Appendix D
Economic Analysis of Results

Introduction of competition to the electricity market may have significant impacts on the price and consumption of electricity. It may also involve transfer of wealth between producers and consumers. That is, consumers may pay more or less for the same amount of electricity, and producers may have a commensurate change in revenues while the cost of production remains very nearly the same. However, the goal of competition is to provide a net overall benefit to everyone, both producers and consumers. One way of quantifying this benefit is through the notion of an improvement in overall social welfare. Examining the change in social welfare is a way of quantifying (through a monetary measure) the net social worth of a particular policy. The effect of competition on this measure is discussed below. Even without relying on such a measure, the effect of competition on producers and consumers can be qualitatively described.

The relationship between supply and demand resulting in a market equilibrium is typically displayed using supply and demand curves, as illustrated in Figure D1, which shows the relationship between the competitive and regulated equilibria and graphically displays some of the conclusions of this report. In particular, it shows the relationship between the change from the competitive and regulated equilibrium prices and the effect on stranded costs and overall social welfare.

There are three curves in Figure D1: a demand curve running through M, A and B; a marginal cost curve connecting I, C, and B; and an average cost curve running through H and A. The demand curve intersects the average cost supply curve (the supply curve under regulation) at point A and the marginal cost supply curve (the supply in a competitive market) at point B. However, Figure D1 shows only a part of the whole picture. Two factors would tend to lower the marginal cost curve. Under competition, producers would tend to reduce their costs in order to maximize profits. Thus, costs would tend to decline over the course of the projection. As discussed in Chapter 5, however, the effect that competition would have on efficiency of electricity production is generally beyond the scope of this study (although one illustrative case is given in Chapter 3). Second, over the range of demand elasticities chosen for this study, the effect of demand elasticity is to shift demand away from the peak periods while leaving overall consumption approximately constant. This is reflected in the nearly vertical demand curve AB in Figure D2. As explained in Chapter 3, demand shifting lowers marginal costs far more than average costs.

The dashed line in Figure D2 represents the marginal cost curve shifted downward as a result of increased price elasticity. At relatively low elasticities, the increase causes additional demand shifting without significantly changing aggregate demand. As a result, the competitive price is shifted downward from C to C'. Consumers pay less for electricity, and producers receive less, while total consumption and average costs remain
approximately constant. Thus, when overall demand remains essentially constant, stranded costs increase with increasing elasticity, as was observed in the study.

Consumers would pay significantly less for the same amount of electricity they use now. Producers would receive correspondingly less revenue for the electricity they produce. Since producers' costs would decline far less than their revenues, their profits (and ability to recover stranded costs) would also decline. The decline in profits would be seen by consumers in the form of lower prices. That is, wealth would be transferred from producers to consumers.

The intersection of the average cost curve and the demand curve gives the regulated price $E$ at quantity $K$ in Figure D1, while the intersection of the marginal cost curve and the demand curve gives the competitive price $G$ at the quantity $L$. As previously shown, the average cost is above the marginal cost of electricity, leading to the conclusion that the equilibrium regulated price $E$ is above the equilibrium competitive price $G$. However, the change in consumption depends on the slope of the demand curve $AB$.

In contrast to the demand curve in Figure D2, the effect of competition shown in Figure D1 is more subtle. Suppose the demand curve runs along the line $AB$ in Figure D1. In this case, consumers show a great deal of responsiveness to price. Not only is the equilibrium price at point $B$ lower under deregulation, but the demand has increased in response to the lower price.

The consequences of these effects can be displayed as follows. Since the axes of the graph are price and quantity, any area represents a revenue or expense. A standard measure of the benefits of electricity to consumers, called the "consumer's surplus," is represented by the area under the demand curve above the market clearing price. This is equal to the area $EAM$ in the regulated case. This area represents the total amount consumers would pay for electricity if each kilowatthour were priced exactly at the customer's value ($JKAM$) minus the amount actually paid ($JKAE$). Similarly, producer's surplus is defined as the area above the marginal cost curve but below the market clearing price. In the competitive case, the producer's surplus is $GBI$--the difference between the total revenue received under competition ($GBLJ$) and the marginal costs incurred ($IBLJ$). This difference is the amount of money producers have to contribute to fixed costs and profit.

Now, the effect of demand elasticity on the various components of general welfare can be seen. The consumer's surplus under competition has increased from the area $EAM$ to $GBM$. Thus, the net improvement in the consumer's surplus is represented by the area inside $EABG$. Because of the demand response to price, demand increases to $L$, and the market clearing price is $G$ rather than $D$. That is, the revenue loss on the original demand level $K$ in the competitive environment is $EAFG$, but there is the added value of $CFB$ from the increased demand.
The area in CFB represents the excess of revenues over marginal costs for production of electricity to meet the increase in demand from K to L. The net loss in revenues, also known as stranded costs, is EAFG - CFB. This is a net wealth transfer to consumers. Since the consumer's surplus increases by EABG and the producer's surplus decreases by EAFG - CFB, the net overall increase in social welfare, that is, the net improvement in both consumer and producer surplus, is given by the area ABC.

Two general conclusions can be drawn from these diagrams. First, if the demand elasticity is relatively small, most changes in consumption will consist of shifts from peak to off-peak periods, with aggregate consumption remaining constant, as seen in this analysis. However, if the aggregate consumption increases with lower price, two other effects become significant: (1) while moving to marginal cost pricing may impose stranded costs, they will at least be partially mitigated by any resulting increase in demand; and (2) given the relationship between marginal and average cost pricing shown here, the demand response to marginal cost pricing will always yield improvements in the overall social welfare measured by the sum of producer's and consumer's surplus.

NOTES:


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URL: http://www.eia.doe.gov/oiaf/elepri97/appd.html
Contact Name: Robert T. Eynon, robert.eynon@eia.doe.gov
Phone: (202) 586-2315
Fax: (202) 586-3045

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Figure D1: Illustration of the Economic Consequences of Deregulation

Figure D2: Effect of Deregulation with Small Aggregate Demand Shift