IF CUSTOMERS SAVE ELECTRICITY, MUST RATES RISE?

Assume a utility which sells 100 kW-h/y at a rate of 10¢/kW-h (5¢ fixed costs plus 5¢ operating costs) for a revenue requirement of $10/y. (These particular figures, chosen for arithmetic convenience, aren't important to the policy conclusion. Note that in this example, too, average price, 10¢, exceeds short-run marginal cost, 5¢.)

1. An oversimplified initial assumption: Suppose the utility gives the customer a widget which instantly doubles end-use efficiency. Suppose the widget costs 2¢/kW-h saved. Now the utility is selling:

50 kW-h/y el. @ 15¢/kW-h (10¢ fixed, 5¢ op.)	**=$7.50/y, plus**
50 "kW-h/y" eff. @ (say) 2¢/"kW-h"	**=$1.00/y**
for a total revenue requirement of	**$8.50/y**

The societal surplus of $1.50/y comes from providing 50 kW-h worth of energy services at an operating cost 3¢/kW-h (= 5¢ - 2¢) lower. Note that the utility recovers all its fixed costs by raising rates 50%, from 10¢ to 15¢/kW-h, as some utilities fear--but bills fall by 15%.

2. Now let's make that assumption more realistic in two ways:

A. Suppose that doubling the customer's efficiency doesn't take place overnight, but requires 15 years, during which the net plant in service depreciates by half. Thus when sales drop by half, so do fixed costs as old bonds mature, so the fixed charge remains 5¢/kW-h. (The depreciation income needn't be reinvested in replacement plant, because the demand which that plant would serve no longer exists.)

B. Suppose that the utility's original 5¢/kW-h operating cost was an average: its generation was half @ 7¢/kW-h and half @ 3¢/kW-h. When demand is halved, the utility backs out the 7¢ plant and keeps the 3¢ plant. Assuming the widget is still unamortized after 15 y--an unusually expensive efficiency measure--the utility is now selling:

50 kW-h/y el. @ 8¢/kW-h (5¢ fixed, 3¢ op.)	=	**$4.00/y, plus**
50 "kW-h/y" eff. @ 2¢/"kW-h"	=	**$1.00/y**
for a total revenue requirement of		**$5.00/y**

If the resulting societal surplus of $5.00/y were, for illustration, split evenly between ratepayers and shareholders, the average ratepayer's bill would fall by 25%, while net for common would about triple.

Thus when we remember that "fixed" costs are not fixed, but slowly fall with depreciation, we see that by saving electricity at a speed no greater than the depreciation rate, both bills <u>and</u> rates can decrease. Yet even if rates did rise, that would be OK as long as <u>bills</u> fell--as long, that is, as the electrical saving were the least-cost resource for the system to acquire. Any criterion based on <u>rates</u> will cause economically inefficient investment. Why? Because in economic terms, energy services delivered to customers are a joint product of two factors of production: electricity, and the efficiency of using it. When we consider <u>rates</u> rather than <u>bills</u>, we are tacitly rolling the <u>cost</u> of one factor (efficiency) into the <u>price</u> of the other (electricity). This bizarre practice conceals a money-saving opportunity: raising <u>total factor</u> productivity by selling the customer a mixture of less of the costly input (electricity) and more of the cheap input (efficiency).

3. What if demand grows while we're saving electricity?

Suppose that during the 15-year period of implementing the doubling of end-use efficiency, demand for electrical services grows by, say, 15% (<u>i.e.</u>, at 0.9%/y). Then after 15 years, the utility is selling:

57½ kW-h/y el. @ 8.52¢/kW-h (5¢ fixed, 3¢ op. for the first 50 kW-h/y, 7¢ op. for last 7½ kW-h/y)	=	$4.90/y, plus
57½ "kW-h/y" eff. @ (say) 2¢/"kW-h"	=	<u>$1.15/y</u>
for a total revenue requirement of		<u>$6.05/y</u>

In contrast, if end-use efficiency <u>hadn't</u> doubled, then on two conservative assumptions (the original plants which supplied 100 kW-h/y still have enough spare capacity to supply 115 kW-h/y, and that marginal generation can be done at the original marginal cost of 7¢/kW-h), the utility's sales would have been:

115 kW-h/y el. @ 9.61 ¢/kW-h (4.35¢ fixed, 3¢ op. for the first 50 kW-h/y, 7¢ op. for last 65 kW-h/y) = <u>$11.05/y</u>,

maintaining the $5/y surplus of the previous case. Note, however, that the fixed costs of $5.00/y after 15 years' depreciation have been spread over the increased sales of 115 kW-h/y, with no provision for reinvestment in replacement plant which, without the doubled efficiency, is much more likely to be required. It would therefore be more realistic to count a fixed cost of at least $5.75/y, <u>increasing the surplus</u> to $5.75/y (or more if marginal construction costs more). We also haven't credited the utility with possible revenue-earning opportunities in the bulk power market if it saves more/faster than others.

Thus, unless a utility saves electricity <u>extremely</u> rapidly, it should not need to raise its rates (¢/kW-h) to cover fixed costs out of fewer kW-h sold, for three reasons:

1. "Fixed" costs are not fixed; they slowly decline with <u>depreciation</u>.
2. <u>Demand growth</u> preserves revenue streams; they simply come from different customers, and no capacity is idled.
3. In addition, <u>saved operating costs</u> (whenever it's cheaper to save electricity than to run the marginal existing plant) <u>can be used to pay fixed costs</u>. This is especially rewarding because the cashflow of saved operating costs is front-loaded: you buy the cheapest savings first, and uses them to back out first those plants which cost the most to run. Such a cashflow is ideal for prepaying debt. The resulting avoidance of interest accrual typically increases the present value of the saved operating costs by about a third.

Thus one <u>can</u> save electricity without raising rates (¢/kW-h), as long as the speed of the saving is less than the depreciation rate (suitably adjusted to distinguish generation from grid investments), plus the rate of growth in service demand, plus an allowance for the ability to apply saved operating costs to prepaying debt and hence reducing fixed costs, plus any allowance for new wholesale export opportunities. In many systems, just the first two of these four terms add up to roughly 5%/y--as fast as the average California utility has in fact been saving electricity in recent years, and much faster than many other utilities think <u>their</u> customers can save.

Moreover, even if <u>very</u> rapid savings <u>did</u> require temporarily higher rates,

4. the rates would have been still higher with <u>in</u>efficient end-use, because then rising demand would have driven new plant construction at high marginal costs and risks; and
5. energy-service <u>bills</u> would still go down, because consumption would fall more than price rose. BILLS ARE ALL THAT MATTER TO THE CUSTOMER. For the utility, all that matter are PROFITS, which equal bills or revenues (<u>i.e.</u>, price times consumption) MINUS COSTS. Decreasing the costs more than the revenues increases the profits; it's then up to the regulators to let the utility keep part of those increased profits.

<u>The bottom line: efficiency programs are very unlikely to raise rates in practice, and even if they did, bills would still go down.</u>