# Profits and Progress Through Distributed Resources

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## Forward
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Writing a "forward" to a Regulatory Assistance Project report challenges the utility executive's pen — pens being a resource still more widely distributed than the laptop. The task challenges on two fronts: first, because RAP is so resolutely and intellectually forward in its own right; and second, because, no matter how fair RAP's proposed solutions seem to be to utility shareholders — and indeed they often are fair — if not well implemented those solutions increase the risk or decrease the scale of utilities.

"Profits and Progress" is *forward*, indeed. It coolly and intelligently discusses the evolving importance of distributed resources and identifies various ratemaking mechanisms that would stimulate their use. Certain to be read by regulators, this report has substantial merits not to be overlooked by utility executives. Among its virtues, it foretells the complex ratecases that must follow the restructuring of the electricity business now well underway.

The key themes of "Profits and Progress" have inescapable force. First, distributed resources, in particular demand-side, natural gas fueled, and renewable resources, can have substantial economic and environmental benefits — but only if their combined energy, capacity, transmission, distribution, and reliability value can not be provided by more conventional means at lower cost. My companies are developing various distributed resource efforts with at least one, and usually more than one, of these goals in mind. Second, all regulation is surely incentive regulation, and those incentives generally stretch the intentions of the drafters. That is true not only of cost of service principles, but also of avoided costs and of more explicit performance-based regulations. Third, the resources chosen in markets are, and will always be, influenced by the legal and regulatory frameworks in which those markets operate, as well as by the social and technological components of supply and demand. In this context, the "Fragile Structures" of regulation do, of course, affect the incentives of both utilities and their customers concerning the use of distributed resources.

Moving quickly to fixed monthly charges for recovery of distribution costs would, in principle, address economic efficiency and utility profitability concerns but the report is probably correct when it says customer resistance to this change will be high. The remedies suggested in "Profits and Progress" require careful analysis in very detailed contexts. Like its namesake, "Progress and Poverty", its affection for a single solution — revenue caps — leaves me uneasy. Utilities, even those with unregulated affiliates, find revenue caps unnatural. I wonder at what point such tools encourage customers to bypass fixed charges, eroding the "common" for the remaining customers? These issues are compounded when distribution charges carry with them transition charges designed to recover stranded investments.

Distributed resources are, as "Profits and Progress" emphasizes, an alternative to other forms of utility investments. But they are more than that; they are an alternative to both utilities and to their regulators. Utility and regulatory barriers should be found and removed. But in the meantime customers are already installing distributed resources when they perceive that they are

more economic than the total cost of the service delivered by the utility or when they add benefits not provided by standard utility service. In today's marketplace, customers are now free to island their service. Regulators should remember this when devising complex incentive systems. Utility executives must remember this when making long-term investments.

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I owe a special word of thanks to John Rowe, CEO and Chairman of Unicom, the parent company of Commonwealth Edison Company. Ten years ago, John wrote the forward to *Profits and Progress though Least-Cost Planning,* which began NARUC's drive to align utility profits with a utility's successful implementation of least cost plans. At the time John was the CEO of the New England Electric System and his Company earned a reputation for developing and implementing innovative and highly cost effective energy efficiency and supply-side options. Thanks to regulatory reforms, his company's customers and shareholders prospered. I am sure the reforms described in this report will help John's new company to become an innovative leader in deploying distributed resources.

Thanks to all,

David Moskovitz

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## 1. INTRODUCTION AND EXECUTIVE SUMMARY

Technological advances in other industries are dramatically impacting the electric utility industry at both the macro and micro level. At the macro level, the aerospace industry has delivered the highly efficient, inexpensive, quickly constructed turbine-based technologies which have been a driving force behind electric utility industry restructuring. The turbine in a GE combined-cycle power plant has as its origin an aircraft jet engine.

Less well known but even more dramatic are the small and micro-scale power plants, technologies born in the military (the electric power source used in M-1 tanks and Patriot missile launchers are powered by new microturbines) and automotive industries (fuel cell car engines will be fuel cell power plants). These distributed generating resources are located in the utility's distribution system and can be on either side of a customer's electric meter. Along with better known and proven energy efficiency and load management technologies, these distributed resources are poised to revolutionize the electric utility industry.

Many, but not all, of these small fuel-based technologies are highly efficient, mobile, and cleaner than central station generation. Distributed resources based on renewables (wind and photovoltaics) and energy efficiency are always cleaner. And, thanks to small size and mass production, the cost of all these technologies is dropping fast. The combination of advances in distributed resources and in control and information technologies means that distributed resources can play a central role **if** markets and regulators allow these resources to compete.[1]

Utility regulators need to create the market environment where cost-effective distributed resources can compete with central station generation.

The task is complicated; distributed resources produce multiple services and each one needs the equivalent of a market. For example, distributed generators deliver energy and capacity, but most rules for competitive generation markets focus on the needs of large scale generators. In this case, the regulator's role is to assure that entry is not impaired and wholesale power market rules accommodate small size resources. A much tougher job for utility regulators stems from the fact that distributed resources also compete against electricity delivered by monopoly distribution facilities. Harnessing market forces in distribution services requires innovative policies and a distribution utility environment that encourages, or is at least neutral to, the deployment of any cost-effective resource that meets customer and utility needs.

The early utility response to distributed resources has been mixed. Some utilities are actively trying to find distributed resources business opportunities: a half dozen utility affiliates have joined with Allied Signal to market its micro-turbine; Plug Power, a Detroit Edison affiliate, is developing and marketing a home-scale fuel cell; and Duquesne Power and Light is investing in H Power, a fuel cell developer.

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[1]Sun Microsystems recently began marketing "Jini", an Internet based technology that allows inexpensive computer chips embedded in home appliances to communicate through power line carriers and the internet in home or offsite control systems. See <http://www.sun.com/jini>. Similar technologies are being marketed by Microsoft and others.

Other utilities, acting on their own and through the Electric Power Research Institute (EPRI), are developing knowledge and expertise on how distributed resources can help them meet their distribution needs. Chicago's Commonwealth Edison recently unveiled the "Neighborhood Project," a joint effort of Edison and environmental and community activists to explore how distributed resources can be deployed to reduce costs and improve service on a neighborhood-by-neighborhood basis.

ot all efforts have been positive, however. Utility investment in energy efficiency is declining and some distributed generation technologies are inefficient and produce high levels of air pollution. Defensive utility strategies also exist that slow the spread of distributed resources. These strategies include onerous and non-uniform interconnection requirements, high rates for standby or backup power, special contracts to discourage self-generation, and recent rate design proposals that substantially increase fixed monthly charges and decrease volumetric charges.[2]

This report looks at the relationship between the use of distributed resources and utility profits.[3]

Our conclusions are:

**A. Location of the distributed resources is critical.**

Distributed resources installed on the utility side of the meter do not jeopardize profitability.

Distributed resources located on the customer side of the meter almost always hurt utility profits. This is true for both demand-side and supply-side resources. From the utility's perspective, demand- or supply-side resources installed on the customer side of the meter produce the same effect: sales go down and as a result revenues and profits go down.

Locating distributed resources in high-cost areas can help. The significant distribution cost savings can offset utility financial losses from distributed resources or even add to profits if the distributed resources are deployed *only* in high-cost areas.

**B. How utilities are regulated is important to the use of distributed resources**

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[2] There are reasonable economic arguments for and against these types of rate design proposals. Regardless of the merits, however, these changes have large customer impacts and are strongly opposed by customer representatives. For example, under the rate design change described, a customer using 1000 kWh a month would experience a 50% rate reduction and a customer using 100 kWh per month would experience a 500% rate increase. Relatively minor increases in customer charges have triggered referenda calling for elected commissioners and the enactment of laws rendering customer charges illegal.

[3] Our focus is on investor-owned utilities. The financial implications for publicly and member-owned utilities may be different.

**on the customer's side of the meter.**

Regulation, as it is practiced in most states, creates overwhelmingly adverse financial impacts on utilities when customers install distributed resources on their side of the meter. If this persists, we can expect utilities to resist distributed resources. Barriers will fall slowly, new barriers will be erected, and the deployment of cost-effective distributed resources will be delayed.

By far the predominant form of regulation currently in use in the US is traditional cost-of-service regulation. Where performance-based or alternative kinds of regulation are employed, price cap (as distinguished from revenue cap) regulation is most common. Price cap regulation generally discourages distributed resources. Revenue cap regulation does not. As discussed later, where utilities are vertically integrated and generation is regulated, most states have fuel adjustment clauses. In these states, the effect of the fuel clause is that utilities can sell a kwh that costs 15¢ to produce for 7¢ and make money.

**C. Industry structure does not have much impact upon profitability.**

The profits of the regulated utility go up or down based on the way regulation works. If the regulated entity is a wires-only company and its revenues are derived from volumetric charges, profits go down when distributed resources cause sales to go down. If the utility has an unregulated affiliate (MicroCo) selling distributed resources, then the affiliate's deployment of distributed resources on the customer side of the meter still reduces the utility's revenues and profits. The business strategy that makes most sense is for MicroCo to operate everywhere except in its affiliated utility's service territory.

The business strategies and regulatory proposals from combined gas and electric companies will be especially interesting to watch. A very profitable strategy for a combined utility would be to market gas-fired distributed resources in areas that are high-cost for electric distribution and low-cost for gas distribution.

**D. There are a number of ways regulators can align utility profitability with the deployment of cost-effective distributed resources.**

The most promising include:

**1. Revenue-based PBR**. Performance-based regulation can take the form either of price caps or revenue caps. Revenue cap approaches for distribution utilities remove the disincentive for customer-side distributed resources.

**Benefits Of Distributed Resources**

Distributed resources can provide a very wide range of benefits depending on the type of resource deployed, where it is installed, and when and how it is operated. The benefits fall into a number of categories.

Generation

Distributed resources can provide capacity (kw) and energy (kwh) benefits as well as many of the related services and benefits that can be provided by other resources. These include spinning reserve, black start capability (micro turbines can go from cold start to full load in two minutes), load following, and reactive power.

Distribution and Transmission

Properly sited and operated distributed resources can reduce and defer investment in transmission and distribution plant. When operated in a way that reduces line and transformer loadings, distributed resources can reduce losses and the high operating temperatures that shorten plant life. Also, distributed resources may make it possible to configure a distribution system so outages affect fewer customers.

Environment

Some, but not all, distributed resources can produce environmental benefits in the form of lower emissions and reduced land use impacts relative to other generation technologies. On the generation side, environmental improvements are likely from renewable based distributed generation as well as from high efficiency gas-fueled sources. On the demand-side, nearly all options will yield environmental improvement.

Reliability

Under the general heading of reliability, increased distributed resource use can lead to shorter and less extensive outages. The small size of distributed resources means the same level of reliability can be achieved with lower installed generation. There is also reduced risk associated with shorter lead times and mobility. Micro turbines can be delivered and installed in just a few weeks.

For a full description of these and other ways that distributed resources can save money and improve service, see A.B. Lovins and A. Lehmann, "*Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*", Rocky Mountain Institute, 1999 (In Press).

**2. Distributed Resources Credits**. A system of geographically deaveraged credits can give customers and others better economic signals to install distributed resources in high cost areas[4] without the adverse consequences of de-averaged retail prices for all customers.

**3. Distributed Resources Development Zones**. High-cost areas where distributed resources are most desirable can be designated. Economic incentives, such as direct payments or waivers of standby charges, can be used to direct development to these areas.

**4. Symmetrical pricing flexibility.** The utility's flexibility to lower prices to discourage distributed resources that are not cost-effective should be tied to the obligation to increase prices in high-cost areas so as to encourage cost-effective distributed resources**.**

Aligning utility profitability with the deployment of cost-effective distributed resources is an important step, but it does not guarantee success. There may be other factors that overwhelm the power of any incentives. Diversionary factors may include rate impacts, competitive and other risks, and issues of control or the lack thereof — each of which can undermine the incentives created in a PBR.

[4]Here, and throughout the report, the term "high cost areas" refers to areas with high transmission and distribution cost.

## 2. DISTRIBUTED RESOURCES: WHAT ARE THEY AND WHY SHOULD WE CARE ABOUT THEM?

### A. What Are Distributed Resources?

Distributed resources are demand- and supply-side resources that can be deployed throughout an electric distribution system (as distinguished from the transmission system) to meet the energy and reliability needs of the customers served by that system. Distributed resources can be installed on either the customer side or the utility side of the meter.

Some supply-side resources, such as generators driven by gasoline and diesel-fueled reciprocating engines, are mature technologies whose cost and performance characteristics are well known. Others, such as micro-turbines and fuel cells, are cutting-edge technologies borrowed and adapted from the defense (the electric power source used in M-1 tanks and Patriot missile launchers are powered by new microturbines), automotive (fuel cell car engines will be fuel cell power plants), and aerospace industries (the turbines in a GE combined-cycle power plant has as its origin an aircraft jet engine). Many of these newer technologies are already more economical, more reliable, and cleaner than the familiar backup generators. More importantly, many exhibit a very strong likelihood for continued and significant cost and reliability improvements.

Demand-side distributed resources comprise a long list of load management and energy efficiency options – reduced peak electricity demand, high efficiency buildings, advanced motors and drives for industrial applications, and many others.[5]

It is not necessary to define distributed resources more narrowly to understand the implications these resources have for the distribution company's profitability.[6] The only distinguishing characteristics for the purposes of this discussion are that these facilities are installed at the distribution level and they can be on either side of the meter. In most cases, distributed resources will be quite small, ranging from less than one kilowatt (kW) to only a few hundred kW, but there are examples of larger installations (generally in commercial and industrial settings). The practical size limit for generators in the distribution system is about 35 to 40 megawatts (MW).

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[5]"Customer side of the meter" is not synonymous with "demand-side," although there is a good deal of overlap. The "customer side of the meter" is just that — the part of the electric system that is on the customer's side of the meter. It refers generally to all aspects of customers' demand for grid-supplied electricity. Customer actions that are relevant to this discussion include improvements in the efficiency with which electricity is consumed or generating equipment that displaces service that would otherwise be provided by the utility. "Demand-side" refers to actions which improve the efficiency by which electricity is consumed or moves electricity use from peak to off-peak periods.

[6]The size of distributed resources will, however, influence regulatory requirements in other ways. For example, interconnection and metering specifications will vary according to the size of the resource in question. To keep transaction costs low, the application of policies such as net metering and standard tariffs will also depend on size.

### B. Why Should Regulators Care Whether These Resources Are Used?

There are six reasons why regulators should care about distributed resources deployment. The first five are compelling enough.

The sixth reason is particularly critical and is the focus of this report. Only regulators can implement the reforms needed to allow distributed resources to compete fully and fairly, in service to the public interest.

#### 1. Save Money

The first and probably the most important reason that regulators and customers should care about distributed resources is that they offer opportunities to save money. What was once thought to be a bright line between generation on the one hand and transmission and distribution (T&D) on the other, turns out to be fading. Distributed resources deliver the full array of generation services (all with lower line losses); they can also substitute for T & D system investment. The type of distributed resource, where it is installed, and when it operates all influence the benefits the resource provides.

Remarkably, in ten of 11 utility studies, the value of distributed resources that flowed from reduced investment in T&D and from enhanced system reliability *exceeded* their capacity and energy

**Cost-Effectiveness**

Distributed resources' cost-effectiveness depend on perspective and what benefits are being counted. For a utility, distributed resources are cost-effective when the capacity, energy, T&D, ancillary services, and system reliability benefits exceed the cost of the distributed resources. If the distributed resource is on the utility side of the meter, the utility's cost is the capital and operating cost of the resource. If the distributed resource is on the customer side of the meter, the utility's cost is the loss of revenues from the customer and the utility may never look at the counter-weighting benefits it receives from the customer's investment.

To customers, the capacity and energy savings are based on avoiding retail purchases. Other customer benefits, which often are much larger than the capacity and energy savings, include the value customers place on increased reliability plus any non-electricity benefits (heat, hot water, air conditioning, etc.).

Not all distributed resources are cost-effective. Distributed resources' cost effectiveness varies — by utility, by customer and by location. But the clear trend is that more distributed resources are becoming cost-effective in more locations.

revenue from high use to low use customers, and is inconsistent with sound rate design principles. Option 2 leaves prices unaffected. Interestingly, in terms of the financial effect on the utility, there is no difference between the two options. Under either, increased sales do not increase profits.

savings.[7]

It is likely that most utility distribution systems in the country have at least some specific areas where it is very costly to deliver electricity. On average, the cost of distribution plant in the United States is about 2.5 cents per kWh. Typically, high-cost areas are those where distribution lines are being installed for the first time or are near capacity and need to be upgraded or replaced. The per-kWh cost in such areas may be an order of magnitude higher than the average distribution cost. Our discussions with distribution companies reveal that distribution costs of 20 cents per kWh in high-cost area are not uncommon.

[7] See *Policies to Support a Distributed Energy System*, Starrs and Wenger, Renewable Energy Policy Project, <http://www.repp.org/articles/pv/3/3.html>.

## 2. Improve Reliability

Increasingly important to regulators and consumers are the many ways distributed resources can improve reliability. Recent experience in New York and Chicago show that reliability is a T & D issue, and it is here that distributed resources can help. (See following Box for a summary of how distributed resources improve reliability.)

**Reliability Benefits**

Reliability benefits accrue in at least five ways.

**1) Lower Reserve Margins.** The level of reserves required to deliver a given level of reliability varies with the size of generating units and the forced outage rate of those units. The larger the unit size and the higher the forced outage rate, the greater the level of reserves required to deliver a given level of reliability. Distributed resources, because of their very small size, will almost always reduce the amount of reserve capacity needed to meet a given level of reliability. Resources with low forced outage rates would further reduce required reserves.

**2) Reduced Transmission Loading.** Reliability is also influenced by the capability of transmission facilities. If located in the right place and operated at the right time, distributed generation can increase reliability by freeing transmission lines to serve reliability purposes. Closely related is the ability of strategically located distributed resources to reduce or eliminate load pockets and provide local voltage support.

**3) Reduced Outages**. The extent of outages (number of customers affected) and the time needed to restore service after an outage can be reduced by the deployment of distributed resources.

**4) Improved Customer Reliability.** An individual customer's reliability can be improved when distributed generation is located on her site and sized to meet all or at least the essential portion of her load. This provides the customer with the opportunity to continue to receive electric service when the remainder of the electric system is down.

**5) Improved Neighborhood Service.** It is possible that improved control and communication technology installed in the distribution system will make it safe and economical to "island" parts of the system. A whole neighborhood or large subdivision might be able to temporarily disconnect from the grid and receive service from distributed resources within the area. This would increase reliability to customers in the island and if the problem was supply related, could help customers who continue to be grid connected by "freeing up" electricity.

### 3. Reduce Pollution

Distributed resources can reduce pollution. Though some distributed resources, such as reciprocating engines, may produce more pollution, and in some cases substantially higher emissions than state-of-the-art combined cycle gas-fired facilities, other distributed resources, such as photovoltaics and fuel cells, produce significantly less air, water and noise pollution than new central station technologies. Still others, such as micro-turbines, provide opportunities to reduce emissions by improving the efficiency with which energy is consumed, through improved heat rates and combined heat and power applications.

### 4. Enhance Customer Service and Choice

Some states are moving ahead with electric industry restructuring, while others are waiting to see if retail competition's promises of lower costs and improved service will be realized. But with or without retail customer choice and whatever the structure of a state's electric sector, distributed resources give customers more ways to meet their energy needs, improve the reliability of their service, and to lower their costs. Distributed resources also provide a valuable and important check on utility market power.[8]

**Customer Choice**

Home-sized emergency generators cost between $250 and $500 per KW and at $1 per gallon of gasoline have running costs (fuel only) that range from 7¢ to 25¢ per kWh.

Are these generators "cost-effective?" Probably not to those steeped in utility economics, but they are apparently very cost-effective to customers. Y2K concerns have been fueling an already brisk market for home-sized emergency generators. One large mail order company, Northern Tool Company, warns its customers of four to six month back orders on most of the 20 or so models it sells.

Imagine how customers will respond when silent, reliable, and maintenance-free PVs or fuel cells, or quiet cogenerating micro-turbines are cheaper than these already popular home generators.

### 5. Favorable economic effects

The fifth reason falls slightly outside the scope of traditional regulation but is nevertheless important. Distributed resources produce favorable local economic and job effects. For example, jobs are created in the distributed resource industry at rates roughly

[8] Distributed resources provide especially important checks on market power in transmission-constrained areas by providing the only effective competition to centrally-generated electricity.

two to five times greater than in the central station generation and transmission sub-sector.

### 6. Regulators' Public Interest Role

Because of their public interest obligations, regulators should care about distributed resources. Even though distributed resources can be cost-effective, reduce pollution, and enhance customer choice, existing regulatory practices discourage the use of these resources. If the use of distributed resources is unprofitable for a regulated utility, we should expect barriers to their deployment to be erected and maintained. If, on the other hand, the deployment of distributed resources is made profitable to the utility, barriers that currently exist are likely to be quickly overcome with the active assistance of the utility.

## 3. PROFITABILITY

### A. Profitability Defined

Our concern in this paper is with the incentives that cause utilities to take, or avoid taking, specific actions. Thus, the question we focus on is: What happens to a utility's profits if it does "X" or if its customers do "Y"? The incentive (or disincentive) is the action's incremental effect on profits, not the level of profits.

Profits can be expressed in absolute terms, such as $100 million, or as a rate, such as dollars per share or percentage return on equity (ROE). Focusing on the absolute return can be very misleading. Rate of return is the more important measure of profitability. Profitability improves if the rate of return (earnings per share) goes up. For example, through increased sales or a merger or acquisition, a firm can grow and see its earnings climb from $100 to $150 million. But, if its costs or related capital requirements grew faster than its revenues, its rate of return and earnings per share would decline. Shareholders would not be happy with management if earnings went up by $50 million but earnings per share, and hence ROE, dropped by 10%.[9]

### B. Profitability to Whom?

#### 1. The Utility

The term "utility" is somewhat ambiguous these days, in light of industry restructuring. For the purposes of this paper, "utility" is the regulated entity regardless of its form. The regulated entity, or utility, may be a wires-only

[9] A good example of the difference between profits and profitability is the recently announced decision of Lockheed Martin-Marietta, a major defense and technology company, to sell $1 billion of assets (including several product lines) in order to improve profitability. If the move is successful, Lockheed's absolute revenues and earnings will drop, but its rate of return (earnings per share) will go up.

distribution company (DISCO), a vertically integrated company, or something in between.[10]

This report examines the impacts of distributed resources deployment on utility profitability. "Deployment" is used instead of "investment" because distributed resources may be installed and owned by the utility, customer, energy service provider, or any other entity. In each case, there will be predictable effects upon the utility's profitability.

**2. Utility Affiliates**

Many regulated utilities also have affiliates engaged in unregulated activities; some of these activities are directly related to distributed resources. When considering whether the deployment of distributed resources is profitable *to the utility*, we do not consider the profits of the unregulated businesses.

Consider a utility (HoldingCo) that has a regulated distribution service (UtilCo) and three unregulated affiliates: GenCo owns and operates large power plants, RetailCo markets electricity to retail customers, and MicroCo sells distributed resources to retail customers. Next, consider whether the activities of each affiliate directly affect the costs, revenues, or profits of UtilCo. Like any generating company, GenCo will try to expand its market share and reduce its costs. RetailCo will want to sign up as many profitable customers as it can. GenCo and RetailCo may be profitable or unprofitable, but neither's actions cause UtilCo's regulated revenues or costs to change.[11] UtilCo can be expected to do what it can to favor the interests of RetailCo and GenCo (both within and outside its service territory), but these actions have no direct bearing on the regulated utility's profitability.

MicroCo's story is very different. The deployment of distributed resources on the UtilCo customer's side of the meter reduces UtilCo's revenues and profits. In this case, the business strategy that makes most sense is for MicroCo to operate everywhere except in UtilCo's service area.[12] Meanwhile, UtilCo might create barriers to others trying to install the same types of facilities in its local service territory.[13]

It is possible that HoldingCo's profits from unregulated activities exceed the

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[10]Our focus is on the incentives for investor-owned utilities. Incentives for publicly and customer owned may be different.

[11] UtilCo would see increased profits if RetailCo's marketing activities caused sales to increase.

[12]UtilCo's service area would probably be used in the early stages to test products and gain initial experience. Also, if UtilCo knew a customer was serious about adding a distributed resource, having MicroCo get the business is better than letting the business go elsewhere.

[13]This business strategy is not unique to distributed resources. For example, some utilities are actively engaged in promoting, and are profiting from, the creation of a competitive electric industry outside of their home state, while at the same time are acting to delay the introduction of competitive access at home.

losses that those same activities impose on UtilCo. But this does not lead to the conclusion that all is well on the regulatory front. Our focus is on the profitability implication of distributed resources on UtilCo.

### 3. Does the Utility's Structure Matter?

Two related issues are at the core of many restructuring debates — utility structure and the utility's ownership of generation. It is natural to expect these overarching issues to have a major impact on utility profitability. As it turns out, however, though both have major implications for many utility matters, neither has a very significant impact on the issue addressed by this report – distributed resources and utility profitability.

A utility may be a "wires only" distribution company or, at the other extreme, it may be a vertically integrated monopoly. In between reside a number of hybrids. One example is a corporate structure where the utility's regulated wires business is functionally separated from its unregulated activities (which may include distributed resources) and "codes of conduct" have been established to keep an honest relationship between the divisions.

The profits of a firm consisting of regulated and unregulated businesses is the sum of the profits of each business entity. Our focus is on the profitability of the regulated entity; its profits go up or down based on the way regulation works. If the regulated entity is a wires-only company and its revenues are derived from volumetric charges, profits go down when distributed resources cause a its revenues to go down more than its costs. Installing distributed resources on the customers's side of the meter almost always causes profits to drop. The possible exception is if distributed resources are restricted to the highest cost areas of the distribution system. As discussed in greater detail later, if the regulated entity is a vertically integrated utility with a fuel adjustment clause (FAC), the same profit implications exist.[14] Our conclusion is simple: Structure does not have much impact upon profitability.

This does not mean the structure of the utility is unimportant or that the structure has no other implications for distributed resources. Clearly, the choice of utility structure is important. The utility's structure affects market power, state and federal jurisdiction, and a host of other important considerations. But, when it comes to distributed resources, corporate structure has little effect upon profitability of the regulated utility.

### 4. Does it Matter Whether Distributed Resources Are Owned by the Utility?

[14] If the regulated entity is a vertically integrated utility without a FAC and marginal energy costs (fuel or purchased power) are very high, the utility's profits may suffer more from supplying power than they would if the customer installed a distributed generator.

Utility profitability (rate-of-return as opposed to earnings) is not directly affected by who owns the distributed resources. The question of utility ownership of distributed resources has many complex facets.[15] How ownership affects profitability is confused by the assumption that adding to rate base (over investing in capital or "gold plating") improves profitability.[16] As already discussed, profitability (as distinguished from profits) improves when the rate of return or earnings per share go up. Adding $1 million to profits does not help if the associated costs reduce the rate-of-return from ten percent to nine percent. It follows that profitability goes up only if the rate of return on new investment exceeds the rate of return on existing investment.

As a general rule, profits go up if the utility can increase revenues without increasing costs or reduce costs without increasing revenues. A good example of the latter is a situation in which distributed resources are substituted for more costly distribution system additions and are installed on the utility side of the meter. In this case sales and revenues are unaffected by their deployment while investment in cost-effective distributed resources substitutes for even higher levels of investment in distribution upgrades. Less investment with the same level of revenues means higher profits, making the utility's profit incentive consistent with deployment of utility-side resources. It also follows that if another entity built and owned the distributed resources (e.g. an IPP that sells power to the wholesale market), the utility would see the same revenues and have no capital investment.

Table 1 illustrates the profitability implications of a related issue — the profitability consequences of utility "ratebasing" as opposed to "expensing" distributed resource costs. The table shows a base case and two scenarios. The base case shows the utility's condition before $100 of additional non-revenue producing capital such as the addition of a distributed resource to reinforce a weak distribution line. The first scenario is the "Expensing" case. This case shows what happens to profits if the utility pays for the distributed resource as an annual operating cost of $20 per year.[17] This might be the case if a utility contracts with a third party who adds the equipment. In the "Ratebasing" case, the utility makes the investment and the utility's revenue requirement goes up by $20 per year.

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[15]These issues are being fully and forcefully debated in a California Proceeding Docket R. 98-12-015. Some parties, including the Office of Ratepayer Advocates and many competitive suppliers of distributed resources, are arguing strenuously that the distribution utility role should be limited and ownership should be prohibited. Distribution utilities are arguing that their role is more expansive and ownership should be an option.

[16]The Averch-Johnson effect, named for the economists who first postulated it, describes a utility's tendency to overinvest, or "gold plate" its capital investment Simply put, the theory holds that a utility will overinvest in capital *if* its rate-of-return exceeds its cost of capital. The same tendency would exist *if* its profits on new investment are expected to exceed the average level of its profits. Neither condition is typical of regulated utilities.

[17]The table reflects a worst case where the utility pays the third party an annual sum equal to the annual cost the utility would have incurred had it owned the plant. A more likely case would have the utility "go out to bid" and the annual payments would be lower than shown in the table. If the bid price were less than $18.20, the pre-ratecase ROE for "expensing" would be higher than that of "ratebasing".

The table shows that the rate-of-return goes down by about the same amount whether the addition is owned by a third party or the utility. In both cases a "rate case" restores earnings to the original level of 12%.

**Table 1**

| Assumptions | | | | | |
|---|---|---|---|---|---|
| | | Base Case and Expensing Case | | Ratebasing Case ($100) | |
| | | | | | |
| Net Plant | | $1000 | | $1100 | |
| | | | | | |
| Debt (amount and cost) | | $500 | 0.08 | $550 | 0.08 |
| Equity (amount and cost) | | $500 | 0.12 | $550 | 0.12 |
| Equity (shares) | | 100 | | 110 | |

| | **Base Case** | **Expensing Before and After New Rates Additional $20 O&M** | | **Ratebasing Before and After New Rates Additional $100 Capital** | |
|---|---|---|---|---|---|
| | | **Before** | **After** | **Before** | **After** |
| Revenue | 1200 | 1200 | 1220 | 1200 | 1220 |
| O&M | 1000 | 1020 | 1020 | 1000 | 1000 |
| Depreciation | 100 | 100 | 100 | 110 | 110 |
| Net Operating Income | 100 | 80 | 100 | 90 | 110 |
| Interest | 40 | 40 | 40 | 44 | 44 |
| Earnings | 60 | 40 | 60 | 46 | 66 |
| **ROE** | **12.00%** | **8.00%** | **12.00%** | **8.36%** | **12.00%** |
| **EPS** | **0.60** | **0.40** | **0.60** | **0.42** | **0.60** |

## 4. REGULATION TODAY

How utilities are regulated is the most important determinant of whether they have an incentive to deploy or obstruct cost effective distributed resources. A survey of current practices in state regulation reveals three features that are relevant to this issue. First, by far the predominant form of regulation currently in use in the US is traditional cost-of-service regulation. Second, where performance-based or alternative kinds of regulation are employed, the predominant form is price-based (as distinguished from revenue-based) regulation. Third, where utilities are vertically integrated and generation is regulated, most states have fuel adjustment clauses.

### A. Regulation: The Basics

The key to understanding the problem distributed resources pose to utilities is having a clear answer to a deceptively simple question: How do utilities make money? Utility economics differ from the economics of an ordinary competitive business. The details of regulation have a profound, but usually not obvious, effect on the answer.

By challenging a few widely held misconceptions, understanding how utilities make money becomes clear.[18]

**1. Misconception Number One: Cost-of-Service regulation creates no incentives.**

The notion that there are two approaches to regulation, cost-of-service (COS) regulation on the one hand and incentive or performance-based regulation (PBR) on the other, is a vast oversimplification that does more to confuse than clarify the issue. **All regulation is incentive regulation.** Regulation in any form gives firms incentives to behave in ways that maximize profits.[19] The question then is: What incentives are created by a particular regulatory approach and how powerful are those incentives? The answers to these questions are not even remotely informed by the name given to a particular regulatory scheme. In certain circumstances, the cost-cutting and performance incentives of COS can be much more powerful than those of PBR. The devil is in just a few of the details: who bears what risks; the level of exposure; and the length of regulatory lag or the period between financial reviews.

**2. Misconception Number Two: What was said in rate cases matters.**

Rate cases seem to be never-ending examinations of the "reasonableness" of costs, disputes about the "prudence" of investments, and arcane "rate of return" debates over the costs of capital and its structure (debt/equity ratio). Given the amount of time, money and resource invested in rate cases by the utility, the regulators, and the parties, one might conclude that rate case decisions on utility costs, rate of return, and revenue requirements actually have some real world consequences. They do not.

Rate cases have only one consequence that lasts beyond the final day of the rate case: Prices have been set. Once the rate case is completed and prices are set, everything said in the hearing process is irrelevant to the fundamental question of how utilities make money. From the day prices are set, utility profits are ruled by a simple formula:

[18] This information relates to how regulation works in most states. A few states have adopted PBR and a few others have a variety of "balancing" accounts that can change the incentives faced by utilities.

[19] This is even true of ostensibly non-profit utilities — cooperatives and municipals — that act naturally to preserve their fiscal health, which is to say that they seek to ensure positive net income.

PROFIT = REVENUE - COSTS

The REVENUE part of the formula is easily computed, but it has nothing to do with the line from the rate case order labeled "revenue requirement" or "allowed revenue."[20] The utility's actual revenue is governed by the following relationship:

REVENUE = PRICE * QUANTITY

Prices were set at the end of the rate case and are fixed until the end of the next rate case. In arithmetic terms, price is a constant, so revenue is directly related to quantity, or sales. Ignoring the subtleties of rate design (*i.e.*, the structure of prices — energy charges, demand rates, and customer charges), if sales go up 2%, revenues will go up by the same percentage.

The COST part of the profit equation is more complicated and takes us to the next myth.

**3. Misconception Number Three: If sales go up, costs go up.**

The system of regulation that we have used in this country for over a hundred years is based on what is sometimes called the unit cost theory. Introducing and explaining a few rate case terms will help. Rate cases all begin with a "test year." In most states, it is a historic year and in a few it is a projected, or future, year.[21] Whether historic or future, the test year is a fixed period of time and all costs and revenues to be examined in the rate case will be for that year. If test year revenues fall short of test year costs (including a reasonable rate of return), the revenue requirement is increased. New prices are set by taking the new revenue requirement and dividing it by test year sales.

The unit cost theory says the test year rate case defines the relationship between revenues, expenses, and investment and says furthermore that this *relationship remains constant.* The unit cost theory allows regulators to choose to use a historic test year, a fully projected test year, or any test year in between. Thus, we can use a historic test year, say 1998, to process a rate case in 1999, and set prices that will be in effect in 2000. Or we can use a projected test year, say 2000, to process a rate case during 1999 to set prices for 2000. According to the unit price theory, both exercises will yield the same prices. The future test year will have a higher revenue requirement (the numerator) than the historic test year numerator, but it will also have higher sales (the denominator). With the

[20] Indeed, in states that use a historic test year, the line in question refers to a period that may be two or more years ago.

[21] If you've ever wondered why there is even a choice between two so very different periods, the answer is the unit cost theory.

numerator and denominator moving in lockstep the end result is that prices in 2000 will be the same.[22]

So much for the theory. The reality is that utility costs and revenues do not move in lockstep as sales change. In fact, it is far more accurate to say they are independent! Statistical analysis of utility costs (excluding fuel and purchased power) has consistently shown that there is no meaningful relationship between costs and kWh sales in the short run.[23]

This has profound effects on how utilities make money. Recall the basic profit formula:

PROFIT = REVENUE - COSTS

Revenues are directly related to sales, and costs are relatively independent of sales. This means profits and sales are directly related. If sales go up 2%, revenues go up 2%, and profits go up 2% because costs change very little. Likewise, if sales drop, revenues and profits drop.

**4. Misconception Number Four: For a vertically integrated utility, high marginal fuel and purchased power costs hurt profits.**

Most vertically integrated regulated utilities live in a fantasy world of economics. Where else can you make a product at a cost of 15¢, sell it for 7¢, and see profits go up as sales grow? But that is exactly what happens for vertically integrated utilities with a fuel and purchased power adjustment clause.

How can this be? A fuel adjustment clause (FAC) essentially takes a utility's cost and turns it into a customer's cost. Under typical FACs, fuel and purchased power costs flow through to customers on a dollar for dollar basis. Absent disallowances for imprudently incurred costs, fuel and purchased power costs have no impact on utility profits.

For those accustomed to the workings of competitive markets, this result is counterintuitive. Assume that it is a hot summer day and the most expensive sources of power are pressed into service. Let's say that the marginal running cost of a very inefficient diesel plant operating on only five of six cylinders is 15¢ per kWh. The 15¢ kWh is sold to a customer at the regulated price of 7¢. Under

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[22] If, for some reason, it is believed that the unit cost theory is violated and revenues, expenses, and investment are growing at different rates, there is a special ratemaking adjustment available in many states. "Attrition" is when costs are growing faster than revenues, "accretion" (when revenues are growing faster than costs). It should come as no surprise that during periods of high inflation, utilities frequently requested and were often given "attrition" adjustments which resulted in larger rate increases. More recently, sales growth has been high and inflation low. One might expect requests for "accretion", but these have been rare while proposals for rates freezes have been common.

[23] See J. Eto, S. Stoft, and T. Belden. "The Theory and Practice of Decoupling." LBL-34555, January 1994. http://eande.lbl.gov/EA/EMP

utility accounting, the 7¢ regulated price is made up of 5¢ base cost (intended to cover the utility's costs that are not within the scope of a FAC) and 2¢ to cover the average cost of fuel.[24] When the kWh is sold, the 2¢ and the 15¢ fuel cost are reflected in the FAC accounting system. The 13¢ shortfall is recovered from all customers later, when the FAC is reviewed and updated. The 5¢, however, is the utility's to keep.[25] The end result: The kWh cost 15¢ to produce and is sold for 7¢. Five cents goes to the utility's bottom line, and a 13¢ "loss" on fuel ends up being paid for by customers.[26]

## B. Distributed Resource Profitability Implications

Three important scenarios flow from what we have learned so far.

### 1. Distributed Resources Located on the Customer's Side of the Meter

The general predominant condition is that, where REVENUE and COST are independent, profits increase if revenues increase and profits fall if revenues fall. This means that any distributed resource that causes revenues to fall hurts utility profits. Any supply- or demand-side resource located on the customer's side of the meter will have this effect. So will all net metering installations.

**Energy Efficiency As A Distributed Resource**

Although much of this report focuses on distributed generation, energy efficiency and load management resources are generally much cheaper, cleaner, and more widely available. The profitability implications for these demand-side distributed resources are essentially the same as they are for distributed generation installed on the customer's side of the meter.

Note that the effect on utility profits does not depend on the cost-effectiveness of the distributed resources. Very cost-effective distributed resources, even zero-cost distributed resources, hurt utility profits if the distributed resources are installed on the customer's side of the meter.

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[24] The actual accounting entries vary from state to state but not the effect.

[25] It goes to the utility's bottom line, insofar as the utility's base (non-FAC costs) has not changed as a result of the sale.

[26] In a few states, vertically integrated utilities do not have a FAC. In these cases, the incentives are in some respects a little better and in others a little worse. The end result is probably not too different, but a more specific conclusion depends on the utility's actual cost and price structure. If prices are high relative to market prices for electricity, the same connection between profits and sales exists. Each kWh sold brings in more revenue than cost. If prices are low relative to market prices — a condition that rarely occurs — the utility may be able to deploy distributed resources in profitable ways.

**2. Distributed Resources Located on the Utility Side of the Meter**

If the distributed resources are installed on the utility side of the meter, there is no revenue loss. If no special attention is paid to where on the system distributed resources are installed or how the resources are operated in relation to the distribution system, there will probably be very little, if any, savings in the transmission and distribution system. The utility's cost savings will however, include system-wide savings, such as the capacity and energy value of the distributed resources and the value of increased system reliability. The impact on utility profits depends on whether the system-wide benefits exceed the capital and operating costs of the distributed resources.

**3. Distributed Resources Located in High Cost Areas**.

In special cases, perhaps covering as much as five percent of a utility's service area, the installation of distributed resources will be in high-cost areas of the system where significant distribution and reliability cost savings are achievable. Locating distributed resources in those high cost areas is the best option.

As summarized in the following table, the impacts of distributed resources on utility profits depend first and foremost on whether the resource is located in a high cost area. Locating distributed resources in high cost areas assures that the benefits, or cost savings, are as high as possible.

| Utility Costs and Benefits Depending on Location of Distributed Resource | | | | |
|---|---|---|---|---|
| | Distributed Resource Location | | | |
| | High Cost Areas | | Low Cost Areas | |
| | Utility Side of Meter | Customer Side of Meter | Utility Side of Meter | Customer Side of Meter |
| Costs | Capital and operating cost of the distributed resource or equivalent payment to third party owner | Revenue loss | Capital and operating cost of the distributed resource or equivalent payment to third party owner | Revenue loss |
| System-wide Benefits | Capacity and energy<br>System reliability<br>Distribution benefits (in high-cost areas) | | Capacity and energy<br>System reliability<br>Distribution benefits (in high-cost areas) | |
| Other Benefits | Distributed benefits including capital cost savings on the T&D system, reliability improvements, | | Few, if any | |
| Effect on Profits | Best situation. Effect on profits most likely to be neutral to positive depending on specific location, costs, and operation | | Worst situation. Effect on profits most likely to be negative. | |

## 5. REGULATORY REFORM OPTIONS

There are a number of regulatory reform options that can align a utility's profit motive with support for deployment of cost-effective distributed resources.

### A. Performance-Based Regulation: Price Caps vs. Revenue Caps

A number of states have experimented with performance-based regulation (PBR). While PBR can take many forms, the predominant structural feature that distinguishes one class of PBR from another is whether it is price- or revenue-based. PBR generally

establishes a fixed period of regulatory lag, generally in the three- to five-year range. During this period the utility is subject to either fixed prices (price caps) or fixed revenues (sometimes fixed revenues per customer). Either may be adjusted by a predetermined formula (typically aimed at capturing the countervailing effects of inflation and improvements in productivity). Price-based approaches make customer-side distributed resources — both generation and energy efficiency — very unattractive to utilities, as every lost kWh of sales results in a loss of revenue.[27] In contrast, revenue-based approaches make utilities indifferent to customer-side distributed resources. Revenue-based PBRs have been adopted in several states as well as parts of the United Kingdom and Australia.

A brief description of the mechanics and financial implications of a revenue per customer PBR follows.[28]

**1. Mechanics**

An issue in any PBR is the starting point or baseline level of rates and revenues. This typically entails a cost-of-service review to ensure that the starting point is neither too high nor too low. This review (in effect, a rate case) yields a reasonable level of test-year revenues, which then constitutes the starting point for a revenue per customer PBR.

**Net Metering, Standard Interconnection Requirements, CTC Collection, Distribution IRP, and Other Policy Options**

A number of policy options to encourage distributed resources have been adopted or suggested. These include net metering, allowing distributed resources to avoid CTC charges, planning requirements for distribution utilities, and mandated open access distribution. This report does not address these policies because, while they may be needed and very effective in encouraging distributed resources, they do not address the profitability issue. To the extent these policies are successful, they tend to reduce utility profits.

The revenue requirement (distribution only) is allocated to each rate or customer class and is divided by the test year number of customers to yield an average revenue per customer by customer class. Assume for illustrative purposes that the average revenue per customer per month is $25. (Although this looks like a customer charge, it is not a rate that customers pay. Prices customers pay continue to be set as before.) Assume that the price customers pay is 5¢ per kWh.

[27]Rate freezes, rate case moratoriums, or "stay-out" provisions all produce the same incentives as a price cap PBR.

[28]More detailed descriptions of the mechanics of a revenue-based PBR appear in several documents including *"Decoupling sales and Profits: An Incentive System That Works", The Electricity Journal, July 1991.*

At the end of a year, two figures are compared: the *actual* revenue the distribution utility collected at the 5¢ per kWh and the *allowed* revenue, calculated as $25 times the number of customers. Any difference, positive or negative, is reflected as an adjustment to the 5¢ price for the coming year.

### 2. Implications

From the utility's financial perspective, a revenue based PBR mirrors what would happen if prices were changed from 5¢ per kWh to a flat customer charge of $25. In either case, the utility's revenue and profits are tied to customer growth rather than sales. Profits are increased by reducing costs and adding new customers as efficiently as possible. But we must emphasize that, although the utility's financial incentives are identical, for the foreseeable future only the revenue-cap PBR is tenable.

We reach this conclusion for two reasons. First, the objectives of economic efficiency and equity require that rates be set to reflect the long-run marginal costs of consumption. That is, they must signal to consumers the true societal costs of their consumption so that consumers can make fully informed decisions to allocate their (and society's) scarce resources to their most highly valued uses. Costs which appear to be fixed in the short-run are variable in the long-run. Second, even small shifts from variable to fixed prices have large equity impacts. Experience shows that the political opposition to high fixed customer charges would be overwhelming.

## B. Making Practical Use Of De-averaged Costs

Another reason that utility profitability is not well served by the deployment of distributed resources is that the prices charged for the services displaced by distributed resources often do not reflect the true costs of those services. If all distribution utility prices were exactly reflective of marginal distribution costs, the deployment of distributed resources would have a very different impact on utility profits. By way of example, recall that average distribution rates are about 2.5¢ per kWh and that in high-cost areas distribution rates are as high as 20¢ per kWh. In theory, regulators could simply de-average distribution prices, requiring the utility to charge something approaching zero in areas that have excess distribution capacity, and something near 20 cents in areas with constrained distribution facilities. Such prices would send the "right" price signals to consumers and would likely cause distributed resources to be installed precisely where they make the most sense. De-averaging prices along these lines, however, is unlikely for compelling practical, universal service, and political reasons.[29]

[29] On an embedded (or historic) cost basis, the "deaveraging" debate tends to be an urban (low-cost) versus rural (high-cost) battle. On a marginal cost basis, the high-cost areas tend to be those marked by high growth, which are often urban and suburban areas.

The recent debate over the use of nodal or zonal transmission pricing to manage transmission congestion raises the same issues. A distribution plant at or near capacity is directly analogous to congested transmission. Congestion pricing for transmission is widely accepted as an efficient way to use market tools to make the tradeoff between transmission construction, alternative power plant dispatch, and siting new power plants. In essence, transmission congestion pricing is a way of geographically de-averaging prices for transmission service.

There are, however, several important differences between the transmission and distribution systems. First, the transmission system is relatively uncomplicated and, unlike the distribution system, is made up of only a few components (lines, loads, and generators). Second, the architecture of the transmission system is a network, providing multiple paths from generation to loads, whereas the distribution system is more tree-like, typically with only single paths from substations to disaggregated loads. These differences suggest it makes more sense to identify stable high-cost zones and develop regulatory policies to reduce costs in those zones than implement a fluid (and costly) "real-time" and "real-place" pricing system to reveal changes in costs and locations at the distribution level. Third, de-averaged transmission prices are charged to retail suppliers, not to retail customers. Retail suppliers may pass along to their customers those de-averaged wholesale prices, by way of de-averaged retail prices. Generally, they have not. To present the right economic signal to customers who are considering distributed resource options, de-averaged retail prices are required. While this may be an option someday, a great deal of consumer education and preparation will be required to make it practical.

If retail prices are not de-averaged and utilities are allowed to own distributed resources, policies will have to be developed to ensure that competitors are treated fairly. Absent de-averaged prices, distribution utilities would be the only entities that know where the high-cost distribution areas are and the only entities positioned to benefit from cost savings related to distributed resource deployment. Because distribution system savings are key drivers of distributed resource economics, utilities would have an unbeatable competitive advantage. Failing to address this problem would deprive the public of the innovation that would come from a vigorous competitive market for distributed resources.

Turning the experience with transmission congestion pricing and recognition of competitive issues into practical regulatory options for the distribution system leads to two related proposals: de-averaged distribution credits and distributed resources development zones. Both proposals are designed to encourage customers and others to install distributed resources in high cost areas. The reason we focus on policies that concentrate distributed resources in high cost areas is simple: distributed resources make most economic sense in the these areas and utility profits are least at risk.

### 1. De-averaged Distribution Credits

De-averaged distribution credits may be a practical alternative to de-averaging all distribution prices. Under a program of geographically de-averaged distribution credits, the utility would establish financial credits for distributed resources installed in a given area. The credit amount would be a function of the distribution cost savings generated by the distributed resources. Credits would be limited in duration and magnitude, in order to match the timing and need for distribution system reinforcements. For example, credits might be available to the first 20 MW of distributed resources installed in the next year, because after that period, loads are expected to have grown to the point that distribution line upgrades are unavoidable. The dollar amount of the credits should, at most, equal the value (savings) derived from deferring the distribution upgrade. Credits would also vary by location of the distributed resources. Credits would be highest in areas of greatest need and would be zero in low-cost areas.[30] For example, customers in an area with 20¢ distribution costs might be offered a 15¢ credit.[31] This would certainly produce a strong economic incentive for customers and others to invest in distributed resources. Because the credit is 15¢ instead of the 20¢ the utility would incur to upgrade facilities, there is an opportunity for savings to be shared.

### 2. Distributed Resources Development Zones

Utility profits do not suffer if distributed resources are confined to high-cost areas. The problem for utilities is how to confine distributed resources to any particular geographic area. Location-based, buy-back rates are one way to focus action in some areas. An alternate approach is to establish distributed resources development zones. These would be high-cost areas within which distributed resources vendors could be encouraged to target customers. Incentives could include but are not limited to direct financial assistance, waiver of standby charges, assistance in contracting with and marketing to customers, and low- or no-cost siting at utility substations and other properties.

## C. Pricing Flexibility

"Economic development rates," "load retention rates," "co-generation deferral rates," and "competitive contract rates" are a few of the names given to special pricing arrangements designed to increase or retain loads. Many utilities have asked for this kind of rate flexibility and most requests have been approved. While the arguments differ slightly from program to program, the common thread is a certain freedom to lower

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[30] Variations of the deaveraged distribution credits could be a sliding scale standby rate or a hookup feebate. For example, standby rates could be on a sliding scale ranging from high to negative. Negative standby rates, which look like distribution credits to customers, would be charged in high-cost areas. A hookup feebate would be a revenue-neutral charge that collects from customers installing distributed resources in low-cost zones and pays customers who install distributed resources in high-cost zones.

[31] Demand-side resources are so much less costly that the winning bid prices would likely be far below 15¢.

prices to levels approaching marginal production costs in order to encourage a customer to expand loads or discourage her from reducing loads through self-generation or other means.

For example, to support "cogeneration deferral rates," utilities argue that cogeneration is, in many cases, not actually cost-effective when compared to the utility's own marginal cost of supply, and that it only appears cost-effective to customers because retail prices are well above the utility's marginal cost. In these cases, utilities have asked for flexibility to lower prices to discourage customers from installing on-site generating options.

An important characteristic that distinguishes distributed resources in this context is the significantly greater scope (in breadth and depth) of benefits that such resources offer. The value of distributed resources is location dependent. Even if reducing rates to discourage distributed resources were a reasonable response in one location, it would be an unreasonable response in others. The utility should have the burden of distinguishing between these locations. One option for regulators is to allow pricing flexibility for low-cost areas along the lines just described, *but only* if a utility simultaneously increases the prices (perhaps through a de-averaged buy-back rate) for high-cost areas.[32] It does not make sense to have a utility actively discouraging the installation of distributed generation and other resources in low-cost areas if it is not simultaneously encouraging them in areas where costs of utility service are clearly above retail prices.

### D. Targeted Incentives for Distributed Resources

PBRs can be designed with targeted incentives for the deployment of cost-effective distributed resources or distributed resources with particular environmental features. Distributed resources are in the public interest because of the cost savings they offer. Therefore, one logical regulatory approach is to create a targeted incentive by allowing the utility a share of the savings they produce. If a utility can demonstrate that it has reduced its transmission, generation, or other distribution costs by installing distributed generation or targeted demand-side investments, regulators could allow the utility to keep some fraction of the savings as a reward. Targeted incentives of this nature have worked successfully for energy efficiency and other demand-side options in the past.

### E. Stranded Cost Balancing Accounts

Stranded cost recovery affects who has an incentive or disincentive to deploy distributed resources. If stranded costs are recovered volumetrically, customers will have an incentive to invest in distributed resources. Conversely, the imposition of exit fees will discourage customers from installing distributed resources.

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[32]Simply treating each request to lower prices based on own location-specific facts is not an adequate response. The utility has no incentive to file for increased prices where existing low prices discourage distributed resources.

The details also matter from the utilities' perspective. Most, if not all, restructured states collect stranded cost through a per kWh charge. In some states, the stranded cost charge is fixed and can be imposed for a specified period of time. Lost sales in these states precipitated by customer-side distributed resources (or by any other cause for that matter) reduce the utility's recovery of stranded costs. In other states, the total amount of stranded cost recovery is fixed and tracked in a balancing account. The per-kWh charge or the duration of the charge is allowed to change until the account is reduced to zero. The latter approach reduces the utility's disincentive to the deployment of distributed resources, since recovery of stranded costs is ensured, regardless of changes in sales.

**Sprawl and Smart Growth**

Considering distributed resource issues together with efforts to address the environmental and economic issues relating to urban sprawl may make seemingly radical pricing options more practical. The environmental consequences of sprawl include land use impacts, transportation and related air pollution impacts. But increasingly, states are focusing attention on the economic drivers and consequences of sprawl. For example, a study by the State of Maine Planning Office looked at the total cost of home ownership in an established urban area compared to a new distant subdivision. The first cost of the urban home was higher until one factored in the added cost of transportation and insurance. More important, the subdivision economics were skewed because many costs, including adding the necessary electric, gas, water, sewer, telephone and road infrastructure were not reflected in the cost of the home. Charging the full marginal costs for the expansion of the infrastructure would have a generally positive effect on land use decisions, reducing the tendency to sprawl.

## F. Short-Term Opportunities

Existing distributed generation and pricing policies have implications for line extensions and system expansions. There are large numbers of generators installed in schools, hospitals, factories, office buildings, hotels, grocery stores, commercial establishments, farms, and residential homes. Yet little attention has been paid to communication and pricing systems that would allow the potential benefits of these existing resources to be tapped.[33]

Line extensions and system expansions are areas ripe for near-term action. Customers rarely are required to pay for line extensions unless the expansion is both extensive and dedicated to only one

[33] See RAP's reliability IssuesLetter <http://www.rapmaine.org/Reliability.htm> for options to use distributed generation for increased reliability in the near term.

customer.[34] Very expensive additions to serve fast growing suburbs are simply folded into overall utility rates. From the perspective of the developer of a large subdivision and the customers buying homes in the subdivision, the expansion of the grid is free. If the cost for the expansion were borne by the developer and customers, development siting and distributed resources investment would be more rational.[35]

## 6. CONCLUSIONS

Our initial conclusions take into account the critical variables affecting utility profitability from distributed resources deployment: utility structure, the nature of the distributed resources, and the form of regulation. The effect of these variables on utility profitability is summarized below.

**Utility Structure:** The financial incentives favoring or discouraging distributed resources deployment are generally unaffected by corporate structure. They are affected by the relationship between a utility's cost and its price for distribution services. The worst situation for a utility is to have low distribution costs and high distribution prices.

**Location of the Distributed Resource:** The location of the distributed resource is critical. Distributed resources installed on the utility side of the meter do not jeopardize profitability. The primary and negative impact on utility profitability of distributed resources deployment occurs when these resources are installed on the customer side of the meter. This is true for both demand-side and supply-side resources. From the utilities' perspective, demand- or supply-side resources installed on the customer side of the meter produce the same effect: sales go down and as a result revenues and profits go down.

Locating distributed resources in high-cost areas has significant potential benefits. The significant distribution cost savings resulting from distributed resources located in high-cost areas can reduce utility financial losses or even add to profits if the distributed resources are deployed *only* in high-cost areas.

**Form of Regulation:** The form of regulation also matters, particularly whether the utility is subject to PBR and, more importantly, whether the PBR is price- or revenue-based. Price regulation generally discourages distributed resources. Revenue regulation does not.

**Other Regulatory Variables:** The deployment of distributed resources is affected by whether the utility has a fuel clause or similar regulatory provision; the nature of stranded cost recovery provisions, including the level of stranded costs, and stranded cost recovery

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[34] Charging customers the full marginal cost for these facilities is a small step in the direction of deaveraged prices. It is a step made practical by the small number of people affected, by the fact that the charge will be generally considered in the context of a land development decisions, and by growing public support for anti-sprawl measures.

[35] The Wall Street Journal reports that a very large subdivision (35,000 units) being built in Texas, is considering installing fuel cells in homes and businesses and tying them together with a local grid. Avoiding the cost of expanding the utility's transmission and distribution system was cited as a motive.

mechanisms (volumetric charges, exit fees, or other mechanisms that affect behavior); and whether there are balancing accounts for stranded costs.

Regulators have a number of policies available to align utility profitability with the deployment of cost-effective distributed resources. Some, such as revenue-based PBR, go directly to the heart of the problem and fix the way regulation works. Others, such as Distributed Resource Credits, Distributed Resources Development Zones, and restrictions on pricing flexibility, aim at making distributed resources profitable to utilities by trying to direct distributed resources deployment to high-cost parts of the utility's system.

Getting utility profitability aligned with the deployment of cost-effective distributed resources is an important step, but it does not guarantee success. Even if regulation is able to completely align utility profits in the deployment of distributed resources, there may be other factors that overwhelm the power of any incentives. Such diversionary factors may include rate impacts, competitive and other risks, and issues of control or the lack thereof, each of which can undermine the incentives created in a PBR.

Consider the experience that many regulators had during the mid 1990s. A number of powerful PBRs were established that encouraged utilities to invest in energy efficiency. Utilities responded and energy efficiency investment and performance increased dramatically. Then conditions in the industry changed and utility executives became preoccupied with utility restructuring, competition, and stranded cost recovery. The shift of focus to these issues substantially detracted from the effectiveness of PBRs, and notwithstanding the profitability of investment in energy efficiency, utility investment in efficiency dropped substantially.

## 7. NEXT STEPS

Based on this report, NARUC should consider follow-up research in four areas[36]:

**1) Simplified Cost Analysis**

More work needs to be done on identifying deaveraged distribution costs, quantifying distributed benefits and creating simple ways to analyze distributed resources policy options and apply them to utility planning and investment methods. To date, the work on quantifying benefits has focused on very detailed site-by-site benefit analysis. This kind of work is necessary, but the very nature of distributed resources demands that the experience being gained be translated into much simpler methods. The transaction costs of case-by-case and line-by-line analysis is a burden that the most cost-effective distributed resources could not bear.

**2) Further Development of Policy Options**

Each of the policy options described in this report warrants a separate paper that

[36]Based on a draft version of this report, NARUC has initiated several follow-up papers including one focused on rate design issues and another focused on PBRs for distribution utilities.

explores the related policy and implementation issues in more depth. For example, De-averaged Distribution Credits: How should the credits be designed? Should credits be paid on an energy or capacity basis? How soon before a planned distribution upgrade should the credits begin? What happens if too few distributed resources are installed to defer the distribution upgrade?

3) **Accommodating Distributed Resources in Wholesale Markets**
Many of the benefits of distributed resources spill over into areas regulated by FERC. For example, transmission pricing policies may be needed to assure that distributed resources receive the benefits of any transmission system savings. ISOs and power exchange policies may be needed to assure that capacity, energy, and ancillary services produced by distributed resources can be sold into the market.

4) **Related Rate Design Issues**
Rate design for distribution services can have a large effect on customer incentives to install distributed resources. A large body of rate design research exists which can be reviewed and applied to distribution utility issues.