# Section III. Price structure

## Basics of rate design — pricing principles and self-selecting two-part tariffs

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### Overview

This overview of the basics of rate design in network industries should be read in conjunction with Mark Jamison's, 1997, more comprehensive write-up on rate structure. After describing some of the key concepts, we will examine in some detail the rationale behind rate structures that can reflect incremental costs, while still facilitating the recovery of fixed (often joint or common) costs. In competitive industries, overhead or joint costs cannot be 'allocated', they must be 'recovered where they can' based on a rate-making philosophy that recognises this fact. The second part of this paper describes the basic issues and problems of recovering these costs, with special reference to electric utilities in an increasingly competitive environment.

One approach is to adopt Two-Part Pricing schemes, one part reflecting capacity and distribution system charges and the other based on on-peak and off-peak energy costs. This approach eliminates distortions caused by average cost pricing, enabling customers to face the true costs of additional electricity purchases. Retail utilities have incentives to create contracts with their suppliers that better reflect cost-causation. During the transition; to this new pricing structure, integrated utilities could base the capacity and system charge price on a Historical Customer Baseline (HCB), so that such customers continue to contribute a 'share' of overhead (or non-usage sensitive) costs. On-peak and off-peak prices are then set at incremental cost. Cost recovery is achieved via appropriate calculation of the monthly fee. Of course, if competitors can offer a better 'deal', the HCB would need to be modified to minimise uneconomic bypass of the incumbent. (See Della Valle and Bidwell, 1995).

A second approach focuses on differential demand elasticities. Customers who have demands which are insensitive to price have few alternative sources of supply. Higher prices to these 'inelastic' demanders represent one way to obtain revenues that can be applied to shared resources (overhead costs). While Ramsey pricing (the technical term for this approach) raises political issues, the outcome may be preferable to losing those customers who face competitive alternatives (including co-generation)[1]. But first, we need to review the basics of rate design.

[1] See Stephen J. Brown and David S. Sibley, The Theory of Public Utility Pricing (Cambridge University Press) 1986, for a thorough discussion of Ramsey pricing.

## Cost causation and price signals

When considering efficient pricing and investment, if neoclassical economists agree on one point, it is the following: rate design matters[2]. A strong case can be made for regulators to allow some discretion in rate design, since firms have far greater information on cost structures and demand patterns than is available to the regulatory. When cost allocation manuals substitute for estimates of forward-looking incremental costs, inefficiencies arise. In recognition of the important role of price signals, a wide range of rate designs has been analysed. The following represents a partial listing of the topics addressed in the literature on optimum pricing and capacity:

Marginal cost pricing. The allocative efficiency consequences of such pricing are well known. For example, the financial viability of the firm may require a subsidy, or more complicated rate designs (such as multipart pricing). Furthermore, short run and long run marginal costs will differ — so while the former serve as the standard for pricing decisions, the latter are relevant for comparing alternative investment patterns — as when alternative providers have different production technologies.

Cross subsidisation and regulation as taxation. Cross subsidisation can be a deliberate regulatory objective as some customers cover the incremental costs of serving favoured customers. Alternatively, it can stem from inappropriate allocations of fixed or variable costs. A related concern is transfer pricing which increases the reported costs of the regulated firm. This device might be used to shift profits from the regulated firm to an unregulated subsidiary. Such shifting raises a dilemma, because when regulators mandate complete separation among business units in response to this problem, the firms can lose economies of scope. The result is higher costs.

Discriminatory pricing and demand separation. The ability to separate markets and prevent resale is facilitated by customers being hooked up to utility distribution systems. Since consumers with inelastic demanders are often the ones regulators are trying to protect from monopoly power, commissions often will overlay cost allocation regulation upon rate level regulation — preventing ‘undue’ discrimination.

Ramsey pricing. If the firm can identify different customer groups and charge different prices to the various customer classes, Ramsey pricing can be utilised to minimise economic misallocations. However, such a pricing policy (charging more to those with relatively inelastic demands) might still be viewed as unduly discriminatory, even though the firm does not realise excess profit. Citizens might prefer other price configurations for the multi-product natural monopolist. Furthermore, there is no guarantee that Ramsey prices are sustainable in the long run: some coalition of customers could end up paying more than the stand-alone costs of serving them — leading to self production and the loss of their business. The technical literature on Ramsey pricing is ably summarised in Sheshinski, 1986, and Braeutigam, 1989. Mitchell and Vogelsang, 1991, apply much of this literature to telecommunications pricing.

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2 Some of the material in this section originally appeared in Berg and Tschirhart, 1995, pp. 310–330. For an excellent survey of rate design, see Arnold, et.al., 1995.

Predatory pricing and market dominance. If high cost suppliers are driven from the market due to entry by a multiproduct natural monopoly, resource allocation is improved. However, these suppliers may claim predatory pricing if the output is produced by an unregulated subsidiary or by the regulated firm. Producers of substitute products could argue that revenues from the utilitys captive consumer groups (or regulated products) cover costs associated with products subject to competition. However, one ought not accept fully-distributed costs as indicators of subsidisation. Furthermore, when a group of firms is under industry-wide regulation and when price is based on industry average costs, the presence of high cost firms could increase the profits of efficient suppliers (Daughety, 1984). The removal of such cost-based pricing would reduce prices and lead to bankruptcy or consolidation of inefficient firms. Such a development would again bring forth charges of predation, but these charges would be groundless.

Cost allocation regulation. A multiproduct firm is charged with allocating its total costs, including common costs, over its various products in an effort to ensure that revenue from the sale of each product covers its allocated cost (Braeutigam, 1980). This area may be one of the more under-analysed in the field of regulatory economics. Regulators have often viewed fully-distributed cost allocations as techniques for ensuring that customer groups are not unfairly burdened with shared costs. Besides leading to potentially undesirable prices and cross subsidies, there is the danger that separations procedures and cost allocation manuals may foster an unwarranted feeling of accomplishment among regulators. Sweeney, 1982, finds that output-based allocation schemes can yield perverse results: we end up with prices such that one or more of them can be lowered — improving welfare without decreasing the monopolist's profit. In addition, we can have relatively high prices in unregulated markets. Finally, Cabe, 1988, illustrates that any output vector can be achieved by some fully-distributed cost method.

Peak load pricing and intertemporal patterns of demand. This literature has a rich history. The early contributions by Boiteux, 1960 and Steiner, 1957, stimulated analyses of intertemporal demand patterns. The production technology (involving fixed or variable coefficients and with and without scale economies) drew upon actual engineering studies of cost structures. Diverse technologies, interdependent demands, selection of rating periods and other issues were addressed, as economists began to characterise realistic demand and cost conditions. Rate design in such situations must take these factors into account. Sweeney explains these results by noting that because regulated products are permitted to obtain a 'fair return' on shared input, output reductions in unregulated markets allow more of the common cost to be shifted to regulated markets. As a result, greater profits are earned in these regulated markets. In one sense, these results may appeal to regulators. The prices are high in the unregulated markets, thereby quelling fears of cross subsidies from the regulated markets. Also, competitors in the unregulated markets would be pleased, since the monopolist is apparently not relying on profits from the regulated markets to predatory price in their markets. In the long run, the monopolist's prices could be undercut in at least some of the unregulated markets, perhaps even driving the monopolist out entirely. The advantages of natural monopoly production for multiple markets are then lost, and the regulator's optimism regarding FDC procedures proves short-lived.

Pricing with random demand and supply. The intertemporal issues noted above have also been addressed in the context of uncertainty. Consumers value reliability of service, which will be affected by the interaction of price (announced in advance) and uncertain demands (driven by weather, seasonal conditions, and hourly factors) and production capabilities (related to unplanned outages).

Nonlinear pricing and interpersonal patterns of demand. Whether one is considering pricing entry and rides in an amusement park or access to and usage of a telephone system, multipart pricing offers a viable option for enhancing revenues. Much of the literature on multipart pricing and nonlinear outlay schedules is surveyed by Brown and Sibley, 1986. The pattern of individual demands proves to be important for the development of first and second-best rate designs involving fees and usage charges.

Sustainable pricing. Faulhaber, 1975, showed that a natural monopolist was not necessarily immune to entry under certain cost structures. This insight raises a dilemma for regulators and implies significant information requirements for optimal pricing decisions. A related issue is the role of the incumbent firm as the supplier of last resort (Weisman, 1988).

Quality of service. Service quality also raises a number of important issues for analysts. The quality level provided under competition, monopoly, or regulation has received substantial attention. In practice, regulators tend to utilise pass/fail standards. While such standards are clear and precise, problems arise in using them to monitor and reward quality. For example, by evaluating performance relative to a pass/fail cut-off, distinctions among various levels of sub-standard and super-standard performance are ignored: utilities have little incentive to exceed targets. In addition, the targets themselves are often somewhat arbitrary, having arisen from a chaotic process reflecting historical engineering capabilities, political pressures, and administrative happenstance. Consumer valuations of different quality dimensions and firm knowledge of emerging technological opportunities are not likely to be reflected in current pass-fail standards.

## Recovery of joint costs in a competitive environment

The brief overview of rate design concepts provides a foundation for addressing the recovery of joint costs in a competitive environment. Electric utility managers understand that the industry has rapidly moved from local monopolies to one that is customer-driven. Co-generation and competition via open transmission policies have disrupted traditional pricing arrangements. Cost allocation manuals are becoming increasingly irrelevant as the electricity industry becomes more competitive. This section outlines two approaches that enable the recovery of joint costs in a competitive environment. One approach involves utilising Two-Part Pricing schemes, so the customers' share of joint costs is less dependent on total consumption. Such rate designs better reflect cost causation on the margin, while permitting recovery of some fixed costs. Another approach involves lower prices to those demanders with alternative sources of supply. Although higher prices to inelastic demanders — those without options — raises some tough political issues, those customers would be even worse off if business and other large customers abandoned their traditional suppliers. Thus, Ramsey pricing involves price discrimination (or price differentiation, if the former term seems too value-loaded).

Electric utilities are going to have to generate value for customers by devising new rate designs which create win-win opportunities. Both Two-part pricing (using Historical Customer Baselines) and Ramsey pricing represent innovative ways to recover joint costs. First, some background material needs to be reviewed.

## Background — recent trends

In the U.S., the electric energy industry lags behind telecommunications in terms of competitive pressures, but regulatory roadblocks to competition at various stages of production have been demolished in a number of countries. In the U.S., since most regulatory authority is vested in the states, the system is conducive to regulatory innovation. The process of evolution within the American regulatory environment is driven by wider adoption of approaches that have been successfully implemented in a few states. This heterogeneity also results in confusing and sometimes contradictory state regulatory regimes. For investor-owned utilities, Rate Of Return (ROR) on rate base regulation has characterised the industry, with customer-class cost allocation rules, fuel adjustment clauses, and management audits further constraining prices and revenue requirements. For municipals and other publicly-owned utilities, cost allocations have tended to establish revenue targets across customer classes, with prices reflecting some type of fully distributed cost.

The evolution of US regulatory policy illustrates changing attitudes towards the efficacy of competition in promoting efficiency. At the same time, concern over environmental impacts has placed new objectives onto the regulatory agenda; the new instruments for achieving new objectives raise complex issues. For example, state-mandated conservation programs will come under pressure, especially if retail wheeling is widely adopted. The costs of DSM programs cannot be spread across a set of captive customers: larger customers, especially, will face choices they are currently denied. Most industry observers expect vertical disintegration and partial deregulation to continue. The implications for incumbents are mixed. Non-generating distribution systems are in a position to 'shop around'. Integrated suppliers are likely to face revenue erosion as competition becomes more widespread.

The interests of various constituencies are tough to reconcile. The National Association of Regulatory Utility Commissioners (NARUC) wants to preserve the flexibility of states so that state PSCs can craft policies which fit their unique circumstances. Groups benefiting from current state regulations want to retain 'local' control — preserving their relative benefits. The American Public Power Association (APPA) supports the agenda of municipally-owned utilities. The National Rural Electric Cooperative Association (NRECA) seeks retention of rules that assist rural electric utilities. At the national level, FERC oversees wholesale and transmission issues, while state PSC regulate facility additions and retail rates. The conflicting pressures and overlapping jurisdictions make coherent policy development very difficult.

One conclusion is clear, price signals are being given greater prominence, although policy makers (both regulators and municipal authorities) tend to avoid dramatic changes in rate design for fear of political repercussions. Historically, prices for different customer groups were set using cost allocation procedures. Revenue 'requirements' were determined from top down — with minimal attention to incremental cost causation. Today, prices and incumbent investments in generating capacity are constrained by competitive alternatives — induced by regulatory promotion of co-generation and independent power producers (IPPs). Thus, in non-core (industrial) markets, customers have alternatives in the form of self generation or geographic re-location. When revenues from some customer groups fall short of 'allocated' costs, utilities experience financial pressures. Core (residential) customers can flex their political muscle to avoid rate increases, resulting in realised returns becoming a residual. For IOUs, rates of return were never 'guaranteed'; rather, they were 'allowed'. However, returns have become more problematic in a world where traditional entry restrictions are being set aside. These developments will constrain municipal utilities and REAs as well.

Deregulation and emerging competition will tend to promote least cost supply. Some vertically-integrated suppliers have low incremental costs relative to their potential competitors. If they have high average (embedded) costs, they will come under financial pressure. IOUs will find cut dividends and change their financial structures (towards more equity). For municipal utilities, it may be difficult to meet interest coverage or continue to transfer traditional amounts to city coffers. However, low incremental cost suppliers are still going to be able to compete for business. On the other hand, high incremental cost suppliers will be in trouble in a competitive environment. 'Stranded investment' is just another word for generating capacity that cannot yield cash flows for covering fixed costs when electricity markets are opened up. Book value exceeds market value of capacity.

National regulatory policy has leaned in the direction of pro-competitive market structures at the generation level. Since PURPA's promotion of co-generation via qualifying facilities (QFs) and of IPPs, national policy has continued to view wholesale competition as stimulating real savings for final demanders. Non-utilities supply almost ten per cent of all electric power in the U.S., and between 1991 and 1994, they built over half of all new capacity. *The Energy Act 1992* created Exempt Wholesale Generators (EWGs) as another vehicle for introducing new players into the game. Since access to transmission can be mandated by FERC, terms and conditions of transmission access has become a significant regulatory issue. Ultimately, large buyers may gain access to alternative suppliers via the transmission network: retail markets will change dramatically. While the problems for network coordination, construction, and reliability are substantial, the trend seems irreversible.

In 1994, both California and Michigan established programs designed to promote more competition. Larger customers who have the ability to shop will tend to pay market-based (incremental cost) prices, leaving core (residential) customers at risk for covering the costs associated with higher cost capacity. The fear of so-called 'stranded investment' blunts efforts to open up local markets. 'Securitisation' represents one mechanism for permitting some cost-recovery by high-cost firms. The short run impacts of competition differ from the long run impacts. In the short run, the efficiency gains may not be substantial, given the demand elasticities — though the monetary transfers could be significant. Over the long run, the movement away from cost-based regulation for IOUs is likely to further stimulate cost-containment and improved price signals. No utilities will be insulated from these pressures.

PURPA-induced competition in the wholesale market for electricity has increased the importance of transmission access as utilities try to find the lowest cost suppliers whose generating facilities may be located far from the utilities' retail markets. The provision of *the Environment Protection Act 1992* requiring utilities to offer wheeling to third parties for a fee is possibly the biggest change in the industry in more than fifty years.

Reduced demand growth, nuclear plant cost overruns, environmental costs, and continued low natural gas prices have led to excess and high cost capacity whose economic value is lower than book value. The resolution of the stranded investment problem has been linked by some to the terms and conditions of transmission access. There had been a 'regulatory compact' under which capacity was built and changing the rules of the game is perceived as unfair. As Costello, Burns, and Hegazy, 1994 note, vertically-integrated utilities, conservationists, and environmentalists tend to oppose retail wheeling. For the former, monopoly franchises are lost as competitors threaten to take away customers. The two latter groups fear reductions in (or elimination of) utility-funded Demand-Side Management (DSM) programs. Also, the forms of Integrated Resource Planning (IRP) which emphasise environmental costs above and beyond those addressed in national laws are threatened. Those supporting immediate retail wheeling argue that sunk costs ought to be ignored for policy purposes — leaving investors holding the bag. Large industrial and commercial customers do not want to bear transition costs.

Continued regulatory and legislative debate can be expected on transmission access and pricing, bidding procedures, setting new price regulations, and devising alternative regulatory constraints. We can already see the outlines of changes that are altering the regulatory landscape. Some believe that competition has become an objective — rather than a mechanism for achieving economic objectives. Certainly, national legislation and FERC have promoted entry into generation markets as a way to keep energy costs down. With this thrust has come pressure for transmission access at a fair price.

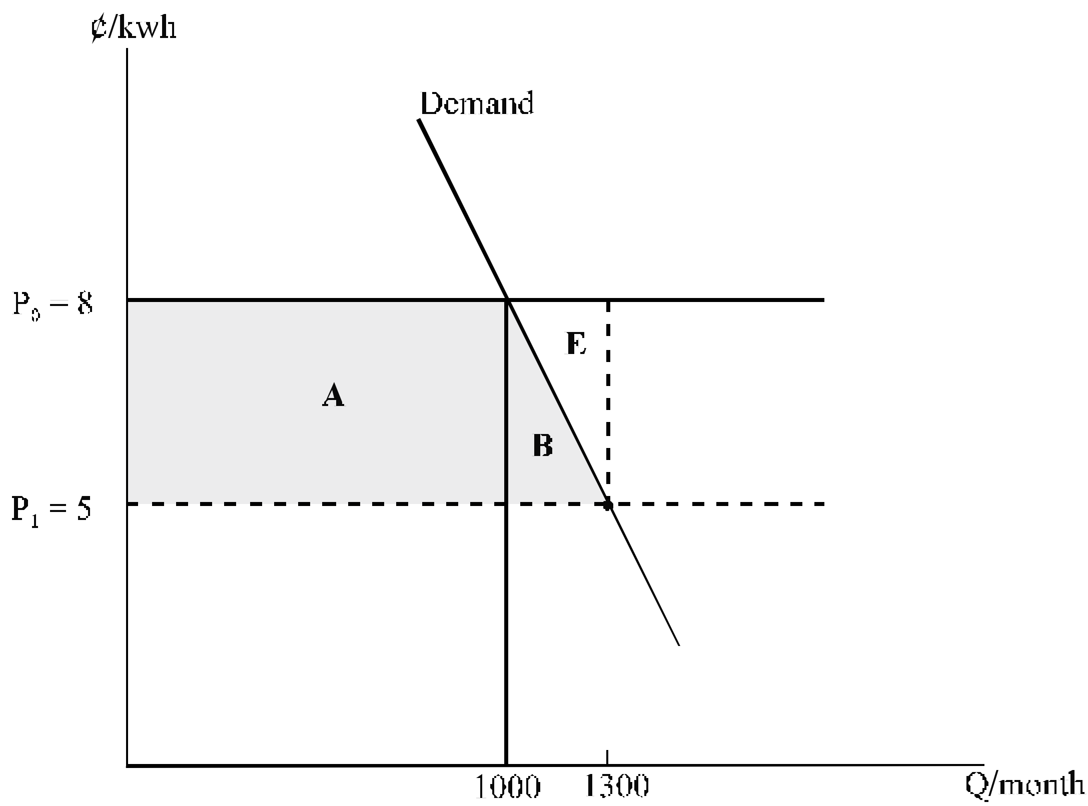
## Multipart pricing and the promotion of efficiency

In the short run, with capacity costs fixed, changes in the wholesale pricing structure can involve particular customers or customer classes benefiting at the expense of others. Whether the process is a zero-sum game depends on the nature of rate re-structuring. If the savings obtained by winners is roughly equal to the additional outlays required of losers, then the objective of net revenue neutrality sows the seeds of conflict. For example, lowering the price to one group and raising it for another can have this characteristic. However, multipart pricing enables the supplier to create win-win options — bringing the marginal price down to incremental cost, while recovering current capacity costs via fixed monthly fees.

It should be noted that cost allocations which are currently used may seem reasonable and consistent with industry practice. Nevertheless, these allocations often are quite arbitrary — reflecting some view of fairness rather than cost causation. Evidence from other industries suggests that competition will force marginal price towards incremental cost.

A diagrammatic representation may help explain the win-win aspects of multipart pricing. Figure 1 depicts a demand curve. At lower prices, the customer is willing to buy more electricity. At very high prices, customers will only apply electricity to very high valued uses. If price is quite low, then thermostats may be adjusted to give greater comfort, more electricity-intensive machinery might be utilised, and energy-conservation activity is less cost-effective from the standpoint of the buyer. In the short run, customers are not likely to be able to make substantial behavioural or operating adjustments, but the change in consumption will be greater as customers have more time to adapt to a permanent price change. Greater long-run responsiveness means that the efficiency gains from improved price signals are greater when consumers have time to make adjustments.

**Figure 1: Benefits from a price change**




Utilities are used to thinking in terms of a customers load shape and how this influences the system load. However, the load shape is a function of the price structure. Time-of-use pricing will alter the hourly pattern of electricity consumption — with that pattern changing more dramatically as customers have more time to adjust to the new price structure. Responsiveness of customers is characterised by economists in terms of demand curves. Greater long run responsiveness means that the consumers have time to make adjustments.

The Law of a Downward Sloping Demand has theoretical and empirical support. Utilities recognise that price influences consumption in the way described above. The Law's Corollary of Greater Responsiveness with Longer Adjustment Time has also been verified. The position of the demand curve is affected by other factors outside the utilitys control. If the price of substitutes decreases, demand for electricity shifts in. If the prices of appliances that use electricity (complements) fall, then the demand for electricity shifts out. Weather conditions also affect the hourly load and monthly consumption. In the Figure, if price is $.08/kwh, then the customer depicted here consumes 1000 kWh. This could be broken down to hourly consumption, but this simple example illustrates the impact of a price reduction. If price falls to $.05/kwh, more than 1000 kWh would be demanded with a lower price. Note that if incomes rise, or average family size increases, or square feet per house increases, or temperatures are less moderate, the demand schedule will shift out. The hypothetical demand curve depicted in Figure 1 holds all these other factors constant, so that monthly consumption depends on price.

In this example, if price per kWh is $.08, then 1000 kWh are purchased, for a total consumer outlay of $80. If price were $.05, then 1300 kWh would be purchased, for a total outlay of $65. If demand had been more responsive to the price reduction (so that consumption rose to, say 2000 kWh, then total expenditures by this customer would have risen to $100. Thus, an increase in outlays does not necessarily imply a reduction in customer satisfaction. In this case, the price reduction induced additional consumption, and kWh were applied to valued uses by the customer!

In the case of the demand curve depicted in Figure 1, the price reduction from $.08 to $.05 yielded an improvement for the consumer. Analytically, this gain could be broken into two parts. The first part reflects the $.03 is saved on each of the 1000 units that used to be purchased at the higher price (area A = $30). Furthermore, 300 additional units are purchased when the price is only $.05. Economists identify area B as reflecting the benefits (above the outlays) associated with this additional consumption. Area B is $4.50 (the area of this triangle is half the base times the height).

Thus, the price reduction benefits the customer by $34.50. The $15 reduction in outlays (from $80 to $65) is not a good indicator of the consumer benefits associated with the price reduction. This point is very important, because rate design that focuses on outlays rather than customer satisfaction is likely to miss some win-win opportunities. In a competitive environment, suppliers cannot afford to ignore opportunities.

So far, we have not considered the firm. If its incremental costs were $.08, then a price reduction to $.05 is a losing proposition. The cost of serving the customer is $104 ($.08/kwh times 1300 kWh), but the revenue from the customer is only $65 ($.05/kwh times 1300 kWh). Underpricing electricity relative to its cost hurts the supplier more than it benefits the customer! From the diagram, the customer gains A+B, while the firm loses A+B+E. If, during peak periods, the price is below incremental costs, the utility ought to revise its prices (if the metering costs are not small relative to the savings).

In the case of the price reduction, what if the incremental cost were $.05? The $.08 price was high relative to the cost of additional kWh. Now the customer gains (A+B), which is more than the supplier loses (-B) from the price reduction! This observation suggests that a win-win option is possible. The utility could offer the customer a multipart price instead of the uniform price of $.08/kwh. The rate structure could be a $30 monthly fee (regardless of units consumed) and a per unit price of $.05. Since area

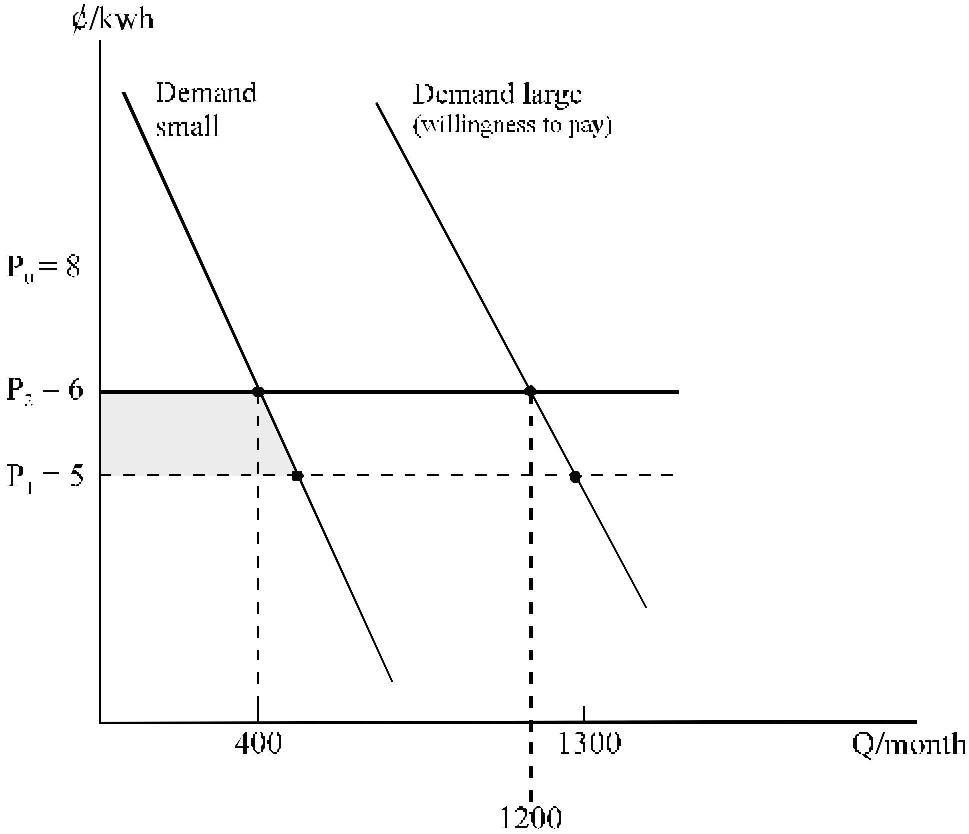
A is $30, it is clear that the customer is better off by area B ($4.50) under this alternative rate design. And the firm is no worse off. So long as the monthly fee is less than $34.50 (and per unit price is $.05), the customer is better off under the multipart scheme than paying a uniform per unit price of $.08.

Return to the $30 fee case, where total customer outlays now equal $95 and incremental cost is $.05. If the total bill is divided by the 1300 kWh, the average price is about $.073. Why not just set a price of $.073 and avoid the slightly more complicated pricing scheme? After all, customers look at their total bills. The response to this question is that the combined gains to the customer and the supplier would be less if price were only lowered from $.08 to $.073 than if the $30.00 monthly fee were imposed in conjunction with $.05/kwh. By himself, the customer is better off by more than $7.00 with the $.007/kwh price reduction. That per unit saving times 1000 kWh happens to be greater than area B. But all of that gain is essentially balanced by a net revenue loss experienced by the supplier! That price reduction is not a win-win outcome. The multipart scheme keeps the supplier whole, while making the customer $4.50 better off than before. Furthermore, the price of $.073/kwh is inefficient. It discourages consumption that is worth more than the resources that would have gone into the production of additional kWh (i.e. the price of $.073 is greater than incremental cost, $.05).

We saw that setting the marginal price equal to incremental cost increased consumption to 1300 kWh. The customer valued that additional consumption more than society valued the resources that went into creating the additional kWh. Thus, incremental cost pricing promotes the efficient use of society's resources. If price is above incremental cost (as is the case with much off-peak consumption), we are under-consuming electricity. If price is below incremental cost (as can be the case with on-peak consumption), we over-consume electricity. Multi-part pricing combined with peak load pricing can make both the firm and the customer better off. Peak load pricing by itself may benefit customers and/or the supplier.

The firm lacks information on the full nature of customer willingness to pay. Billing records can provide clues regarding potential consumption patterns, but optimal rate designs can facilitate both cost-recovery and efficiency. Figure 2 illustrates the benefits from utilising self-selecting two part tariffs. Two demands are depicted in the Figure; the supplier does not know which customer has which demand. As shown in the example, Option 1 has a $10 monthly fee, but a marginal price of $.05 per unit. The larger demander will select this option, since Option 2 (no fee, but a per unit price of $.06) yield less consumer surplus. The smaller demander selects the second option. Such price options enable the supplier to extract more consumer surplus than under uniform pricing — which enhances the financial viability of a firm under competitive pressure. Such rate designs are especially important if there are substantial fixed costs.

**Figure 2: Self-selecting two part tariffs**




**Option 1**

$F_1 = \$10$
$P_1 = 5¢$

**Option 2**

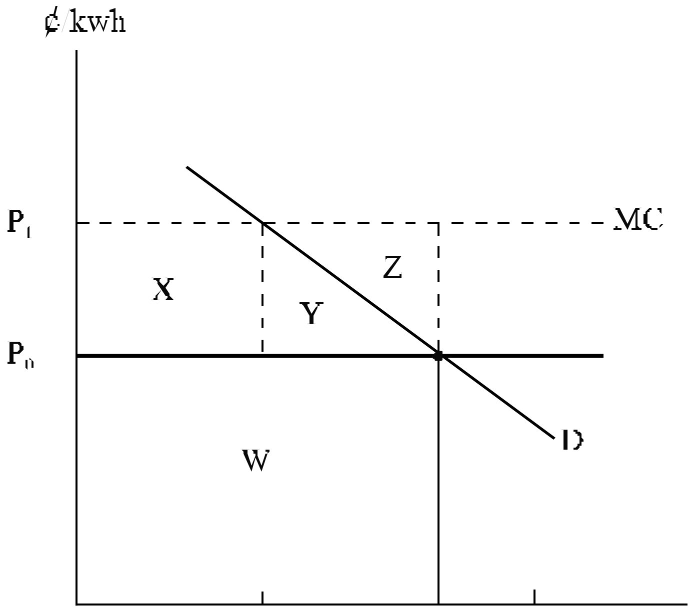
$F_2 = 0$
$P_2 = 6¢$

$D_{large}$: if select option 2, lose more than \$12 of surplus (vs $F_1$ is only \$10)

$D_{small}$: if select option 1, gain less than \$10 of consumer surplus (vs $F_1$ = \$10)

Figure 3 illustrates the problem of pricing below incremental cost. Each unit sold is priced at less than the cost of production. The supplier would be better off making a deal in which he gave the demander a lump sum credit to his bill of X+Y, while raising the price to P1. The customer is no worse off than initially (less electricity is consumed, but the customer is indifferent to P0 for each kWh versus a rebate of X+Y per month and a higher price of P1).

**Figure 3: Pricing below incremental cost**




Note, these observations regarding multipart pricing are strengthened when longer run adjustments are taken into account. Demand is more elastic (or responsive to price changes) when customers have more time to adjust their energy-using equipment. If price increases, the firm may have few alternatives in the short run. But soon, energy-conserving investments can be implemented, and consumption drops more dramatically than in the initial months. The time for adjustment depends on the nature of the industrial, residential, or commercial demand. Utility managers who understand the role of price signals can promote the efficient conservation of energy.

The precise amount to be included in the fixed fee is not a simple calculation. Were recent years 'normal'? What if the level of this historical contribution is no longer sustainable in a competitive market? The answers to these questions require substantial analysis. Suffice it to note that such monthly fees can be calculated that would leave the firm better off than before. Bringing the incremental price in line with incremental cost is a potential win-win move. Rate designers ought to consider this addition to their price portfolios in a competitive era.

## Ramsey pricing

As noted earlier, Ramsey pricing corresponds to price discrimination such that total revenues equal total costs. The ability to separate markets and prevent resale is facilitated by customers being hooked up to utility distribution systems. Faulhaber and Baumol (1988, p. 594) cite Ramsey pricing as '... a clear example of a principle that derives from the [economic] literature and has (recently) achieved a good deal of attention among government agencies.' They note that it has been discussed in many courts, state commissions, the Federal Communications Commission (FCC), the Federal Energy Regulatory Commission (FERC) and the Interstate Commerce Commission (ICC), as well as in other countries. Faulhaber and Baumol also highlighted the stand-alone cost test as an example of a contribution of economic theory to regulatory pricing practices. The test places a ceiling on rates. No consumer or group of consumers ought pay more for service than the cost of serving them apart from all other consumers. Although this approach can be traced to pricing practices established for the Tennessee Valley Authority under the name 'separable costs and remaining benefits' (EPA, 1975, Straffin and Heaney, 1981), only in the last two decades has it become prominent in the literature where it has been related to the core concept in game theory (Faulhaber, 1975; Sorenson, et al., 1976, Sharkey, 1982). The theory also provides regulators with a rigorous definition of cross subsidisation that eschews the arbitrary definitions associated with fully distributed cost pricing practices. Faulhaber and Baumol indicate that both the FCC and ICC have considered using stand alone cost tests in rate making. Since consumers with inelastic demands are often those regulators or municipally-owned utilities are trying to protect, firms often overlay cost allocation procedures onto price level decisions — limiting 'undue discrimination'.

Ramsey Pricing is related to marginal-cost pricing in that prices are a percentage deviation from marginal costs, where the percentage is inversely proportional to demand elasticities: more elastic (responsive) demands have lower price-cost margins. In Figure 4, two demands are illustrated. If price is \$.04 in each market, then the total contribution towards fixed costs is E+F (\$20 in market 1) and T+V (\$20 in market 2). So the base case involves 1000 kWh monthly consumption in each market, with \$40 in revenue above incremental cost going towards fixed costs. If price is increased to \$.06 in the relatively inelastic market 1, the firm gains A (\$18) and loses F (\$2), for a supplier gain of \$16 in this market. Although the firm no longer receives revenues of F + G (\$4) due to the 100 kWh reduction in quantity consumed, the supplier also avoided the cost (G) of producing that output. Thus, the loss of F is recorded. The customer is worse off: given by -(A+B), or \$19. The numbers indicate that societal welfare has declined by \$3, as price has been increased far above incremental cost (\$.02). However, if the price is reduced to \$.025 in market 2, then this customer gains more than the utility loses, and the potential for an overall welfare improvement exists.

On net, the reconfiguration of prices can improve societal welfare so long as gains (and losses) experienced by either customer are valued equally. To see this, consider Market 2 in greater detail, where price is reduced from \$.04 to \$.025, and consumption increases from 1000 kWh to 1600 kWh. The supplier loses T (\$15) but gains W (\$3) when it reduces price to \$.025. There is a supplier loss of \$12 in market 2. However, customer 2 gains T and U, where U is \$4.50. Clearly, the customer gains (T+U equals \$19.50) are more than the supplier's losses. The common sense explanation is that bringing price closer to incremental cost increases economic efficiency in this market (here, by \$7.50). When the two markets are taken into account together, the supplier is actually better off (+ \$18 – \$12) while customer welfare (weighted equally for winners and losers) has also increased (down \$19 in market 1 and up \$19.50 in market 2).

This example is meant to illustrate the benefits of pricing closer to incremental cost in elastic markets — balancing off the inefficiencies of raising price further above incremental cost in another market. The formula for calculating optimal markups in the two markets involves markups that are inversely proportional to the respective demand elasticities.

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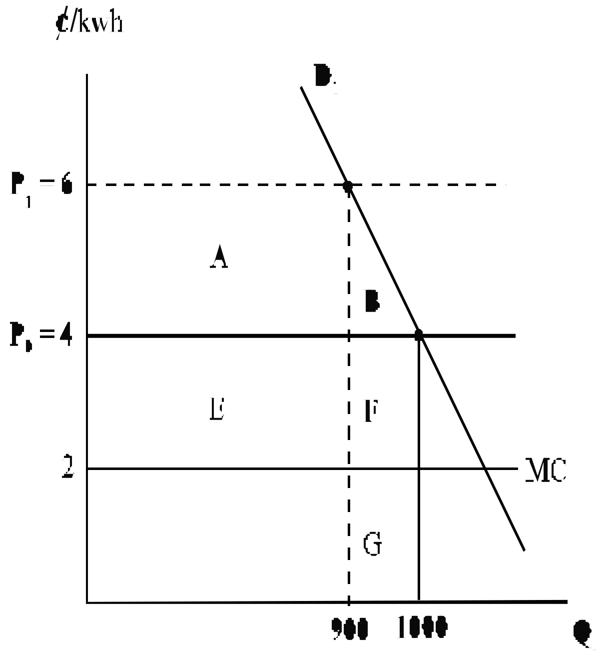
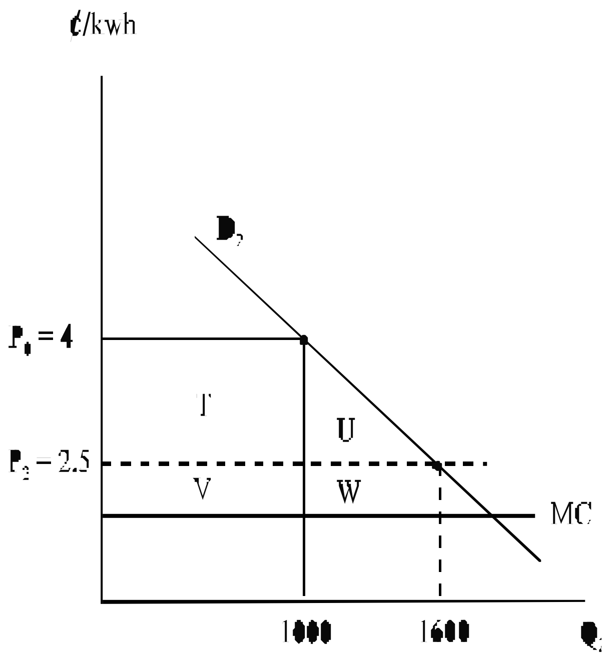
(1)




**Price increase**
Supplier: +A - F
+$18 - $2

Customer: - A - B
- $18 - $1

(2)




**Price decrease**
Supplier: -T – W
-$15 – $3

Customer: +T +U
–$15 – $4.50

Electric utilities have charged different prices to different customers for decades. Ramsey Pricing involves charging more to those with relatively inelastic demands. Commercial customers often do not have co-generation opportunities and are often the ones hit with the highest prices relative to incremental cost of service. Residential customers have political clout, so that despite relatively inelastic demands, their price-cost margins are often smaller than for other customer groups. Industrial customers, on the other hand, may be footloose in the long run: firms can move production capacity to other locations. Alternatively, industrial customers may have self-production as an option. In either case, these customers have relatively more elastic demands. Electric utilities have responded to such situations by offering lower prices (via 'cooked' cost allocations) or interruptible rates at discounts that might be greater than the savings warranted by the extent of actual interruptions.

Competition is likely to attack those customer classes with greatest price-cost margins. Thus, commercial accounts would appear to be vulnerable to entrants who have access to transmission and distribution facilities. All utilities will have to respond to such threats by re-structuring their rate designs. The presence of alternatives makes customer demands more elastic. So utilities will act in such a way as to reduce the prices quoted to such customers. From the standpoint of social efficiency, this restructuring is appropriate if the market demand of such customers is relatively elastic.

If the customers market demand for electricity is actually relatively inelastic — but it becomes elastic with the availability of competitive options, then the reduction of such prices may not promote social efficiency. However, from the standpoint of public policy, this possibility is probably swamped by the view that competitive pressures will be more effective in promoting cost containment than regulation. In terms of economic theory, the social efficiency losses (and gains) associated with welfare triangles are dominated by the large rectangles reflecting cost savings associated with improved incentives for cost containment. Public policy has supported increased competition in generation not just because of the associated rate restructuring (such that prices track costs), but also because costs are likely to be lower with competitive pressures.

## Concluding observations

What are the implications of competitive trends for utility pricing?

Utilities that understand their cost structure and are successful at cost containment will be in a better position to develop prices that enable them to survive in a competitive world.

Utilities that understand their customers' actual (and potential) consumption patterns (and valuations) have an advantage over potential rivals.

Market intelligence will become a major factor in decision-making. Major customers will be lost and gained on the basis of the types of contracts that are developed.

New skills will be required of utilities. During the transition to competition, utilities must restructure themselves to provide the information and internal incentives required to compete effectively with their rivals.

These points need to be underscored. If the supplier does not know its own incremental cost, it cannot be sure whether additional sales are financially desirable. One implication of this point is that an obligation to serve high cost customers with low prices will need to be replaced by other funding mechanisms, if 'universal service' is to remain a public policy objective. Similarly, if the supplier does not know how the customer is likely to respond to new prices, financial planning and capacity decisions become problematic. Potential load shapes become relevant for decision-makers, since new rate designs will induce changes in consumption patterns. If simplicity is one casualty of competitive pressures, utility account managers will have to explain the benefits of more complicated rate structures to their customers. Competition will make life harder for infrastructure executives. The possibility of competition also complicates rulings on the price and quality of interconnection or an entrant's access to information possessed by an incumbent.

Monopoly suppliers are able to dictate price. An unregulated monopolist has an incentive to know its cost structure and demand patterns. However, a regulated monopolist (or a government enterprise) whose prices are partly the result of political compromises, has weakened incentives for cost containment and an inadequate understanding of cost-drivers. So long as total revenues cover total costs, there may not be pressure for a non-profit oriented firm to identify incremental costs. Some customers may be paying far more than cost of service while others could be paying less that incremental cost. However, the prices, based on (politically acceptable) cost allocations are not necessarily sustainable under competition — where price tends to track the incremental cost of electricity. Cost allocations which were unrelated to cost causation were possible in the absence of customer choice. But the world of electric utility and telecommunications monopolies is rapidly disappearing.

New price structures can offer win-win opportunities, such that both the supplier and customers can be better off than before. Of course, if competition drives the average price too low relative to the utility's average cost, most of the benefits from rate re-design will be captured by customers — if the utility tries to successfully retain its customers. The principles of rate design identified here are crucial to the recovery of joint costs in a competitive environment. Both managers and regulators need to understand the efficiency implications of alternative rate structures.

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