be applied to electricity networks.

REGULATION

All forms of price controls involve at least an initial assessment of the cost base and a reasonable return on capital in order to determine the initial price levels and price structure. However the current arrangements being "hybrid" in nature and being intended to broadly track key costs are considered particularly burdensome. There is also significant scope for disagreement and regulatory intervention.

An important administrative cost that exists with the current arrangements that would not exist with a price control cap is the need to track customer numbers in several segments.

[1] IPART (May 1997) Draft Determination on the Proposed Access Undertaking (as varied) of AGL Gas Networks Limited.

ENVIRONMENT

The approach may create incentives to restrict output but it does nothing in terms of generating incentives for efficient demand management. We argue below that its adoption for this purpose is misplaced and in conflict with economic efficiency and effective responses to environmental concerns and hence overall economic welfare.

In any event the impact that the distributor can have on demand is very limited. As stated by IPART in the 1996 Electricity Prices determination (Report no.2.2 pg17):

In its Interim report the Tribunal proposed that regulation should:

- *Focus the incentive for energy efficiency on those best placed to provide it on a commercial basis. This suggests that the retail supply business may have primary responsibility for energy-efficiency because it has direct relationship with the customer.*

CONCLUSION

As argued more extensively in the next section, IPART has placed a disproportionately high focus on environmental issues at the expense of economic efficiency by adopting a hybrid revenue form of regulation for network services.

RETAIL GROSS MARGIN

The current arrangements regulate revenue for the retail business at the gross profit margin level. The costs of wholesale energy, ancillary services and network costs are passed through at cost (actual or deemed). The retailer earns a maximum gross margin which comprises fixed, energy and customer components very much like the network revenue cap formula.

The gross margin approach removes the risk to the retailer of changes in exogenous costs such as energy, network prices and ancillary charges. However these components need to be separately regulated.

IPART is proposing to apply a cap that fixes the retail gross margin as a percentage of sales and passes through costs. Its adoption is supported up until the full deregulation of the retail franchise market in January 2001.

ALLOCATIVE EFFICIENCY

Depending on side constraints there will be profit incentives to reduce prices and increase services for high profit customers and increase prices and reduce services for low profit customers.

PRODUCTIVE EFFICIENCY

A price cap provides more of an incentive for productive efficiencies as opposed to a gross margin cap. This is because the margin cap allows a fixed margin to be added to whatever costs are incurred whereas a price cap means that the retailer bears the risk of unexpected cost increases.

REGULATION

It is considered that a price cap is simpler to administer than a gross margin cap. The overs and unders account has been a further complication that has been costly to administer.

5 PROMOTING DEMAND SIDE MANAGEMENT AND ENERGY CONSERVATION

5.1 A RATIONALE FOR GOVERNMENT INTERVENTION

One of the key arguments for a revenue cap is its relatively favorable treatment of demand side management (DSM) and energy conservation. As summarized by IPART in 1996 —

"Setting a cap on overall revenue or margins rather than average prices greatly reduces the link between revenue and sales of electricity. This significantly reduces the incentive to promote electricity sales and increases the range of demand management and energy efficiency options which are commercially feasible." (IPART (1996), pp.10-11)

To explore the desirability of revenue caps as a means of supporting DSM, it is important to revisit the rationale for government intervention in this area.

Market failures mean that an unregulated market would adopt too little DSM. Commonly cited sources of market failure include —

- Externalities associated with adverse environmental impacts, such as from the greenhouse effect.
- Information failures. High transaction costs may deter users gaining the information required to minimize life-cycle costs. The so-called builder/owner and landlord/tenant problems are other forms of information failure. For example, a landlord may seek to minimize capital costs and hence rentals by buying the cheapest water heater, but the tenant is then left to pay the high operating cost of energy inefficient equipment.
- Failures in capital markets that prevent users borrowing the money required for energy efficient equipment (that tends to be relatively expensive up-front, but offers the lowest life-cycle cost).[2]

Government intervention that overcomes such market failures could increase the adoption of DSM initiatives and improve economic efficiency. But it is important that the intervention adopted is the most cost effective alternative and that any adverse impacts on other objectives of public policy are taken into account.

5.2 ADDRESSING THE ENVIRONMENTAL EXTERNALITY

For the NSW electricity industry, most adverse environmental impacts are from air and water emissions and the location of plant and electricity lines have so far proved reasonably manageable. Greenhouse gas emissions associated with electricity generation are likely to be the single most important environmental consequence of the industry in coming years. DSM initiatives have an important role to play in reducing greenhouse emission by reducing the units of electricity required.

[2] For a further discussion of market failures affecting the adoption of DSM initiatives, see Government Pricing Tribunal of NSW (1995, pp 10-12), NSW Government (1995, pp 51-55) and the Industry Commission (1991, pp 267-275).

Greenhouse policy has advanced considerably since IPART's 1996 decision to introduce revenue regulation. In November 1997 the Prime Minister released Australia's response to climate change, with a series of initiatives announced aimed at reducing forecast emission levels in 2010 from 28 per cent above the 1990 level to 18 per cent. In April 1998 Australia became a signatory to the Kyoto Protocol to the United Nations Framework Convention on Climate Change. This set a more formal target of limiting Australia's greenhouse gas emissions to 8 per cent above 1990 levels on average in the period 2008 to 2012. A National Greenhouse Response Strategy followed in 1998, containing further initiatives to reduce emissions in addition to those announced in 1997.[3]

The restructuring of the electricity industry has been seen as one of the key ways of improving the industry's greenhouse performance, along with measures to promote renewable energy (such as through the NSW Sustainable Energy Development Authority) and the introduction of efficiency standards for fossil fuel generation. Emissions trading is also receiving considerable attention as a way of managing greenhouse gas emissions. The National Greenhouse Response Strategy announced a commitment to assess options for establishing an emissions trading system in Australia with a view to deciding on responsibilities and a timeframe for implementation.[4] A number of consultation papers have been released since this commitment was made with the assessment of options continuing through to 2000. It is understood that considerable thought has been given to the development of an emission trading system for the NSW electricity industry.[5]

The benefits of tradable emission rights in managing emissions are well established. As noted by Department of Industry, Science and Tourism (DIST) —

"According to economic theory, tradable emission permits offer the benefit of achieving a specific emission target at least cost by enabling reductions to be made at the lowest marginal cost of abatement across participants in an emissions trading scheme." (DIST, 1998, p.v)

Emissions trading for greenhouse gases represent an attractive alternative to meeting the industry's environmental responsibilities. For example, rather than the industry trying to reduce electricity sold through DSM initiatives, it may be more sensible for the industry to reduce the greenhouse gas emissions per unit of electricity sold. *The role of a tradable emission system is to allow the market to determine which is the least cost option of meeting the required level of emissions. The government's role under emission trading is to set the environmental target and enforce compliance ¾ it doesn't have to define how the target is met*.

It is also important to realise that an emissions trading system greatly enhances energy sector planning. For some time the industry has sought to incorporate environmental values into its planning process, but doing so has been hindered by uncertainty in the emphasis that should be placed on environmental concerns. An emissions system helps make least cost planning more meaningful by providing a value for environmental impacts (where this is equal to the market price of a unit of tradable emissions).

[3] See the Commonwealth of Australia (1997 and 1998). Note that the Kyoto Protocol is yet to be ratified.
[4] Commonwealth of Australia, 1998, p 38
[5] See for example the NSW EPA's submission to the House of Representatives Standing Committee on Environment, Recreation and the Arts (1998).

Ultimately the value of the hybrid revenue cap as a means of improving the industry's environmental performance must be assessed relative to the alternative policy instruments. It is also important that IPART's decisions on environmental management are integrated with policy developments elsewhere. The Government Pricing Tribunal had earlier indicated its sympathy with this argument —

"The Tribunal considers that many of these (environmental) policies are matters better considered by the Commonwealth and State governments rather than an independent pricing regulator such as the Tribunal. Such policies are most effective when part of an integrated energy or environmental policy." (Government Pricing Tribunal, 1994, p 3)

We are not aware of any analysis showing that the hybrid revenue cap offers the highest benefit-cost ratio of the alternative policy instruments. Our assessment is that a system of emissions trading is a more attractive alternative, being a more certain and efficient way of managing the industry's greenhouse emissions.

It may be argued that the revenue cap must remain in place until any emission trading scheme or alternative policy instrument is in place. In this respect it is important to appreciate that Australia's target under the Kyoto agreement is a future target. While early action to reduce emissions will probably reduce the cost of meeting the Kyoto target, Australia is not obliged to take immediate action. However, the inefficiencies associated with the current hybrid revenue cap far outweigh the environmental benefits and do not support its continued use.

5.3 ADDRESSING OTHER FORMS OF MARKET FAILURE

It is also relevant to consider whether the other forms of market failure present a case for intervention to support DSM. Certainly the structure of the industry prior to the reforms of the 1990s added to a bias against DSM initiatives. For example, monopoly positions reduced the need for electricity suppliers to reduce the cost of energy and cost subsidies would have led to too much electricity being used at the expense of other forms of energy. But the recent structural reforms make it easier for the industry to pursue DSM (with electricity suppliers moving to being integrated suppliers of energy) and competition creates an improved incentive for electricity suppliers to pursue DSM to minimize user costs.

In a recent submission to the Victorian Office of the Regulator, CitiPower noted that —

"The rationale behind mandatory Demand Side Management (DSM) is that market failures prevent customers from undertaking cost-effective investment in energy efficiency.... Citipower believes that most reasons posited for these market failures lack merit.

The rationale for mandatory DSM programs is further weakened by the acceleration of competition. Competitive markets compel utilities to maximise non-regulated revenues, including revenues from DSM. Each distribution board will be especially motivated to pursue demand-management in the service territories of other distributors. Competitive energy service companies will also become more active. All of these factors suggest that competitive markets can largely be countered on to ensure that customers undertake cost effective DSM." (CitiPower (1999), p.36).

CitiPower cited an exception to this conclusion. They recognized that the potential for transaction costs associated with acquiring information can impede the adoption of DSM

initiatives and there was a valid role for customer awareness programs (CitiPower (1999), p.36). Our view is that if there are significant market failures that prevent the optimal level of DSM (in addition to environmental externalities), government intervention should directly address such market failures. For example, energy efficiency standards and customer awareness campaigns are in principle a better way to correct information failures than a revenue cap.

Crew and Kleindorfer (1996) argued the case as follows —

"Some advocates of revenue controls have argued that they are needed if energy conservation is to be encouraged. We would certainly not disagree with the view that if revenue controls are abolished current policies on energy conservation and demand-side management would need to be re-examined. While we favor the promotion of economically efficient conservation measures, DSM policies based on revenue controls are inefficient. Thus, along with the adoption of price cap regulation should go the reform of such DSM policies." (Crew and Kleindorfer, 1996, p.51)

5.4 PRICE CAPS AND DSM

It is recognised that a simple price cap has the potential to impede DSM, and any system of price caps would need to make provision for legitimate DSM initiatives. In some cases a sensible level of flexibility can prevent problems occurring. For example, consider a DSM initiative that involved the electricity provider leasing or hiring energy efficient equipment or lighting (on the basis that it reduces electricity use and overall costs). The adoption of such an initiative would be supported if electricity authorities could recover equipment rentals as a separate non-tariff item on the bill (eg similar to the way a phone rental is a separate item on a Telstra bill). The development of other ways of adjusting a price cap is beyond the scope of this report.

Adjusting a price cap to accommodate DSM initiatives creates a regulatory effort with associated risk of regulatory failure. The potential problems that may arise need to be weighed against the potential for regulatory failure from a revenue cap.

5.5 CONCLUSION

The interest in intervention to support DSM initiatives and reducing the environmental impact of the industry is well founded. But there are reasons for questioning if the current hybrid revenue cap is the best policy alternative.

In short there are two policy objectives to be addressed. One is to supply any given level of electricity demand in the most efficient way. The second is to ensure the socially desirable level of electricity demand. It is generally sensible for separate policy instruments to be used to target separate objectives. In this case a revenue cap is being used to meet two major policy objectives, and in the process comprising the extent to which either objective is being met.

6 EXPERIENCE OVERSEAS

Case studies, economic theory and empirical evidence suggest that cost minimisation is problematic under traditional US-style cost-based regulation. This arises from firms and regulators having different information, capabilities and objectives, with corporate objectives engaging in opportunistic behaviour to outwit the regulator. There are difficulties in monitoring and benchmarking the relevant variables, which leads regulators to fall back on precedent.

Regulatory policy changes, generally involving some form of price-cap regulation, have sought to avoid the inefficiencies associated with cost-of-service regulation. They have been accompanied by significant gains in efficiency, although it is not always clear how much of this was due to increased competition rather than improved regulation (Berg 1998).

In both the UK and the US, the facilitation of increased competition is increasingly seen as a major component of any utility regulation scheme. Many regulatory experts in both countries consider that price-cap regulation facilitates a move to more competitive markets, and has a number of other advantages.

UNITED KINGDOM

The UK has made significant use of price-cap regulation, with variations in approach related to specific industry circumstances.

Two options were proposed for regulating British Telecom (BT) on privatisation in 1984 — controlling prices by setting a maximum rate of return and imposing an output-related profits levy which provided an incentive to keep output high and prices low. The regulator successfully argued for a third option, an RPI – X price cap in areas where BT was expected to retain some monopoly power. The scheme was intended to focus consumer protection where it was most needed, be simple to monitor and avoid regulatory capture.

The BT scheme was expected to be temporary, replaced by effective competition. In practice, after 5 years the reach was extended and X was increased, based on predictions of BT's profits and rate of return. The intention was to eliminate BT's excess return over four years. This approach has much in common with rate-of-return regulation, but was designed to give BT a greater incentive to be efficient and to force it to take more risk.

When British Gas was privatised in 1986, it was also subject to price cap regulation, modified to allow pass-through of the price of gas, over which the company had no control (RPI – X + Y). In practice, falling gas prices were entirely passed on to consumers.

Price cap regulation was also adopted for the water industry, privatised in 1986. The form was RPI – X + Q, with X reflecting expected productivity increases and Q the cost of investment to meet quality targets. Yardstick comparisons were adopted when setting and reviewing price controls for each company.

Electricity distribution businesses in Great Britain were given RPI – X price controls on privatisation in 1990. The companies subsequently earned large profits. In order to reduce excess profits when the price controls were reviewed in 1994, an immediate price cut was imposed, backed by RPI – 2 controls. This was designed to combine acceptable total revenue

with a sensible price level by the end of the regulated period. In the event, continued excess profits and sharp increases in share market valuations led to a further 10 per cent price reduction in 1995, based on revised asset valuations (Green 1997).

In 1994 the electricity regulator also altered the form of control. Where revenue previously increased proportionately with the number of units sold, henceforth it would increase at half that rate, and be related to customer numbers rather than revenue. The rationale was that distribution costs did not move entirely with units sold, but that there needed to be an incentive for companies to seek out and meet the needs of their customers. It was considered necessary to avoid artificial disincentives in the distribution price controls to the companies' pursuit of energy efficiency, while retaining an appropriate marketing incentive (Office of the Regulator-General 1998).

While an alternative of profit-sharing has been proposed by some commentators, most regulatory experts support the price control system as giving companies an incentive to cut costs, with gains passed on to consumers after a short time. Further details on UK regulation are given in Table 2 (Green 1997).

TABLE 2: KEY FEATURES OF PRICE BASKET, REVENUE, AND RATE OF RETURN CAPS

Feature	Price Basket Cap	Revenue Cap	Rate of Return Cap
Constraint set by cap	Weighted average of prices cannot exceed cap	Revenues cannot exceed limit (related to output) set by cap	Tariff cannot predict a rate of return above regulated level
Coverage	Specified prices (line rentals, domestic calls)	Specified types of sales (such as to captive small consumers)	Regulated business's predicted revenues
Implementation required	A list of prices	Output measures	Tariffs that give revenue predictions
Weights on quantities	Set by regulator	Actual quantities	Predicted quantities
Price weights in cap	None explicit	Set by regulator	From tariff
Constraint on cross-subsidy tariff	Subsidiary cap required	Separate constraint required	Regulator could disallow
Opportunity for manipulation	Very small	Some (likely to be small in practice)	Some (likely to be small in practice)
Cost pass-through terms	Might be included in cap (difficult)	Simple to include in cap	Tariff might contain escalation clause
Correction factor	Not required	Required	Not required
Advantage	Simple to define and monitor	Allows constraint to respond to actual output and pass-through costs	Investors face lower risk, reducing cost of capital
Limitation	Needs a full list of prices	Needs homogenous output measures (revenues must be < output x weight)	Need predictions of revenues and costs for each new set of tariffs
Example	British Telecom	British Gas	US utilities

Source: Green (1997)

When Northern Ireland Electricity was privatised in 1993, a hybrid approach was adopted for the transmission and distribution businesses. The price control formula includes a fixed monetary component and a variable component which depends on the quantity transmitted and distributed. Both variables are subject to an RPI – X adjustment. This hybrid approach weakens the link between allowed revenue and volume, implying a reduced incentive to firms to adjust prices in favour of low marginal cost services in order to expand volumes. It also lessens any bias against participation in demand management programs as an alternative to network investment (Office of the Regulator-General 1998).

UNITED STATES

Price-based controls have been used extensively in the United States in recent years. Average price caps are combined with a regulatory approach in which efficiency measures are determined by the industry, rather than by the individual utility. Measures such as total

factor productivity are used to estimate trends in industry unit costs and set the value of X in the CPI – X price indexation formula. Individual utility revenues have no special relevance and are not considered explicitly. This approach, as described by Kaufmann and Lowry (1997, 1998), appears to be favoured by a majority of the United States regulators (IPART 1999).

Crew and Kleindorfer (1996) argue that as a result of increasing competition in the US electricity industry, traditional cost-of-service regulation is increasingly inefficient and unsustainable. There is a need for regulatory schemes that provide greater incentives for efficiency and eliminate current incentives for inefficiency. The authors preference is for price-cap regulation, which is compatible with the development of competition and offers significant improvements over traditional cost-of-service methods of regulation, provided that X factors are appropriately defined and that there is credible commitment by regulators. They argue strongly against revenue caps, which have a number of undesirable properties, including incentives to increase prices.

By contrast, price-cap regulation (PCR) encourages X-efficiency on the part of the firm and provides some protection to the monopoly's customers. With PCR under competitive conditions, the regulated company's profits are driven by increased X-efficiency and sales, providing strong incentives.

US states have adopted a great variety of regulatory plans for the telecommunications industry (Table 3). Sappington & Weisman (1996) argue that incentive regulation has great potential to provide substantial gains to all parties in the telecommunications industry, but that realising these gains depending on greater understanding of the impacts of incentives and constraints. In keeping with the UK experience, they argue that the best incentive plan for any particular jurisdiction will depend on the detail, on the goals adopted and on the regulatory resources available.

Price-cap regulation began to replace traditional cost-based regulation of the US telephone industry in 1989. By 1996, about 30 states had some form of price-cap plan (Tardiff & Taylor 1996). The trend to increasing competition requires regulations that facilitate an efficient transition to full competition in many markets.

TABLE 3: THE VARIETY OF REGULATORY PLANS FOR TELECOMMUNICATIONS IN THE US

State	Primary Form of Regulation
Alabama	Earnings Sharing
Alaska	Rate of Return
Arizona	Rate of Return
Arkansas	Rate of Return
California	Price Cap / Earnings Sharing
Colorado	Earnings Sharing
Connecticut	Rate of Return
Delaware	Price Cap
District of Columbia	Earnings Sharing
Florida	Earnings Sharing
Georgia	Earnings Sharing
Hawaii	Rate of Return
Idaho	Revenue Sharing
Illinois	Price Cap
Indiana	Price Cap
Iowa	Rate of Return
Kansas	Moratorium
Kentucky	Price Cap
Louisiana	Earnings Sharing
Maine	Price Cap
Maryland	Earnings Sharing
Massachusetts	Price Cap
Michigan	Price Cap
Minnesota	Earnings Sharing
Mississippi	Earnings Sharing

State	Primary Form of Regulation
Missouri	Moratorium
Montana	Rate of Return
Nebraska	Deregulation
Nevada	Earnings Sharing
New Hampshire	Rate of Return
New Jersey	Price Cap / Earnings Sharing
New Mexico	Rate of Return
New York	Earnings Sharing
North Carolina	Rate of Return
North Dakota	Price Cap
Ohio	Price Cap
Oklahoma	Rate of Return
Oregon	Price Cap / Revenue Sharing
Pennsylvania	Price Cap
Rhode Island	Price Cap / Earnings Sharing
South Carolina	Rate of Return
Tennessee	Earnings Sharing
Texas	Earnings Sharing
Utah	Rate of Return
Vermont	Rate of Return
Virginia	Price Cap
Washington	Rate of Return
West Virginia	Moratorium
Wisconsin	Price Cap
Wyoming	Rate of Return

Source: Sappington & Weismand (1996)

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