The Regulatory Function in Advancing Energy Efficiency

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About the Presenter

Ken Costello is the Principal of Natural Gas Research and Policy at the National Regulatory Research Institute (NRRI). He has conducted extensive research on topics relating to the natural gas and electricity industries, as well as public utility regulation. His most recent work has focused on the natural gas sector, with particular emphasis on the issues facing public utility regulators and local gas distributors. These issues include revenue decoupling, cost trackers, electric-to-gas substitution, energy efficiency, financial speculation in natural gas, outsourcing, rate issues in retail gas markets, fuel diversity in electric generation, the effects of federal legislation on the natural gas market, incentive mechanisms for gas procurement, gas supply planning and regulatory oversight, long-term contracting for gas pipeline services, and assessing market trends in the natural gas sector. Mr. Costello is a member of the NARUC Subcommittee on Gas.

Previously, Mr. Costello worked for NRRI as an associate director and senior institute economist. He has also held positions within the Illinois Commerce Commission, the Argonne National Laboratory, and the Commonwealth Edison Company. At NRRI, he has provided training and consulting services to Argentina, Bolivia, Canada, the Central and Eastern European countries, China, Costa Rica, Egypt, India, Japan, the Newly Independent States, and Russia. His research has appeared in books, technical reports, and papers, in addition to scholarly and trade publications. These publications include the *Cato Journal*, *Electricity Journal*, *Energy Journal*, *Energy Law Journal*, *Public Utilities Fortnightly*, *Regulation*, *Resources and Energy*, *Utilities Policy*, and *Yale Journal on Regulation*.

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I. Getting the Most Benefits from Energy Efficiency Initiatives

A. The obligation of regulators ("state public utility commissions")

1. The U.S. will expend substantial resources over the next several years to promote energy efficiency (EE).

    a. The Obama administration has emphasized the importance of advancing EE, allocating billions of dollars to the states to further this goal.

    b. State public utility commissions (PUCs) and other state entities are also aggressively pushing energy utilities to promote EE.

2. With large EE expenditures, it is imperative to maximize the benefits.

3. It is not enough just to implement EE initiatives that pass some cost-benefit test; they should also produce the highest possible benefits for the dollars expended.

4. State commissions, therefore, have an obligation to utility customers and the general public to ensure maximum benefits from utility EE initiatives.

    a. Let us assume that a utility is spending $20 million on EE, which when allocated most effectively can produce benefits of $30 million.

    b. The commission has an obligation to make sure that the benefits are $30 million rather than $25 million, even though the benefits would still exceed the costs.

B. Background on utility EE initiatives

1. Utility EE initiatives are premised on the existence of market and consumer behavioral problems that warrant subsidies and other forms of intervention, as long as their costs are less than the benefits.

2. While the primary focus should be on getting the prices right, doing so often results in political difficulties; both high energy prices and taxes (e.g., to account for externalities) encounter serious political opposition. Thus, policymakers rationalize appliance standards, building codes, and utility EE initiatives.

3. Past utility EE programs have confronted a number of problems in maximizing benefits; poorly designed programs have:

    a. Included "free riders" as participants (i.e., customers who would have invested in EE without utility programs, thus making no contribution to incremental energy savings),

    b. Featured nonalignment of program objectives with a specific market or "behavioral" problem (e.g., using rebates when the fundamental problem is customers not receiving adequate information to make an informed decision about whether to invest in EE),

    c. Provided low utility motivation for success (via traditional ratemaking practices), and

    d. Contained inadequate utility financial inducements for consumer participation (e.g., most customers were not interested in loan programs, and education had a limited effect on energy savings).

4. Some analysts have criticized the cost estimates (per unit of energy saved) of utility EE programs due to:

    a. Unaccounted "free riders,"

    b. Non-reporting of all relevant costs by utilities, and

    c. Optimistic assumptions in the engineering analysis of energy savings.

5. The conceptual problem: Three scenarios

    a. Regulators might require energy utilities to spend a fixed amount of dollars on EE.

        (1) Let us assume that a regulator wants a utility to spend X dollars on energy efficiency.

        (2) The utility should then attempt to maximize "B" when expenditures on EE $\leq$ $X.

            (a) "B" equals the avoided costs of the utility (which is the primary benefit) plus other benefits.

(b) Benefits, therefore, depend on both the magnitude of energy savings and the dollar value of those savings (e.g., the energy saved in peak periods has greater value than the energy saved in off-peak periods).

b. Secondly, regulators might require utilities to achieve targeted energy savings from initiatives.

(1) Let us assume that a regulator wants a utility to achieve "Y" energy savings (e.g., 10% of current electricity sales).

(2) In this instance, the objective would be to achieve these savings at least cost (i.e., minimize the dollars expended on EE when energy savings $\geq$ Y).

(3) This objective is not exactly a twin of the first objective, since the first objective is in dollar terms while the second objective is framed in terms of physical energy savings.

c. Thirdly, in the future the federal government could impose a regulatory mandate to achieve certain targets in EE (The Waxman-Markey bill, for example, contains a provision that would require gas utilities to use one-third of their carbon allowances for EE initiatives. The industry estimates that it would force gas utilities to spend $5 billion per year on EE; currently, they spend less than $1 billion per year.)

d. In all instances, the objective should be to maximize utility performance by:

(1) Producing the most energy savings from the dollars expended, or

(2) Minimizing the dollars spent in achieving the targeted level of energy savings.

e. None of the three scenarios would result in the optimal level of energy savings, which requires finding the level of energy savings where the marginal benefit equals the marginal cost.

6. Most regulators apply the cost-effectiveness test in evaluating utility EE initiatives.

    a. Under the Total Resource Cost (TRC) test, for instance, the utility compares the cost savings from producing, transporting, and distributing less electricity with both the utility and customer costs for EE.

    b. The TRC test accounts for non-price market problems (e.g., inadequate information, misinformation) that can distort consumers' decisions to invest in EE.

    c. Even if a utility's EE initiatives pass the TRC test and are therefore economically tenable, they could fail to maximize economic benefits. Several factors can cause suboptimal benefits; I will discuss these factors and benefits later.

C. The meaning of EE and its implications

1. "EE" here refers to the usable energy per unit of energy absorbed by an appliance or piece of energy-using equipment (i.e., the "site" definition of EE, measured, for example, by the energy factor of an appliance).

2. In contrast, "energy conservation" normally means the actions taken by consumers to reduce their energy use. Examples include turning off the lights when leaving a room and turning the air conditioner down or off at night.

3. EE aims to reduce the amount of kilowatt-hours or therms needed to satisfy a consumer's demand for end uses such as cooling, space heating, and hot-water heating.

4. Consumers generally need to make upfront investments, such as more expensive, higher-EE appliances and insulation, in exchange for lower energy costs over time.

5. Under most rate structures, lower energy sales mean the utility suffers a decline in short-term earnings.

6. EE is not synonymous with economic efficiency:

    a. Achieving more energy savings can result in additional costs that exceed the benefits.

    b. For this reason, regulators must examine the costs and benefits of any utility expenditure on promoting EE, and most of them do.

7. EE is primarily a consumer decision that accounts for the benefits and costs of investing in EE (e.g., the lifecycle cost of EE versus no EE action).

8. As discussed below, for various reasons consumers might not make the optimal decision either in what is best for them or what is best for society.

9. Discussion has recently intensified regarding redefining EE on the basis of the full fuel cycle that accounts for energy losses from production and delivery in addition to "site" losses.

D. The benefits from EE initiatives

1. The major social benefit from EE comes from the avoidance of costs by energy utilities as they provide fewer kilowatt-hours or therms to their customers.

    a. These costs include variable costs, such as fuel and maintenance, as well as capital expenditures for new capacity that could be deferred.

    b. Benefits depend not only on physical energy savings but also on the dollar value of those savings. A utility would generally have higher cost savings during peak periods, as energy savings can eliminate the need for or defer new capacity additions.

2. Many experts consider EE a low-cost, near-term strategy for greenhouse gas mitigation.

    a. The commercialization of carbon-constrained technologies such as nuclear power, carbon capture and storage from coal plants, and some forms of renewable energy is not expected for another decade.

    b. In the interim, EE can play a critical role in meeting carbon dioxide targets.

3. For educational and information initiatives, it is especially difficult to quantify the benefits.

    a. Education could lead to "market transformation" that over time would cause utility customers to invest more in EE without any utility or government support.

b. Education and advertising can also stimulate energy savings by making utility customers more aware of the benefits to be gained from EE investments.

c. How to measure these benefits with a reasonable degree of accuracy is beyond the capability of any existing analytical approach.

4. One position is that a utility should allocate less monies to those initiatives for which benefits are non-quantifiable and unverifiable:

a. A utility can, however, justify its expenditures on educational initiatives based on evidence that utility customers either do not have access to adequate information on EE or have information that makes it difficult for them to make good decisions.

b. This example illustrates a market problem.

E. Four principles for maximizing benefits

1. A *first principle* is aligning individual initiatives with an identified market or "behavioral" problem. The existence of these problems is a necessary, but not sufficient, condition, for utility and governmental actions. The sufficient condition also requires that the benefits of non-market intervention be greater than the costs.

a. Market and "behavioral" problems—examples:

(1) They can include inadequate consumer information or information that is confusing and difficult for utility customers to interpret; significant uncertainty about benefits; high transaction costs; and split incentives between builders and occupants.

(2) They can also derive from regulatory actions such as setting faulty rate structures. Examples of faulty pricing are:

(a) Subsidized rates that are offered to one class of customers and paid for by other customers

(b) Average-cost pricing, which can widely deviate from marginal cost during peak and other periods

(3) Behavioral problems can arise from:

(a) Consumers undervaluing the multi-year benefits of EE relative to the initial costs, and

(b) Inertia (e.g., laziness), in which consumers decide to do nothing even though they expect to receive net benefits from investing in EE.

b. The benefits from utility EE initiatives directly relate to their effectiveness in addressing market and "behavioral" problems.

(1) Those problems, by definition, cause consumers to forgo benefits that exceed the costs of additional EE investments.

(2) The premise behind utility EE initiatives, after all, is that consumers are not availing themselves of highly energy-efficient appliances with short paybacks.

(3) Educational and information programs are more beneficial when:

(a) Consumers lack good information on the benefits of EE investments, or

(b) That information is difficult or time-consuming to acquire.

(4) When consumers lack the resources to invest in EE, utility financial assistance to reduce the initial cost could induce them to invest in cost-beneficial EE.

(5) Utilities can reduce transaction costs, as well as consumer inertia, by including information on their websites that decreases the time consumers must spend to make decisions on EE.

(6) A utility can also nudge consumers toward EE by pointing out the dollars they are losing by not investing in EE (e.g., a household is paying $300 more per year to its utility when it fails to invest in a new high-efficiency furnace).

(7) Behavioral economics suggests that providing direct feedback to consumers can increase EE (e.g., giving consumers real-time information on their energy usage versus giving consumers monthly information on their energy usage and cost).

2. A *second principle* is that the benefit-cost ratios of potential utility initiatives should determine their prioritization.

   a. If a utility has a fixed amount of dollars to spend on EE, it should allocate resources to those initiatives with the highest benefit-cost ratios.

      (1) This approach follows the idea that the utility should initially pursue the "low-hanging fruit."

      (2) The presumption is that those initiatives with the highest benefit-cost ratios are addressing more serious market and "behavioral" problems.

   b. All initiatives with a benefit-cost ratio greater than one are economically justified. The relative ratios across initiatives, however, can affect on the margin, as well as on the aggregate, how utilities should allocate dollars among initiatives. An example follows:

      (1) Assume, for example, that a utility has $10 million to spend on EE, and that the benefit-cost ratios for three alternative programs are 3.0, 2.5, and 2.0.

      (2) Even though all the programs are economically justifiable (since their benefit-cost ratio exceeds one), maximum benefits derive from allocating all of the $10 million to the first program. By doing so, the total benefits would be $30 million.

      (3) If, alternatively, each program receives an equal share of the money, the total benefits would be only $25 million.

3. A *third principle* relates to harmonizing a utility's financial and other motivations with the EE initiatives.

   a. This principle relates to what is called the "principal/agent problem"; namely, how to motivate a utility to achieve the objectives set out by the regulator.

(1) Let us assume that a regulator wants a utility to commit itself to effectively promoting EE.

(2) At the minimum, the utility hopes to avoid any negative financial consequences; this outcome could require a revenue-coupling rider, a lost revenue adjustment mechanism, or a rate design that protects the utility against unexpected sales declines (e.g., straight-fixed variable rate design).

(3) The regulator could go further by allowing the utility to profit from cost-effective initiatives comparably to profits from supply-side alternatives. Profits can come from:

(a) Shared savings,

(b) Performance target incentives, and

(c) Rate-of-return adders

(4) The National Action Plan described profit opportunities as "providing the utility incentives for the successful management of energy efficiency programs."

(5) Without financial inducements, the regulator would have to more closely monitor the utility to make sure it is carrying out its goal for EE.

b. Regulators should consider three aspects of ratemaking as they relate to utility EE programs:

(1) Cost recovery of utility EE actions,

(2) Utility recovery of lost margins from EE, and

(3) Explicit utility-performance incentives for cost-effective EE actions

c. Regulators can motivate utilities to over-promote EE (e.g., an extremely high ROE leading to utility overspending on EE activities).

d. Decisions require a regulator to consider ratemaking mechanisms that have differing effects on regulatory objectives:

(1) Virtually all mechanisms advance some regulatory objectives while impeding others.

(2) A difficult but inevitable task for regulators is to make tradeoffs among ratemaking objectives that best serve the public interest.

4. A *fourth principle* for maximizing the benefits from utility EE initiatives is to exploit the most effective institutional arrangement for designing, administrating, and implementing the EE initiatives.

a. The utility itself might not be the preferred party to undertake these functions.

b. Outsourcing these functions to a third party could increase the benefits from EE initiatives funded by the utility and its customers.

(1) The third party could be a not-for-profit entity or a state government agency that coordinates all the utility EE activities in a state.

(2) An outside party could have more expertise, more experience, and more robust financial incentives than a utility with which to maximize the benefits from EE.

c. Outsourcing offers three kinds of potential benefits to a utility:

(1) The outside firm can pool the activities of a number of utilities and other firms, realizing economies of scale that can result in cost savings to a utility.

(2) The outside firm could have a higher level of expertise than a utility. By specializing in a narrow area, it can achieve efficiencies that other firms such as energy utilities with broader functions cannot.

(3) Especially for small utilities, outsourcing can permit the acquisition of expertise that is cost-prohibitive to develop internally.

d. As well, it could be easier to devise a performance contract between a utility and an outside party that grants incentives for good performance than for regulators to devise incentives that would lead to the same outcome.

(1) Unless a regulator is willing to allow a utility to profit from promoting EE, the utility will lack the motivation to maximize the effectiveness of those actions.

(2) Outsourcing then becomes a more attractive alternative.

F. Basic questions that regulators should ask

1. Regulators have an obligation to ensure that a utility's expenditures on promoting EE yield the greatest possible benefits to customers.

2. This obligation includes regulators asking and getting answers to basic questions that include:

a. What particular market and "behavioral" problems are EE initiatives addressing?

b. What EE initiatives would most effectively address each of those problems?

c. What are the benefit-cost ratios for each EE initiative?

d. How should a utility allocate the monies in an EE budget to different activities, based on the benefit-cost ratios?

e. What financial motivation does a utility have to:

(1) Promote EE, and

(2) Design, administer, and implement EE initiatives yielding the highest benefits?

f. What financial inducements would provide a utility with an adequate incentive to promote EE most effectively?

g. What are the advantages and disadvantages of a utility designing, administering, and implementing EE initiatives, compared to a third party performing one or more of these functions?

II. Aligning a Utility's Financial Interests with Energy Efficiency

A. Regulators face the following challenge:

1. Alignment, as we discussed earlier, is just one element in achieving good EE programs.

2. Alignment comes from ratemaking.

3. A regulator can choose among several ratemaking mechanisms that promote EE.

4. Regulators set "just and reasonable" rates based on legal requirements and policy objectives, some of which conflict (*see* Bonbright's list of goals for ratemaking).

B. What does Section 410 of the American Recovery and Reinvestment Act (aka the Stimulus Bill) say?

1. State regulatory agency will "seek to implement" appropriate proceedings for each electric and gas utility, a general policy that:

   a. Ensures that utility financial incentives are aligned with helping customers to use energy more efficiently;

   b. Provides timely cost recovery and earnings opportunities for utilities achieving cost-effective, measurable, and verifiable efficiency savings; and

   c. Sustains or enhances utility customers' incentives to use energy more efficiently.

2. Regulators should consider four aspects of ratemaking:

   a. Cost recovery of utility EE actions

   b. Utility recovery of lost margins from EE

   c. Explicit utility-performance incentives for cost-effective EE actions

   d. Rate design that determines the marginal price during different periods (e.g., seasonal, real time, time of day)

3. Regulators should ask the following questions:

   a. What ratemaking or cost-recovery mechanisms have the ability to align utility financial incentives with the promotion of EE? What tradeoffs are associated with each mechanism?

   b. What would constitute a regulator providing a utility with adequate incentives to aggressively promote all cost-effective EE?

      (1) Should a utility be expected to execute EE initiatives effectively and efficiently as long as it recovers revenue losses and EE costs dollar-for-dollar, or

      (2) Should it have the opportunity to earn higher profits from successful EE initiatives?

   c. What ratemaking or cost-recovery mechanisms can provide a utility with timely cost recovery and earnings opportunity?

   d. Are these mechanisms only applicable to those utility EE initiatives that are cost-effective and for which energy savings are measurable and verifiable?

   e. What ratemaking or cost-recovery mechanisms would not diminish customers' incentives to use energy more efficiently?

   f. Does section 410 go beyond eliminating disincentives by endorsing positive direct incentives?

   g. How does section 410 differ from the section 532 PURPA 111(d) standard of the Energy Independence and Security Act (EISA) of 2007, titled "Rate Design Modifications to Promote EE Investments"?

C. States have responded differently to section 410—examples from SEARUC states:

   1. Alabama

   2. Florida

   3. Georgia

   4. North Carolina

D. What different ratemaking mechanisms encourage (or at least do not discourage) EE? What have states done?

1. Earnings stabilization for the utility

    a. Revenue decoupling rider

    b. Lost revenue adjustment mechanism

    c. Straight fixed-variable rate design

    d. Earnings sharing mechanism

2. Performance incentive for the utility

    a. Shared savings incentive

    b. Performance target incentive

    c. Rate-of-return adder

3. Timely cost recovery for the utility

    a. Cost-recovery rider or tracker

    b. System benefits charge

4. Proper pricing signals to consumers

    a. An inverted and non-declining rate structure

    b. Real-time or dynamic pricing

    c. Critical peak pricing

    d. Long-run marginal cost pricing

5. Regulators have combined different ratemaking mechanisms to promote cost-effective EE (e.g., revenue decoupling along with a cost rider for EE expenditures).

E. What tradeoffs do regulators have to make in advancing different regulatory objectives? Possible conflicts exist between promoting EE and

1. Achieving utility financial stability

2. Minimizing short-term rates

3. Having strong incentives for cost control

4. Making energy affordable to low-income households

5. Moderating risk to customers

6. Minimizing customer-funded subsidies

F. How should a regulator select a particular ratemaking mechanism or a combination of mechanisms?

1. Ratemaking requires regulators to consider and make decisions on mechanisms that have varying effects on objectives, with most advancing some objectives while impeding others.

2. Making tradeoffs among ratemaking objectives that best serves the public interest poses a difficult challenge for regulators.

3. The standard requirements for "just and reasonable" rates and policy-based objectives are:

a. The core principles of ratemaking require that:

(1) Rates reflect the costs of an efficient or prudent utility,

(2) Rates reflect the cost of serving different customer classes and of providing different services and different level of services,

(3) Rates allow a prudent utility a reasonable opportunity to receive sufficient revenues to attract new capital, and

(4) Rates avoid undue price discrimination.

b. Policy-based objectives include:

(1) Public acceptability

(2) Rate stability and gradualism

(3) Equity or fairness

(4) Affordable utility service

(5) Efficient consumption

(6) Promotion of specified social goals such as EE

4. Section 410 implicitly tells regulators to consider EE as a major objective of ratemaking.

5. Regulators might want to consider a three-step process for regulatory ratemaking decisions:

    a. Define the public interest in terms of ratemaking objectives and the weights assigned to individual objectives

    b. Understand the performance of each ratemaking method in advancing and impeding different objectives (which requires unbiased information and analysis)

    c. Apply a decision-making rule that is consistent with advancing the public interest given the:

        (1) Information available and

        (2) The weights assigned to individual objectives; promoting EE is just one objective (other objectives listed above), whose weight depends upon a regulator's preference for promoting EE relative to other objectives.

6. An illustration: Why the wide acceptability of revenue decoupling (RD) for gas utilities, most of whom have experienced a decline in sales per customer over time?

    a. RD avoids the perverse incentives of cost riders

    b. RD does not cause a utility to earn excessive returns

    c. RD does not diminish the incentive of customers to invest in energy efficiency

    d. RD avoids the problem of determining test-year sales and throughput

    e. RD would not result in drastic effects on any individual customer

    f. Strong "coalition" support by industry and conservationists

    g. RD would seem to better advance the "gradualism" and "public acceptability" objectives of regulation than (say) straight-fixed variable rate design

References on Ratemaking Issues

1. Ken Costello, *Decision-Making Strategies for Assessing Ratemaking Methods: The Case of Natural Gas,* NRRI 07-10, September 2007, at http://www.nrri.org/pubs/gas/07-10.pdf.

2. Ken Costello, *Revenue Decoupling for Gas Utilities*, NRRI 06-06, April 2006, at http://www.nrri.org/pubs/gas/06-06.pdf.

III. Other Important Regulatory Issues Linked to Energy Efficiency

A. How should utilities conduct evaluation, measurement, and verification (EM&V) of energy savings for individual or collective EE programs?

1. How should they account for free riders and the rebound effect, for example, to measure the net energy savings? This activity is essential for assessing the performance of EE programs and for determining whether a utility should receive any financial rewards or full cost recovery.

2. How should utilities control for the different factors affecting energy usage?

B. How should regulators define EE?

1. Should EE account for energy losses from production to end use rather than just "site" losses"?

2. This issue has emerged at NARUC meetings and before some regulators.

C. How should regulators address certain equity issues?

1. What role should the Rate Impact Measure (RIM) test play in evaluating EE initiatives?

2. What happens to customer bills or rates due to changes in utility revenues or operating costs caused by an EE initiative?

3. Who should pay for those initiatives and what are tolerable short-term rate increases to pay for them?

D. How should regulators account for environmental effects?

1. Should they be included in the costs of different resources?

2. If so, how can utilities quantify them with reasonable accuracy to be included in the decision-making process?

E. What are the nature and size of market and behavioral failures?

1. How should a utility distinguish between market failures and market barriers?

2. Market barriers includes low energy prices, fluctuating energy prices, and high technology costs, which are not market failures on their own; and discerning the difference between rational and irrational consumer behavior.

3. Do energy consumers routinely leave a proverbial $100 on the floor? If true, why do they?

F. What is the size of the "EE gap" and what are the implications for utility intervention?

1. The "gap" refers to the difference between actual EE and some notion of optimal energy use.

2. Sometimes analysts illustrate the "gap" by comparing the market discount rate and the relatively high "implicit discount rates" consistent with consumer choices over appliances with different costs and energy efficiencies.

3. A pertinent policy question is: What factors explain the "gap" and what are their implications for policy-makers?

G. With efficient energy pricing; federal appliance standards; federal, state, and local building codes; and abundant federal funding of EE (e.g., monies from the Stimulus Bill for weatherization programs), what is the rationale for utility EE programs?

1. What is the justification for utility EE initiatives?

2. How can utility-financed EE complement market-driven and governmental actions?