The Effects of RTO Policies on Energy Efficiency Programs

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ABSTRACT

The Federal Energy Regulatory Commission (FERC) has ordered the formation of large Regional Transmission Organizations (RTOs). The RTOs are designed to handle a variety of functions relative to the electric transmission system, including transmission operations, planning, scheduling, and investment in upgrade and additional transmission capacity. If formed, RTOs will greatly affect how emerging competitive power markets develop in the United States. They will, therefore, have a significant influence on the evolution of energy efficiency programs and markets. This paper examines the background associated with RTO formation and briefly reviews the activities of RTOs. The paper then explores several issues related to the effects of RTOs on energy efficiency programs and markets. These issues include: RTO objectives, market rules, pricing, the use of load profiles, Federal and state regulatory issues, and other factors which will affect energy efficiency under an RTO structure.

Introduction and Background

Beginning with FERC Order 888, issued in 1996, the Federal Energy Regulatory Commission (FERC) began implementing a policy to restructure electricity markets in the U.S., particularly with respect to developing competitive wholesale power markets (FERC 1996). Evolution of this policy resulted in FERC Order 2000. Order 2000 recognized the critical importance of electric transmission in the development of competitive markets for power. Order 2000, therefore, provided the basis for the formation of Regional Transmission Organizations (RTOs). RTOs are intended to improve the operation of the nation's electric power system in a number of ways. In particular, the FERC issued Order No. 2000 to promote the formation of RTOs in all areas of the country.[1]

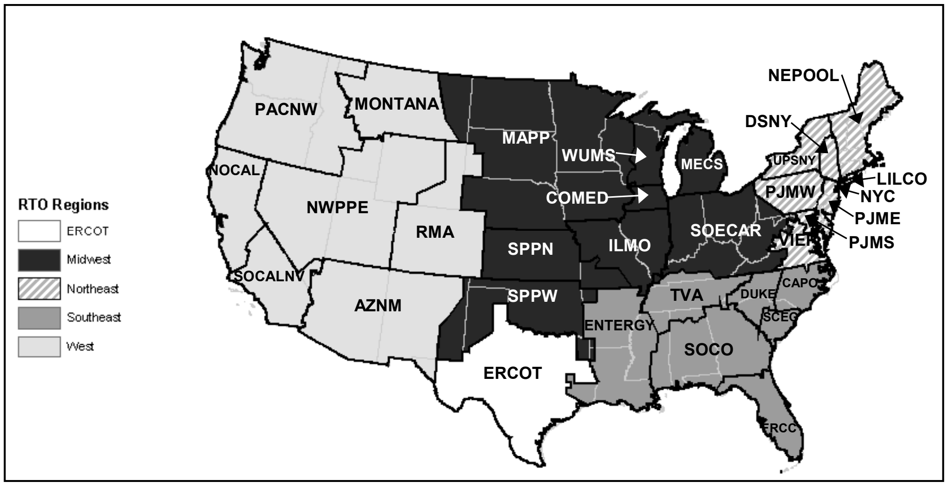
The Commission stated that properly functioning RTOs could provide several types of economic benefits:

- Improvements in transmission system operations with resulting enhancements to inter-regional trade, congestion management, reliability and coordination; and
- Improved performance of energy markets, including
  - greater incentives for efficient generator performance; and
  - enhanced potential for demand response.

[1] Originally envisioned as purely an operator of transmission systems, RTOs are also being asked to operate wholesale power markets. Therefore, in this paper, we refer to RTOs as also including "Independent System Operators" or ISOs. According to FERC, RTOs/ISOs must be independent of market participants. Therefore, independent transmission companies (ITCs), which own transmission, or those owners who are part of or affiliated with market participants (such as vertically integrated investor owned utilities), cannot serve as RTOs.

These changes to the regulation and operation of the electric power system would, according to the Commission, also lead to a reduced need for intrusive government regulation (FERC 2000). Figure 1 illustrates FERC's interest in the development of five large RTOs throughout the U.S. Since RTOs are still being formed, and the process is evolving, FERC is conducting analyses on a range of scenarios ranging from as few as four RTOs to as many as ten RTOs (ICF Consulting, 2002). As of March, 2002, there are six functioning wholesale power markets with various forms of transmission oversight and control: the Independent System Operators (ISOs) of California, New York, New England, and the Midwest, the PJM Interconnection, and the Electric Reliability Council of Texas (ERCOT).[2]

Figure 1. FERC Basic Policy Case RTO Assumption



Source: ICF Consulting 2002

RTOs and Energy Efficiency

Before embarking on a discussion of the implications of RTO development on energy efficiency programs, it is important to distinguish between what we regard -- for purposes of this paper -- as "energy efficiency" and other forms of "demand response." Energy efficiency is traditionally defined as technologies or programs that can reduce the amount of energy consumed to meet a given end use (such as space cooling). In the electric case, therefore, energy efficiency would be defined in terms of kilowatt hour (kWh) reductions at the end use level. Demand response, as it has come to be used, deals with reductions in capacity at particular points in time (such as peak hours) and is measured in kilowatts (kW). The term "demand response" is used in this paper as the generic term for all customer changes in actions or behaviors that introduce price elasticity into the wholesale market or can be used to increase system reliability. Hence, demand response includes both load reduction and price responsive load. Demand response is akin to load management programs in the era of demand side management (DSM). In this paper, we focus on the relationship of RTOs to energy efficiency programs. A separate paper, (Kathan and Mihlmester 2002) addresses demand response in greater detail.

[2] The Midwest ISO includes all or parts of Minnesota, Wisconsin, Michigan, North Dakota, South Dakota, Nebraska, Kansas, Illinois, Indiana, Ohio, and Kentucky. The PJM includes Pennsylvania, New Jersey, Maryland, Delaware, DC, and West Virginia.

Reliability and Market Facilitation

In its move to develop RTOs, FERC stipulates that RTOs can improve transmission system operations and increase the reliability of the electric grid. FERC also notes that RTOs are critical to facilitating the development of competitive wholesale power markets. It appears that these two goals may be in conflict, with direct implications for energy efficiency programs. On the one hand the move to facilitate open and active markets implies that market forces alone can determine the appropriate levels of demand for energy efficiency. More specifically, the free market and competitive electric supplies will determine wholesale prices, and then consumers will determine the appropriate mix of consumption, energy efficiency (and demand response). Largely under this justification, the old paradigms of least cost utility planning/integrated resource planning, under which many DSM programs were justified, have been abandoned (particularly in those states that have restructured their power markets). Further, though FERC alludes to the transmission planning function for RTOs, it does not explicitly offer a "least cost" planning framework where energy efficiency programs might be evaluated along with enhanced transmission capacity (or for that matter demand response approaches, which are beginning to be incorporated in FERC policy thinking). Also, such planning would have to be done on a regional basis, consistent with RTO boundaries. These regions cut across states whose public service commissions traditionally have cognizance over such planning activities and energy efficiency initiatives.

On the other hand, FERC's assertion that RTOs can enhance grid reliability argues for some form of system planning and control other than via free market forces. In this regard, energy efficiency programs can play a role in enhancing grid reliability by reducing peak demand and overall demand on the transmission grid. Also, as shown in Figure 2, energy efficiency can improve grid reliability, and, as shown in Figure 3, can moderate wholesale power prices for all consumers (Cowart, et.al., 2001). Thus, to the extent RTOs are responsible for reliability of the grid, energy efficiency can be an important component of their reliability approach.

FERC has begun, in part, to address this issue in its Draft Working Paper on Standard Market Design (FERC 2002). In the paper, FERC staff propose that "the RTO would choose an ultimate (long-term regional planning and expansion) solution, whether transmission, generation, or demand side, after vetting proposals through an open stakeholder process."

Figure 2. U.S. National Energy Efficiency Savings

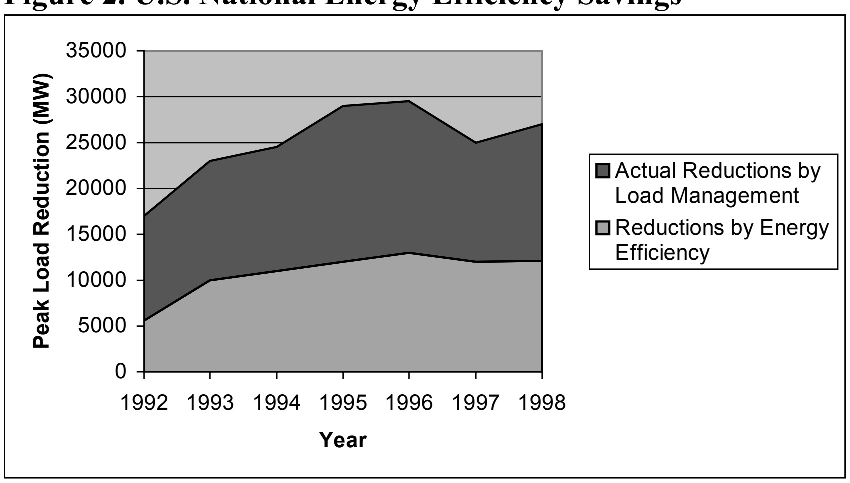
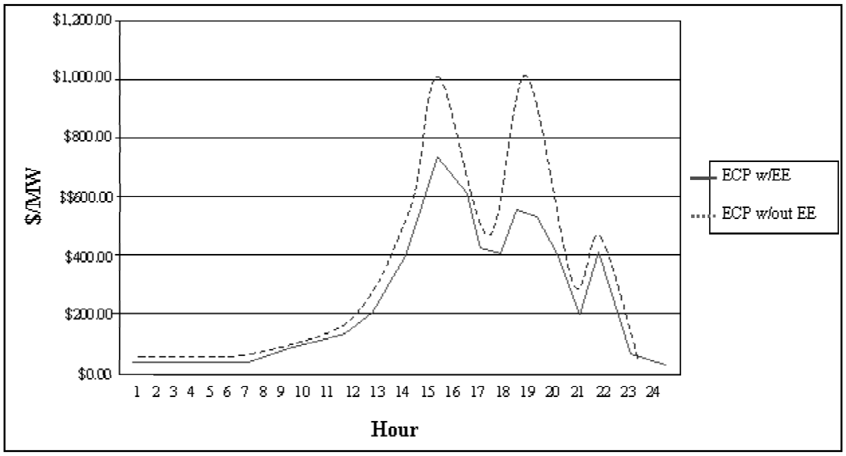


Figure 3. Impact of Demand Reductions (EE) on Wholesale Energy Clearing Prices (ECP) in the New England Regional Power Pool on June 7, 1999



Source for Figures 2 and 3: Cowart 2001

This tension between the RTO as a free market facilitator and the RTO as an insurer of grid reliability through an open regional planning process has important implications for the future direction of energy efficiency programs. This is because energy efficiency, especially locationally "targeted" energy efficiency, can be part of the "demand side" solution alternative to increased generation or transmission capacity.

RTO Market Design

In Order 2000, FERC required RTOs to develop market designs that would promote efficient grid operations. These market designs can also have significant impact on energy efficiency. Specific aspects of RTO market design that could have implications for energy efficiency programs include: 1) demand response programs, 2) pricing constructs, particularly locational marginal pricing (LMP), 3) settlement approaches, and 4) financing considerations. Each is briefly discussed in the following sections.

Demand Response Programs

RTO market designs are encompassing markets for demand response. Frequently, load is being allowed to bid into energy and so-called installed capacity (ICAP) markets (Hirst and Kirby 2000, Kathan and Mihlmester 2002). This load often takes the form of distributed generation or curtailable load, which can be bid directly by larger customers or through aggregators or franchise utilities. Specific market rules vary by RTO. In some cases, actual metered consumption reductions are used, and the capacity is measured against a "baseline." These baselines are typically based on average usage in the previous five to ten days.

Existence of such markets (and similar ancillary services markets) in RTO market design is somewhat encouraging, but more so for demand response initiatives than energy efficiency. This is primarily because energy efficiency can deliver savings at both on-peak and off-peak times, but the magnitude of on-peak savings (or "callable" savings) depends upon the specific energy efficiency technology. Mechanisms for calculating energy efficiency contributions to "installed capacity," or for "crediting" energy efficiency into baselines used to measure demand response reductions, have not been explicitly developed in market designs. In some cases, energy efficiency may be disincentivized, since it lowers the baseline used to calculate demand reductions. Therefore, energy efficiency programs, though they can contribute to peak load reduction, cannot easily be credited for these reductions under evolving market rules. One possible approach to this problem is the development of a market for energy efficiency "credits." For example, this could be modeled on existing market constructs for emissions allowances and renewable energy "green tags" (an emissions allowance is a permit to emit a given quantity of a pollutant, such as a ton of sulfur dioxide. The allowance is tradable). Thus, under this construct, an energy efficiency installation would generate a capacity credit for its peak load reduction contribution that could be traded and bid into wholesale markets.

Pricing

Wholesale power and transmission pricing will have very important implications for energy efficiency initiatives. Two major wholesale pricing mechanisms have been developed or proposed by RTOs. These include zonal pricing and locational marginal pricing or LMP. Locational marginal pricing results in wholesale power prices that vary by node within the grid and reflect the costs of transmission congestion.[3] Within the California ISO, for example, locational prices are set by zone, whereas PJM and the proposed SeTrans RTO will employ nodal LMP. The New York and New England ISOs plan a mixed system in which generators face nodal prices and consumers face zonal prices (Cowart et.al., 2001).

LMP pricing can send important signals about the value of energy efficiency in areas of transmission congestion. In this sense, energy efficiency can be encouraged in such "load pockets," which see high LMP prices. However, many existing energy efficiency programs operate on geographical bases that transcend delivery nodes. In doing so, the locational differential value of energy efficiency is not readily recognized. In other words, energy efficiency in a congested load pocket should be worth more than equivalent efficiency improvements in non-congested areas. But many existing energy efficiency programs are utility-wide or state-wide, and in some cases, "egalitarian" pressures argue against preferences for transmission constrained areas. There have been exceptions recently, such as efforts in New York to delivery enhanced energy efficiency and demand response services in the transmission constrained New York City area (Neenan 2001). In its recently released *National Transmission Grid Study,* the U.S. Department of Energy (DOE) states the need to remove regulatory barriers to "targeted energy efficiency" as a method to address transmission bottlenecks and lower costs to consumers. (DOE 2002)

In addition to wholesale prices driven by RTO market design, retail pricing will, of course, play a critical role in energy efficiency. Many observers have pointed out that there is a fundamental disconnect between the wholesale and retail power markets. Most retail customers do not have the interval metering necessary to see and respond to hourly changes in wholesale power prices. This makes energy efficiency a harder sell, particularly where retail prices are capped as a result of utility restructuring. However, as caps begin to expire

[3] The FERC Standard Market Design is proposing that an LMP approach be used by RTOs.

and wholesale costs are passed through to customers (though perhaps not in real time for most customers) the value of energy efficiency, particularly in areas of transmission congestion, will become increasingly recognized. In theory, customers should respond to these price signals by reducing their consumption during times of peak prices. RTO market designs and their treatment of congestion costs can thus have significant influence on energy efficiency programs and value propositions. These can be expected to fluctuate by location, though the FERC Standard Market Design can be expected to provide some inter-regional consistency.

It should be noted that interval metering by itself does not ensure greater efficiency of energy use. Rather, it provides price transparency on a quasi-real time basis such that customers can make their own time differentiated consumption decisions. Some types of customers, such as retail establishments, may still choose to consume the same volumes of electricity during peak periods for other business reasons, even though they can now "see" the higher prices. Smaller customers may have limited abilities to reduce consumption in response to price signals. Other customers may adjust hourly consumption as they react to hourly prices.

Settlement

The balance and settlement rules developed by RTOs will also have an important effect on energy efficiency initiatives.[4] In particular, issues related to load profiling and multi-settlement markets could have important implications.

In balancing and settling wholesale power transactions between generators and "load serving entities" (LSEs), which can be either competitive retailers or franchise utilities, RTOs typically employ load profiles. This is because the vast majority of retail customers do not have interval meters. Such customers are thus assigned to customer classes for which a load profile is developed (often based on weather response functions). These load profiles assign consumption to hours and are then aggregated and used to financially settle wholesale transactions.

The use of average load profiles for non-interval metered customers does not capture the capacity and energy reductions associated with energy efficiency measures, which can also dampen their peak demand (e.g., high efficiency air conditioning equipment and/or high efficiency lighting). In wholesale settlement, LSEs are obligated to meet the loads associated with the load profile, and financial settlement is based on these profiles. As a result, wholesale customers do not receive the benefits of this investment. Also, LSEs who might make such investments in energy efficiency on their customers' behalf would see little incentive to do so since settlement is based on the load profiles.

Some jurisdictions (such as California and New York) have initiated efforts to promote and subsidize more widespread installation of interval meters so that energy efficiency investments can be more directly valued by customers and their retailers. Indeed, promotion of interval meters **and** the regulatory will to implement time differentiated pricing

[4] In this section, "settlement" refers to the process of settling a financial transaction between the wholesaler of electricity and the retailer (or load serving entity.) Because electricity cannot be easily stored, the retailer orders electricity in advance for his customers. The difference between the amount ordered (and presumably supplied) and the amount actually consumed is termed an "imbalance" and this amount must be calculated and factored into the financial settlement between wholesaler and retailer (which could be a regulated distribution company).

are major goals of competitive retailers (Kinscherf 2002). This retail ratemaking authority rests with state public service commissions and not with FERC. By and large, state regulators have been reluctant to impose mandatory time differentiated rates, though some have approved voluntary rates (for example, Washington state with regard to Puget Sound Energy). Maryland, which did approve a PEPCO mandatory residential time of use rate for newly constructed homes above a certain size, rescinded that requirement with the advent of restructuring and retail choice in the state.

Perhaps a more effective alternative to the load profiling issue would be the development of a family of load profiles for particular customer classes. Customers within a class who have implemented energy efficiency measures, either directly or through their LSE, would have an alternative profile used in the settlement process versus those customers that have not. This could incent both customers and LSEs to install energy efficiency, if such installations are accounted for in the financial settlement process for non-interval metered customers (Cowart et.al., 2001). A version of this load profile policy has been approved for direct load control programs in ERCOT.

Another aspect of the settlement process, which potentially impacts energy efficiency programs, is "multi-settlement" market designs. In these designs proposed by RTOs, markets are settled or cleared more than once (usually twice). This can allow demand side resources to plan for and better take advantage of wholesale market price signals.

For example, the proposed SeTrans RTO market design envisions a two-settlement market consisting of both day-ahead and real-time settlements. Using offers and bids from both generators and dispatchable loads, the RTO hopes to "minimize the cost of energy in the day-ahead market and the cost of supplying energy imbalance in the real-time market across the region and will facilitate congestion management while keeping flows within all security limits." (SeTrans 2002).

Multi-settlement markets can provide clear advance signals to suppliers and load, thus the first market performs a hedging function on the real time market for both end use customers and LSEs. Exposures to unexpected shortages in the real-time markets are thus reduced (Cowart, et.al. 2001). While this feature of RTO market design mostly facilitates demand response opportunities, it can also help to promote energy efficiency initiatives. This would particularly be the case where energy efficiency investments could receive credits affecting dispatchability, as discussed above. Even in multi-settlement markets, it would be necessary to construct forward contracts for efficiency-derived load, which could offer both capacity (kW) and energy efficiency (kWh) benefits. These instruments would also have to have appropriate measurement and verification (M&V) protocols.

Financing Considerations

Transmission services and RTOs are regulated by FERC. Traditionally, transmission has been a tariffed service, and its cost is passed through to consumers as either a separate transmission charge, or as part of a bundled supply charge consisting of generation and transmission (as distinct from distribution). Unbundling transmission costs (and indeed the costs of ancillary services from transmission) has been FERC's goal.

Transmission tariffs could be adjusted to be based on peak demand placed on the transmission system by generators. As peak demand increases, RTOs, transmission owners, and system operators (these can be one, two, or three separate entities) may see a need to increase transmission capacity. However, this requires expensive capital, which in some cases cannot be rate-based until construction is complete. In such cases, it may behoove transmission owners to invest in energy efficiency and demand response as the lesser-cost alternative to expensive capital projects (McCoy 2002).

The transmission system is highly dynamic. The addition (or subtraction) of generation, new wires, load, or distributed resources can dramatically affect the reliability of the system. Markets in ancillary services have been developed to provide cost effective resources to ensure reliability on a regional grid basis. Richard Cowart of the Regulatory Assistance Project has argued strongly for the need for "regional" reliability charges, since the RTO is in effect a regional entity encompassing many states and franchise utility service territories. In particular, he argues for a regional RTO version of integrated resource planning. Under this framework, supply, transmission, and demand side resources would be systematically evaluated to determine the lowest cost regional solution to electric reliability (Cowart 2002). "When supported by cost-effectiveness analysis, RTOs should be permitted to recover those investments on the same basis as regional transmission investments, ancillary service costs, or other RTO expenses." Achievement of this goal would require regulatory initiatives by FERC and state public service commissions. However, such a construct could be a particular boon to energy efficiency programs. A strong regional component and funding source for energy efficiency would be overlaid with Federal and state initiatives. Specific energy efficiency approaches would, in this context, be tied to grid reliability measures. Thus, specific measures and program types would likely be the focus. Also, almost certainly there will be a locational focus to such energy efficiency efforts around congestion and load pockets. There would also be a significant load management aspect (peak kW) to these programs, in addition to energy (kWh). Cowart particularly makes the point that such a least cost planning or IRP approach should be used whenever there is a proposal to socialize transmission expansion investments (by increasing transmission charges across all customers including those not in transmission constrained areas) (Cowart, et.al., 2001). The FERC working papers on RTO formation endorse an "integrated" regional planning approach to transmission (i.e., generation, transmission, and demand side resources should all be considered) but do not provide details on how this should be done, or a decision criterion, such as "least cost." (FERC 2002).

Energy Efficiency, Power Markets, and Policy

In the 1980's and 1990's, energy efficiency in the United States received a major boost from the adoption of Integrated Resource Planning (IRP) by state utility regulatory bodies and regulated vertically integrated utilities. This was because it was possible to show that demand side management (often encompassing energy efficiency measures) was cheaper than building new power generation or transmission. Utilities were thus ordered to provide energy efficiency programs and received cost recovery and often incentives to do so.

FERC's efforts to deregulate and restructure the power sector are focused on allowing market forces to determine how much and where energy gets consumed. RTOs are the means of facilitating these markets, providing the mechanisms and infrastructure for buyers and sellers of electric energy to come together. Under this open market construct, energy efficiency's value would be purely market and price determined. If prices were high, consumers would install energy efficiency measures to reduce the amount they consumed. If prices were low, there would be less incentive to do so. The supply prices would be determined by market forces, balancing supply and demand at different locations and not by state regulators. There can be barriers to energy efficiency under such pure open market constructs. For example, market designs are focused at very short-term signals (day ahead and real time), whereas energy efficiency tends to pay back over the longer term. Economic load response programs can work against energy efficiency to the extent that customers are motivated to maintain high consumption baselines so that the value of their load reduction is greater.

The linchpin for energy efficiency in restructuring electric markets is reliability. Indeed, it is reliability concerns which necessitate a bridge between market forces and regulatory policy. Policymakers and the public in the U.S. do not regard electricity as a pure commodity (which for very limited times may be unavailable, like fresh green peppers in January); rather, electricity must always be available at every location. Reliability requires planning which, by definition, implies that it cannot simply be left to market forces. FERC has proposed RTOs as the planning entities to ensure regional reliability in the electric system. Based on the physics of electricity, the tools available to ensure reliability include generation, transmission, demand response (load reduction) and targeted energy efficiency, which can also have a load reduction benefit. RTOs are to consider all of these tools in the planning process. The use of targeted energy efficiency as a reliability tool by RTOs will change the way energy efficiency has traditionally been delivered. There will be biases toward geographical targeting of programs in load pockets and toward certain types of technologies, which can deliver on-peak savings.

Conclusions

RTOs or ISOs are in operation in California, New York, Texas, New England, the Mid Atlantic and the Mid West. Additional RTOs are being developed. The exact number or scope of RTOs is yet to be determined. Further, issues pertaining to the demand side of the power markets and to the relationship between Federal and state regulations are being debated. Some states have completely restructured their electricity markets while others remain fully regulated with vertically integrated utilities supplying customers. Still other states are somewhere in between.

This paper highlighted several issues relating to RTO impacts on energy efficiency:

- Reliability necessitates an RTO sponsored regional planning approach, which should consider generation, transmission, and demand response. The latter could include targeted energy efficiency, but procedures need to be formalized.
- FERC's efforts to develop a standard market design will have an effect on energy efficiency. Economic load reduction could disincentivize energy efficiency, but developing "negawatt" type trading regimes could promote targeted energy efficiency.
- Interval metering and time differentiated retail pricing would allow end users to "see" real prices and take appropriate action, including installation of energy efficiency measures. However, regulators must allow such pricing to flow through to retail customers.

- Load profiling and its role in wholesale transaction settlement needs to better reflect the value of energy efficiency.

FERC appears to be committed to the further development of RTOs. Its recently published cost-benefit study has shown that RTOs, particularly when demand response approaches are included, can have positive economic benefits of over $60 billion on a 20-year net present value basis (ICF Consulting 2002). FERC is moving to standardize market rules and issue other orders pertaining to transmission, RTOs, and power markets as part of its pending "giga-NOPR." These developments will undoubtedly affect energy efficiency programs and the energy efficiency industry. They will also affect the market dynamics and value propositions of energy efficiency in increasingly competitive energy markets. At the time of this writing, it appears that some of the changes being wrought by RTOs can be disincentives for energy efficiency, while other aspects of RTO formation could greatly incentivize energy efficiency in new ways.

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