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# A Rate Design to Encourage Energy Efficiency and Reduce Revenue Requirements

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# Executive Summary

The search for low-carbon electricity resources intensifies as more attention is paid to greenhouse gases (GHG). If energy efficiency in the electricity sector is to be a major resource in the battle against greenhouse gases, utility regulators need to create an environment that enables and encourages cost-effective energy efficiency. This paper addresses one overlooked method of decoupling a utility's income from sales and offers a complementary set of price signals to consumers that are designed to enhance energy efficiency.[1] The decoupling strategy is a Straight Fixed Variable (SFV) rate design, and the customer price signal is a Revenue-Neutral Energy Efficiency Feebate (REEF).

Rate designers contrast straight fixed variable design with standard two-part rates. The terminology can be confusing because both forms involve two-part rates; the difference between them has to do with how each approach treats fixed costs. Straight fixed variable rate design places all of a utility's fixed costs into a fixed component of a utility customer's bill, thereby recovering only variable costs, such as fuel and purchased power, on a variable (e.g., per kWh or kW ) basis. A standard two-part tariff, in contrast, usually collects some fixed costs through a variable charge. The standard approach causes larger users within a class to pay more than the fixed costs they impose on the system, with small users paying less than their share of fixed costs.

Both designs recover variable costs predictably. They differ in the predictability of fixed cost recovery in the context of sales reductions. Because the "standard" method recovers part of the fixed costs through the variable charge, increased customer energy efficiency causes sales reduction, which in turn leads to a gap in fixed cost recovery and income. A straight fixed variable approach, in contrast, insulates the utility's income from changes in sales per customer.

SFV rate design creates a rational model for allocating fixed and variable costs. One criticism, however, is that by moving fixed costs out of the variable charge, the rate design weakens the price signal, thereby reducing a customer's economic incentive to use energy efficiently. That is, the average short-term variable costs left in the variable charge will be less than what had been collected from customers in the variable component under the Standard

[1] Other potential barriers exist to electricity energy efficiency, including whether there is comparability in profitability from the utility's perspective between supply and demand resources in jurisdictions where utilities have a role in delivering energy efficiency services, and numerous consumer-oriented market barriers.

Tariff. Hence, the second component of this paper is a revenue-neutral energy efficiency feebate (REEF) for customers. A revenue-neutral feebate works by charging fees to those who use more than a typical amount of electricity while giving rebates in the same total amount to others in the class who use less than that amount. Feebates can update continuously the targets for efficiency as people change their energy consumption. Feebates have been proposed and implemented to encourage increases in the automobile gasoline efficiency. The utility would see no financial effect, but consumers could see their bills go either up or down depending on their usage relative to similar customers.

Shifting dollars so that fixed costs are fully recovered through fixed charges, with variable fully recovered through variable charges, not only decouples income from sales (eliminating the utility's disincentive to encourage customer efficiency); it also reduces the utility's financial risk associated with variance in sales. Sales variations associated with weather, the economy, price elasticity, and energy efficiency not stimulated by utility-sponsored programs are all eliminated by SFV rate design. This reduction in risk means that that the commissions can reduce the authorized return on equity, thereby lowering rates for all.

This report is available on the NRRI website at:
http://nrri.org/pubs/electricity/rate_des_energy_eff_SVF_REEF_jul08--08.pdf

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## I. Energy efficiency's role in mitigating greenhouse gases

Greenhouse gas reduction through some type of carbon emissions law at the federal and state levels is gaining increasing momentum. Utility power plant emissions will almost certainly be a set of emissions targeted for control. The strategies frequently discussed to reduce carbon emissions for the electricity generation sector are: increased use of natural gas, increased energy efficiency, increased renewable non-emitting generation, new nuclear power plants, and carbon sequestration. These strategies are applicable whether the carbon restrictions take the form of a tax, cap or trade, or source-specific reductions. Neither new nuclear plants nor carbon sequestration will make significant contributions to carbon reductions for at least a decade. This reality leaves gas generation, non-carbon-emitting generation, and energy efficiency.

Utilities have had an inherent financial bias against demand-side resources that reduce sales, since reductions in sales reduce the income of utilities that use the Standard Two-Part Tariff (Standard Tariff). The Standard-Two Part Tariff recovers only a portion of a utility's fixed costs from fixed charges, leaving the residual fixed costs, including income, to be recovered from charges that vary with use. This coupling of sales and income has made utilities reluctant to embrace strategies that reduce sales, regardless of whether the utility is the program implementer or funder, or whether non-utility entities provide these functions. Negawatts instead of megawatts as an energy resource, conservation programs designed to reduce bills in general or make electricity more affordable to low-income households, and energy efficiency programs that are wholly outside of the utility's control—all of these measures have met with utility resistance, partly because of the underlying linkage between sales and income. Decoupling mechanisms that seek to make utilities indifferent to sales variations often encounter implementation and administrative challenges as well as resistance from ratepayers.

The Energy Information Administration's 2007 base case has energy efficiency as the leading strategy for reducing carbon emissions, until around 2023 when carbon sequestration takes a leading role. For energy efficiency to occupy this large role, regulators must (1) eliminate the disincentive for energy efficiency that links decreased sales to decreased income, (2) provide customers with energy efficiency incentives, and (3) provide utilities with financial incentives to promote energy efficiency as a resource comparable to supply resources in places where regulators expect utilities to play a role in implementing or funding energy efficiency initiatives.

This paper starts by focusing on one decoupling approach, a Straight Fixed Variable (SFV) rate design. Straight Fixed Variable rate design is a rational way to recover fixed and variable costs because it aligns pricing with variable and fixed cost causation, thereby removing the utility's profit-sensitivity to reduced sales. The problem with SFV is that it reduces the variable charge to short-term variable cost, which is likely to be lower than the economically efficient level of long-term marginal cost, leading to over consumption. To address this problem, an economic incentive for consumer energy efficiency is needed. This paper therefore proposes to discuss the SFV rate design with revenue-neutral energy efficiency feebates. Feebates are a combination of fees and rebates.

## II. Straight fixed variable rate design

### A. Overview of the concepts

A Straight Fixed Variable Tariff is designed to assign all fixed costs to fixed charges and only variable costs to variable charges. Fixed costs do not change with changes in output, whereas variable costs do change with output. Economic theory would have the price of electricity based upon long-term marginal cost.[2] Given regulators' general use of embedded cost pricing for utility ratemaking, allocating fixed costs to fixed charges and variable costs to variable charges is a reasonable second-best solution from an economic rationality and equity perspective.

The Standard Two-Part Tariff, by allocating some fixed charges to the variable rate, causes large users to pay for fixed costs in excess of their load share. SFV rate eliminates this characteristic. Assume there are two off-peak water heating customers, each with the same contribution to system peak use, except that one uses a lot more hot water. The user of more hot water under a Standard Tariff will pay a disproportionate share of the fixed costs, relieving the other customer of a portion of its share. Although the fixed costs needed to serve each customer are the same, they bear different cost shares.

In addition to correcting for the disproportionate recovery of fixed costs, placing all fixed costs into the fixed charge decouples per-customer sales volume from a utility's income. The table below provides a simplified comparison of the effect of a reduction in sales on a utility's income when using a Standard Two-Part Tariff versus an SFV rate design. Standard Two-Part Tariffs and SFV tariffs can have the same basic components (e.g., customer, demand, and energy charges), with the only difference being that there are no fixed costs in the variable portion of the SFV tariff.

[2] See Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions, Volume I* (Cambridge, MA: MIT Press, 1988), Chapter 4.

**Table 1: Effect on Income Associated with Reduced Sales**

| | Standard Two-Part Tariff (No Decoupling Adjustment) | | Straight Fixed Variable Tariff | |
|---|---|---|---|---|
| | **Base Case** | **Energy Efficiency Case** | **Base Case** | **Energy Efficiency Case** |
| **Key Assumptions** | 100 customers<br>1000 kWh/customer<br>Fixed charge $15/customer<br>Variable Charge $0.075/kWh | 100 customers<br>950 kWh/customer<br>Fixed charge $15/customer<br>Variable Charge $0.075/kWh | 100 customers<br>1000 kWh/customer<br>Fixed charge $50/customer<br>Variable Charge $0.04/kWh | 100 customers<br>950 kWh/customer<br>Fixed charge $50/customer<br>Variable Charge $0.04/kWh |
| **Revenues** | | | | |
| **Revenues from Fixed Charges*** | $1,500 | $1,500 | $5,000 | $5,000 |
| **Revenues from Variable Charges** | $7,500 | $7,125 | $4,000 | $3,800 |
| **Total Revenues** | **$9,000** | **$8,625** | **$9,000** | **$8,800** |
| **Expenses** | | | | |
| **Fixed** | $4,000 | $4,000 | $4,000 | $4,000 |
| **Variable ($0.04/unit)** | $4,000 | $3,800 | $4,000 | $3,800 |
| **Total Costs** | **$8,000** | **$7,800** | **$8,000** | **$7,800** |
| **Income** | **$1,000** | **$825** | **$1,000** | **$1,000** |

* Fixed charges are here presented without any adjustment for Return on Equity in SFV cases to reflect reduced risk.

In the example above, the utility experiences a decrease from the base level of sales set in the rate case, from 1,000 units per customer to 950 units per customer. The effect on income of a 5% reduction in sales when a Standard Tariff is used is a decrease in income of 17.5%. Under the SFV tariff, income is not changed by the decrease in sales. The larger the change in income related to a change in sales under an existing Standard Tariff, the greater the need for rate redesign and the greater impact the change will have on the utility's behavior.

### B. Major reasons for regulatory reluctance to implement an SFV rate design

Straight Fixed Variable rate design is not a new idea, nor is decoupling of income from sales. SFV rates are used for gas utilities in North Dakota, Georgia, Oklahoma, and Missouri. The author is not aware of any place where an SFV rate design is used to recover the costs of an electric utility. The apparent unpopularity is likely based on the following concerns:

1. Moving revenue from the variable component of a standard two-part tariff to the fixed charge can reduce a customer's economic incentive to conserve.

2. Larger users should be allocated more of the utility's fixed costs.

3. Moving revenue from the variable component of a standard two-part tariff to the fixed charge adversely affects small users within a class, including possibly low-income customers.

4. There are differences of opinion about which costs are fixed and which are variable.

Each of these concerns is addressed below.

#### 1. SGV reduces consumers' incentive to conserve energy

As explained in Part II.A above, recovering fixed costs solely through fixed charges is an economically reasonable second best solution when rates do not reflect the long-run marginal cost of electricity. But the reduction in the variable charge arising from a shift of fixed costs to the fixed charge can reduce the customer's economic incentive to conserve. Reduced savings on the customer's bill that are associated with SFV rate design in certain situations can extend the payback period, from the customer's perspective, of a customer-funded energy-efficiency investment. The example on the next page sets forth two cases from the consumer's perspective and compares the payback period for the same customer-funded energy efficiency investment.

**Table 2: Comparison of Payback on Energy Efficiency Investments**

| Reduction of Monthly Customer Usage from 1000 to 900 Units<br>Energy Efficiency Investment of $200 | | |
|---|---|---|
| | **Standard Two-Part Tariff**<br>**$15 Fixed Charge**<br>**$0.075/unit** | **Straight Fixed Variable**<br>**$50 Fixed Charge**<br>**$0.04/unit** |
| **1000 units** | Fixed $15.00<br>Variable $75.00<br>Total $90.00 | Fixed $50.00<br>Variable $40.00<br>Total $90.00 |
| **900 units** | Fixed $15.00<br>Variable $67.50<br>Total $82.50 | Fixed $50.00<br>Variable $36.00<br>Total $86.00 |
| **Savings** | **$7.50/momth or $90/year** | **$4.00 or $48/yer** |
| **Payback Period w/o adjustment for decoupling** | **2.2 years** | **4.2 years** |
| **Payback Period after $1.66/month adjustment for decoupling[3]** | **2.9 years** | **4.2 years** |

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[3] Based on assumptions used in Table 1 where a $175 income shortfall would need to be recovered from all customers in the class.

The above example shows that consumers would have a shorter payback period with the Standard Tariff than a SFV tariff. Absent other modifications, the SFV thus would discourage some customers from making an investment; they would see a payback in 4.2 years rather than 2.9 years.

There are several responses to the assertion that SFV provides less of an economic incentive for customers to conserve than a Standard Two-Part Tariff.

a. If everyone conserved to exactly the same degree and a decoupling adjustment clause were used to recover the utility's lost income, then the bill to the consumer under either Standard or SFV tariff would be the same. See Table 3 on the next page, where the customer's bill is $88 under either tariff. Table 3 demonstrates that when the utility's income is protected from erosion due to reduced sales, and when all customers in a class reduce usage by the same percentage, the bills before and after the sales reduction under either tariff are the same. When all customers conserve proportionally equally, there is no conservation disincentive associated with SFV rate design compared to the Standard Tariff with a decoupling tracker. The issue is, therefore, not that SFV reduces the conservation incentive; rather, it is that customers may behave differently from each other even when offered the same opportunities to conserve.

**Table 3: Effect on Customer Bill**

| Across-the-Board 5% Reduction in Usage and a Decoupling Adjustment | | |
|---|---|---|
| | **Standard Tariff**<br>**$15 Fixed Charge**<br>**$0.075 Variable Charge**<br>**$.001842 Decoupling Fee** | **SFV**<br>**$40 Fixed Charge**<br>**$0.04 Variable Charge**<br>**Decoupling Fee N/A** |
| **1,000 Units** | Fixed $15.00<br>Variable $75.00<br>Total $90.00 | Fixed $50.00<br>Variable $40.00<br>Total $90.00 |
| **950 Units** | Fixed $15.00<br>Variable $71.25<br>Decoupling[4] $1.75<br>Total $88.00 | Fixed $50.00<br>Variable $38.00<br>Decoupling N/A<br>Total $88.00 |

b. When the Straight Fixed Variable rate design is used in conjunction with the Revenue-Neutral Energy Efficiency Feebate (REEF), the regulator can reflect long-term marginal costs and the costs of externalities in a customer's price signal without upsetting the embedded cost-based revenue requirement calculation for the utility. The REEF concept is discussed at Section III.

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[4] The Decoupling Fee was calculated by dividing the $175 income shortfall from Table one by the 95,000 units (100 customers x 950 units), or $0.001842/unit.

### 2. Larger users' share of the utility's fixed costs

Some oppose straight fixed variable because it would reduce large users' share of the utility's fixed costs. The argument of SFV is that it aligns the customer's cost share with the burden that the user places on the system. No user – large or small -- should pay more than its appropriately allocated share of fixed costs. If all customers within a class place the same fixed costs (costs that do not vary with usage) on the system, then all customers within that class should pay the same amount in fixed costs. Costs that are not fixed and vary with usage should be recovered form the variable charge. Variable charges should recover charges such as RTO capacity charges, variable demand charges associated with purchased power, and the variable portion of depreciation charges.

The allocations between fixed and variable costs in an SFV rate design occur within a customer class. Creating homogeneous membership within customer classes is a first step towards reducing misallocations among customers within a class. Stratification of customers into more homogeneous groups allows for better assignment of costs under any ratemaking approach.

### 3. SFV places a greater burden on small and low-income customers than do Standard Tariffs

SFV tariffs do charge low-usage customers within a customer class more than a Standard Two-Part Tariff. If a utility incurs the same fixed costs by having two customers connected to the system who are able to take as much power as they want whenever they want, then each customer should pay the same in fixed charges, because assigning fixed costs within a specific tariff to a fixed charge is fair to all customers.

The Revenue-Neutral Energy Efficiency Feebates discussed in Part III below are designed to shift revenue responsibility from small users to large users within a customer class, without distorting the rate design. The shift in revenue responsibility associated with REEF addresses the issue that low-usage customers would bear more costs due to a move from a Standard Tariff to a SFV tariff.

The effect that a SFV tariff would have on low-income customers is far from conclusive. The literature is not consistent regarding whether low-income customers use more or less electricity than the average customer. Consumption often depends on demographics other than income, such as family size; quality of housing stock; owners versus renters and whether the renter pays the electric bill directly; end uses such water heating, cooking, and space heating; appliance efficiency; and age of householders. There are many other ways of addressing low-income customers' energy affordability issues besides allocating fixed costs to variable charges that may or may not be beneficial to low-income customers. These strategies include, in part, low-income usage-reduction programs where the utility may make investments in the low-income housing stock to increase energy efficiency (note that SFV rate design creates no disincentive for low-income usage reductions programs, in contrast to the Standard Tariff), rate discounts targeted directly to low-income customers, maximum bills as a percentage of a customer's income, and federal low-income energy assistance grants.

#### 4. Difficulties in determining which costs are fixed and which are variable

It is not always transparent which costs vary with sales. Examples of costs which do not vary with sales include administrative overhead such as rent, office building depreciation, or interest on long-term debt. The depreciation of a generating plant, however, has a fixed component and a variable component; i.e., the more the power plant is used to meet demand, the faster it depreciates. The variable component of depreciation should be assigned to the variable component of the SFV tariff and booked as incurred. Labor is predominately a fixed cost, but a portion may be variable, such as overtime for power plant maintenance or customer service, during high-usage summer periods. Commissions that decide to consider an SFV as a decoupling tool may wish to allocate additional time and resources to the rate design portion of the rate case where the SFV concept is first developed.

### C. Benefits of SFV

SFV rate design provides a rational allocation of and recovery mechanism for fixed and variable costs, and decouples sales from income. SFV reduces the risk of the utility as an investment. SFV protects a utility's income from externalities associated with variance in sales such as weather, the economy, price elasticity, and energy efficiency. With a reduced variance in income, risk to investors is reduced. Reduction in risk should be linked to a reduction in the allowed return on equity (ROE). A lower ROE reduces the cost to all customers.

Another benefit of an SFV tariff is that it also makes a utility indifferent to the meter running backwards for net metering of demand-side renewable resources. The removal of losses associated with net metering allows a utility to promote smaller solar and wind technologies.

With an SFV rate design as the decoupling mechanism, nothing other than the base tariff need be posted on the bill, unless the variable charge includes some type of an adjustment mechanism. This method is simpler than a Standard Tariff with decoupling adjustment mechanism, which if implemented to track all changes in revenues from each part of the tariff could have separate adjustments for the customer, energy, and demand components as well as ongoing reconciliation adjustments. The SFV rates are set within a rate case without the decoupling adjustment mechanism associated with a Standard Tariff and without the accompanying recurring audits and hearings to ensure that the decoupling adjustment has been accurately recovered.

## III. Revenue-Neutral Energy Efficiency Feebate

The Revenue-Neutral Energy Efficiency Feebate (REEF) allows regulators to promote energy efficiency beyond the average cost price signals provided by the variable portions of most rate designs. Regulation normally looks at embedded costs and then divides costs by usage to get prices that are average-cost-based. This method ignores avoidable long-term costs that have not occurred and may not occur if the need for additional resources is avoided by changes in customer behavior. Marginal cost pricing is difficult to achieve when revenue requirements are based on embedded costs. State commissions have tried inverted block rates to try to achieve this goal, but those rates aggravate the decoupling problem discussed above, because the movement towards marginal cost pricing is accomplished by shifting more of the embedded fixed cost to the marginal charges in the inverted block rates..

A REEF enhancement to an SFV rate design allows regulators to adjust pricing to reflect long-run marginal costs without affecting a utility's total revenues. Feebates combine rebates and fees into a single program to encourage behavior. The fees fund the rebates, thus making the price incentives revenue-neutral for the utility. The combination of SFV rate design and feebate thus creates an income-neutral environment for energy efficiency.

### A. REEF— a general description

The REEF is an intra-class adjustment in which customers who use more than some typical amount pay a fee, while customers who use less receive a rebate. The fees and the rebates offset each other fully, leaving the utility revenue-neutral. These fees and rebates can be designed to induce certain behaviors, such as off-peak conservation (thus reducing coal generation) or on-peak summer conservation (to avoid peak-related future generation costs). The benchmarks used to determine rebates and fees are continuously adjusted by the changes in actual usage to reflect changes in the consumption of different customer classes, whether associated with the weather or with a reaction to the REEF.

The REEF can be designed to reflect long-term marginal costs and to provide customers with price signals relating to externalities. This redesign is an improvement on standard utility pricing, which uses only average embedded costs. For example, average embedded cost pricing would reflect the cost of carbon credits at current prices but would not reflect future carbon costs or long-term marginal costs

Price incentives based upon avoidable costs usually affect total revenues collected and therefore affect the embedded cost ratemaking math. A post-revenue requirement adjustment to rate design that is revenue-neutral allows the regulator to sharpen the price signals without changing the underlying total revenues earned by the utility. In addition to targeting avoidable long-term costs and carbon emissions, the feebate can be designed to maintain the conservation incentives that existed under the Standard Tariff for some period so as not to penalize customers who relied on that pricing paradigm and made energy-efficiency investments.

Every rebate paid to a customer is funded by a customer-paid fee from the same class of customer. It is, therefore, important to have homogeneous customer classes. It might also be necessary to create benchmarks within some classes to normalize usage targets (e.g., in a commercial class, setting the benchmarks based upon usage per squarefoot of retail space rather than total usage). Customers will quickly see that they can earn credits by using energy more efficiently. It may be more acceptable in some cases to limit the application of REEF to relatively homogeneous classes while not applying it to classes that are particularly heterogeneous.

## B. REEF—implementation issues

### 1. Keep REEF adjustments within a class

A REEF should be designed to keep the adjustments within a class of customers. Customer classes should be defined so that customers are as homogeneous as possible (e.g., heating customers separate from non-heating customers). Classes can generally follow rate classes. Revenue-neutral adjustments will occur within each class. It may not be practical or necessary to have a REEF for each class. The heterogeneity among large industrial customers may make using rate classes impractical and require other comparison techniques, such as looking at the same customer's usage over time. The lack of heterogeneous rate classes for portion of a utilities customers is not a reason to reject the REFF for other customers.

### 2. Determine and apply the benchmark

The benchmark should focus on goals that the regulator finds important and that are not adequately addressed by the underlying pricing structure. The benchmark could be based solely on energy, if the focus is carbon; on demand, if the focus is avoiding the need for future generating capacity; or on off-peak energy only, if the strategy is to focus energy efficiency when coal is on the margin. The benchmark could also be based on another goal or combination of goals. The benchmark(s) within a class would be determined for each REEF calculation period so that as customer behavior and exogenous factors (e.g., the weather) change, the benchmark changes also. Once a benchmark for the period is determined, it would be compared to the actual usage of customers in that class for that period to determine the fee or rebate due to each customer.

The feebate program could be developed such that customers that are within a certain percentage or standard deviation of the benchmark would have no adjustment. This "null zone" approach would eliminate noise around the middle, applying adjustments only to customers who are either considerably more or less energy efficient than their class members. Null zones create simplicity but also dampen price signals, because of the exclusion of units within the null zone.

### 3. Determine the size of the fee and rebate

The strength of the REEF as a price signal is related to the size of the fees and rebates. The regulator need only set the fee; the rebate for each customer will result from allocating all the fees received to those who have earned a rebate. Commissions generally have a great deal of discretion, as long as the methodology for establishing the fees is consistent with public interest goals and reasonably based upon underlying costs associated with those goals. These costs may be understood as either actual avoided costs (e.g., the real-time cost of electricity) or potentially avoidable costs (e.g.,long-term marginal costs or externalities not currently internalized to the utility's costs), with no effect on the utility's current revenue requirement. The rebate is calculated by allocating the total fees charged to the customers whose usage was below the benchmark (e.g., proportionally based upon usage below the target level). A customer's current bill would be adjusted with a fee or rebate as established above, rather than through a lagging adjustment as in a decoupling adjustment. There is an actual dollar amount and actual usage used in this calculation, unlike the decoupling adjustment that uses the next period's usage to recover the lost revenues This actual cost and usage method keeps usage and fees/rebates synchronized, eliminating any need for reconciliation or true-ups.

The actual size and design of the fee needs to be determined based upon the facts such as long-term margial costs or avoidable costs in individual cases. The size of the feebate can create an energy efficiency signal that is stronger than the standard tariff's signal (see Table 5 for an example). The design of the rebate need not be consistent between rate classes and can even have increasing blocks (e.g., the biggest energy hogs pay ever-increasing fees).

### 4. Target the REEF

A REEF can be used to target usage that is aligned with the public policy goals of the regulator. If the goal is to shed coal generation that is on the margin only during off-peak hours, the target would be off-peak usage. Conversely, if carbon dispatch is being used instead of economic dispatch by the RTO, or if the market for carbon credits is very expensive, then coal might be on the margin during on-peak hours. More than one public policy goal may be targeted at the same time as long as they do not conflict.

### 5. Set the REEF adjustment period

The application of the REEF requires that there be a period over which usage data is collected and compared. There are a few ways to define the adjustment period. The first is to have an adjustment for each billing cycle. Every customer within a customer class would have a REEF calculated based upon meters that are read on the same day for the same billing period. The benefit of this approach is that it provides analytical rigor, as all customers will have been billed for consumption in the same period, with the same number of weekdays and weekends and with the same weather. The calculation of fees and rebates is easy to manage; all the data comes in at the same time and an adjustment is placed on the subsequent bill. Using the billing cycle breaks the class into about 20 subgroups (number of billing cycles within a month), and therefore might cause a situation where the groups are too small to prevent the behavior of a small number of customers from having too much influence on the feebate calculation.

Another approach is to gather all customers' data during a set period such as all meters read in June. Periods of between several days and a month can be considered. The longer the period, the more customers there will be within the adjustment group. On the other hand, a longer data-gathering period increases the chance that anomalies may occur among the customers because of exogenous changes, such as weather. If a month is chosen and one customer's data is for the 30-day period May 3 through June 1 while another's period is June 1 through June 30, the weather conditions might be much different between these two periods.

Using weekly rather than monthly groups reduces the incentive group size by about 75%, but avoids the problems associated with two-month spans in weather changes.

#### 6. Billing

The REEF, either the rebate or the fee, would be posted on the customer's next bill as a specific amount with a clear explanation such as, "Your usage was 50 kWh less than this month's energy efficiency benchmark of 750 kWh. You are being awarded a rebate in recognition of your commitment to using energy efficiently and improving the environment." Or "Your usage was 50 kWh greater than this month's energy efficiency benchmark of 750 kWh, and you are being charged an energy efficiency fee. To reduce or eliminate this premium or earn an energy efficiency credit, pleases consider how you can use energy more efficiently and improve our environment. Call 1-800-555-SAVE." The message could be different depending on the Commission's explicit public policy goal and rate class.

Instilling the most transparency, flexibility, and confidence in a REEF requires frequent, timely, and accurate actual meter reads. Automatic meter reading enhances this potential. Estimated meter readings reduce confidence that the right customers are the paying correct fees and receiving the correct rebates.

### C. REEF—an example

A REEF can be developed in many ways to enhance the SFV rate design. The REEF's design depends on many underlying issues. This example assumes that, after considering the long-term marginal cost of electricity and the potential future cost of carbon credits, regulators determined that the variable cost of electricity should be $0.09/kWh. This unit price is higher than either the $0.04 under the SFV or the $0.075 for the Standard Tariff, as shown in Table 1, and creates a $0.05/kWh fee for excess usage under the SFV rate design. The $0.09/kWh rate would be based upon factors not included in the current embedded costs that regulators find appropriate to provide as price signals to consumers about the true cost of electricity. This example assumes that costs do not vary by time of day or time of year. The benchmark usage is 1000/kWh/customer. The table shows how credits and premiums would be allocated among the five customers in this class. A null zone has not been included.

**Table 4: REEF Example**

| | 650 kWh | 900 kWh | 1000/kWh | 1200 kWh | 1250 kWh |
|---|---|---|---|---|---|
| **SVF Tariff** | $76.00 | $86.00 | $90.00 | $98.00 | $100.00 |
| **REEF Adjustment** | -$17.50 | -$5.00 | $0.00 | $10.00 | $12.50 |
| **SVF plus REEF** | $58.50 | $81.00 | $90.00 | $108.00 | $112.50 |
| **Standard Tariff** | $63.75 | $82.50 | $90.00 | $105.00 | $108.75 |

In this example, the REEF-SFV combination shifts costs from larger customers to smaller customers more strongly than did the Standard Tariff, even though the fixed costs have been removed from the variable charge of the SFV tariff. Only at the typical usage point of 1,000 kWh are the bills under the Standard Tariff and the SFVR-REEF combination equal. A consumer using 650 kWh saved an additional $5.25 (8.2%) under the SFV-REEF tariff, and a consumer using 1,259 kWh paid $3.75 (3.4%) more than the Standard the Tariff. A stronger conservation incentive has been provided.

The REEF is self-adjusting. As consumers become more energy efficient, the REEF standards become stronger. Table 6 provides an example which takes into account reduced average usage.

**Table 5: REEF Example – Step 2**

| | 650 kWh | 850 kWh | 900/kWh | 1000 kWh | 1100 kWh |
|---|---|---|---|---|---|
| **SVF Tariff** | $76.00 | $84.00 | $86.00 | $90.00 | $94.00 |
| **REEF Adjustment** | -$12.50 | -$2.50 | $0.00 | $5.00 | $10.00 |
| **SVF plus REEF** | $63.50 | $81.50 | $86.00 | $95.00 | $104.00 |
| **Standard Tariff** | $63.75 | $78.75 | $82.50 | $105.00 | $108.75 |
| **Decoupling Adjustment** | $2.53 | $3.32 | $3.51 | $3.90 | $4.29 |
| **Std Tariff + Decoupling** | $66.28 | $82.07 | $85.51 | $108.90 | $113.04 |

The bill for the 650 kWh-customer is higher than in the earlier case ($63.50 vs. $58.50). This change in the bill is because all consumers are now more energy-efficient, reducing the total fees collected, and this consumer did not change his consumption.

There are many other ways to structure a REEF other than the one shown in this example. A REEF can be applied to all components of a tariff, to the demand or energy components alone, or to on-peak rather than off-peak usage, depending on the objective of the price signal. Benchmarks could compare the customer's behavior to his own previous usage when there is no reasonable comparison group with credits shared with other heterogeneous customers within the customer class.

# IV. Comparison of SFV-REEF Tariff with other decoupling tools

## A. Overview of other decoupling tools

### 1. Revenue decoupling tracker

This automatic adjustment clause increases or decreases rates depending on how actual sales compare to base sales established in a rate case. There are many implementation issues, including setting base usage figures for each rate class and for each tariff component. In implementing this type of a decoupling mechanism, income neutrality requires adjustment only for revenues associated with fixed costs (net revenues) and not gross revenues. Net revenues are gross revenues net of variable costs. Income neutrality is not achieved (see the following table) when gross revenues are used as the basis because variable portion of gross revenues are already adjusted by the change in sales.

**Table 6: Net vs. Gross Revenue Adjustments**

**Assumptions:** Rate Structure - $15 fixed charge plus $0.075/kWh; Variable Cost $0.04/kWh; 100 customers; Base sales of 1000 kWh/customer; Actual Sales of 950 kWh/customer

| | Base Case | Actual w/o Decoupling Adjustment | Actual with Adjustment for Gross Revenues[5] | Actual with Adjustment for Net Revenues[6] |
|---|---|---|---|---|
| **Revenue** | | | | |
| **Fixed Charge** | $1,500 | $1,500 | $1,500 | $1,500 |
| **Variable Charge** | $7,500 | $7,125 | $7,125 | $7,500 |
| **Decoupling Adj.** | N/A | N/A | $375 | $175 |
| **Total** | **$9,000** | **$8,625** | **$9,000** | **$8,800** |
| **Costs** | | | | |
| **Fixed** | $4,000 | $4,000 | $4,000 | $4,000 |
| **Variable** | $4,000 | $3,800 | $3,800 | $3,800 |
| **Total** | **$8,000** | **$7,800** | **$7,800** | **$7,800** |
| **Income** | **$1,000** | **$825** | **$1,200** | **$1,000** |

[5] Adjustment calculated by subtracting total base revenues from total actual revenues.

[6] Adjustment calculated by netting out reduction in variable cost from gross revenue adjustment.

Failure to net out revenue changes designed to recover variable costs from the adjustment leads to an unintended increase in utility income of 20%. The same mechanism would cause an unintended decrease in income if adjusting for an increase in sales.

Decoupling trackers require recurring audits and a reconciliation mechanism. The use of a revenue decoupling tracker could require several line items on a bill, making the bill more complicated and possibly causing customer resistance to the approach. A decoupling tracker can create revenue neutrality, but requires considerable administrative effort to execute accurately.

### 2. Lost revenue recovery adjustment

The lost revenue recovery adjustment (LRRA) creates an explicit revenue adjustment for particular actions taken by a utility. For example, if a utility replaces a light bulb with a compact fluorescent, a specific lost revenue adjustment would be recovered from ratepayers. The LRRA targets utility-driven energy efficiency-related losses in revenues—not those changes in revenues associated with fluctuations in factors such as the economy, the weather, or non-utility energy efficiency programs. It can be difficult to quantify either the action or the effect on revenues of softer yet important programs. Harder-to-quantify utility-sponsored programs include energy efficiency customer education, or fluorescent bulb distribution, as it is hard to know whether distributed compact fluorescent light bulbs get and stay installed. There is a natural tendency for utilities to want to overstate the effect on revenue of particular action; likewise, ratepayer advocates tend to understate the increase or decrease in the associated revenue adjustment. Continuous measurement and monitoring is required to ensure that estimated savings are reasonable approximations of actual savings. Lost revenue recovery adjustments should also be designed to reflect changes in net revenue versus gross revenue, as discussed at the section on revenue trackers The LRRA takes a good deal of administrative effort to implement, audit, and reconcile.

## B. Other decoupling tools compared to the SFV-REEF rate design

Table 7 compares SFV-REEF rate design to other decoupling tools. This comparison utilizes three indicators in addition to the underlying economic premise that variable fixed cost should be recovered solely through fixed charges.

1. Effectiveness and accuracy as a decoupling tool: This comparison addresses how well income neutrality is achieved by each method (i.e., how well the approach decouples income from sales).

2. Effectiveness as an energy efficiency incentive: This comparison addresses whether the method provides signals to the utility and the customer to save energy.

3. Ease of administration and billing.

## Table 7: Comparing SFV-REEF to Other Decoupling Tools

| | **Revenue Decoupling Tracker** | **Lost Revenue Recovery Adjustment** |
|---|---|---|
| **Effectiveness in Decoupling Revenues and Income** | Can achieve same decoupling as SFV but only if net revenues are used as the adjustment rather than gross revenues. Use of gross revenues can produce unintended income rather than income neutrality. Unlike SFV, can adjust for changes in sales associated with the number of customers. | Targets only revenue losses associated with utility programs. Does not make utility indifferent about lost revenues associated with other energy efficiency programs. Difficult to measure softer measures such as education or full or sustained implementation of each action. Tendency by stakeholders to under-or overstate adjustment factors. |
| **Effectiveness in Encouraging Energy Efficiency** | Underlying Standard Tariff may include more customer incentive for energy efficiency than SFV as more dollars are recovered through variable charges. Difference disappears if all customers conserve the same amount. Existing Standard Tariffs may not provide accurate price signals.<br><br>Inclusion of REEF allows regulators to better target specific customer behavior and reflect long-run marginal costs.<br><br>Both methods eliminate the disincentive to utilities associated with energy efficiency but do not provide a profit incentive. | Underlying Standard Tariff may include more customer incentive for energy efficiency than SFV as more dollars are recovered through variable charges. Difference disappears if all customers conserve the same amount. Existing Standard Tariffs may not provide accurate price signals.<br><br>Inclusion of REEF allows regulators to better target specific customer behavior and reflect long-run marginal costs.<br><br>Does not achieve the same breadth of energy efficiency decoupling as SFV. May make utility opposed to non-utility energy efficiency initiatives. |
| **Ease of Billing And Administration** | SFV easier to bill and administer. No extra lines on bill. SFV requires no tracking, audits or reconciliation that is required by tracking mechanism.<br><br>SFV may require an income tracking protocol to ensure excessive earnings do not occur.<br><br>REEF introduces some additional administration for billing. No reconciliation is necessary. | SFV easier to bill and administer. No extra lines on bill. SFV requires no tracking, audits or reconciliation that is required by lost revenue recovery mechanism.<br><br>Lost recovery mechanism requires ongoing measurement and monitoring of estimated and actual savings.<br><br>SFV may require an income tracking protocol to ensure excessive earnings do not occur.<br><br>REEF introduces some additional administration for billing. No reconciliation is necessary. |

The SFV-REEF tariff is fundamentally superior to the other decoupling mechanisms. It decouples income from sales almost as completely as one method and better than the other, provides better price signals, and is much easier to bill and administer. For all of these reasons, in a time when energy efficiency must become a growing part of the resource mix to meet carbon standards and fight greenhouse gases, a Straight Fixed Variable Rate design supplemented by a Revenue-Neutral Energy Efficiency Feebate should be considered by regulators across the country.

## V. Conclusions and Recommendations

Energy efficiency is a resource that requires more attention as regulators, utilities and consumers of electricity set off to engage in the battle against greenhouse gases. The following actions, together, will create a regulatory environment more conducive to improving the natural environment.

1. ***Eliminate the disincentive associated with the current coupling of sales and income.*** Coupling has discouraged utilities from employing strategies that reduce sales, by implementing a straight fixed variable rate design as a decoupling tool. This paper suggests that the SFV rate design is superior to the standard two-part tariff from an economic theory perspective, provides broad decoupling, and is much easier to implement and administer than other decoupling tools. An SFV rate design reduces a utility's financial risk, which should lead to a decrease in the allowed rate of return and total revenue requirements and rates.

2. ***Supplement the SFV rate design with a Revenue-Neutral Energy Efficiency Feebate program.*** The REEF allows regulators to provide targeted price signals that reflect costs such as long-term marginal costs and externalities that have not been internalized to a utility's cost structure. The REEF ameliorates concerns that some may have with an SFV rate design and allows regulators to carefully target incentives for specific customer behavior without changing the utility's overall revenue requirement.

This type of regulatory package puts downward pressure on rates while improving the regulatory environment for energy efficiency.