Distributed Resources and Distribution Company Profitability
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INTRODUCTION

NARUC has asked RAP to look at how the deployment of cost-effective distributed resources might affect the profitability of regulated distribution companies and to identify how the deployment of these resources can be harmonized with the financial interest of the distribution company. This paper was prepared for RAP's Peer-to-Peer session on this topic and provides a brief overview of the issues, our preliminary conclusions, and food for thought.

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

What are distributed resources? Distributed resources include demand and supply side resources that can be deployed within the distribution system as distinguished from the transmission system (although this paper focuses mostly on distributed generation.) These resources might be installed either on the customer side or the utility side of the meter. Demand side resources can include load management or energy efficiency options. Supply side resources can include generators of any type, including photovoltaics, reciprocating engines, micro turbines, fuel cells or other types of devices.

To understand the implications distributed resources have for the distribution company, it is not necessary to define distributed resources any more narrowly. The only distinguishing characteristic for the purposes of this discussion is that these facilities are installed at the distribution level. Generally, distributed resources will be very small in size, ranging from less than 1 KW to a few hundred kWs. The practical size limit for generators located in the distribution system is in the area of 35 to 40 MW.

Why should regulators care whether these resources are used? There are three principle reasons regulators should care. The first, and most important, is that distributed resources provide an opportunity to save money. Savings may come as lower cost of energy production, reduced investment in distribution plant, reduced investment in transmission, system reliability enhancements, improved reliability for the particular customer, or a most likely combination of these factors.

Second, distributed resources provide an opportunity to reduce pollution. Even though some distributed resources such as reciprocating engines may produce more emissions than state-of-the-art combined cycled gas fired facilities, many distributed resources such as photovoltaics and fuel cells provide significant opportunities to reduce pollution. Others, such as micro turbines, provide longer term opportunities to reduce pollution through improved technologies with better heat rates and combined heat and power applications.

Third, distributed resources provide customers with more choices. In short, there is no philosophical, ideological, "small is beautiful", or other similar reason regulators should care about distributed resources. Regulators should care about distributed resources because while they can be cost effective, reduce pollution and meet customer needs, existing regulatory practices may unintentionally discourage the use of these resources.

ASSUMPTIONS

At this stage of our analysis of distributed resources and their implications for distribution utilities we have made a few assumptions. First, we assume that there are areas of particularly high distribution costs in almost every service territory throughout the country. On average the cost of a utility distribution plant in the US is about 2.5 cents per kWh. We assume that on a marginal cost basis there are high cost areas and low cost areas. High cost areas are areas where distribution lines are being installed for the first time and areas that are near exhaustion and need to be upgraded or replaced. The per kWh cost in high cost areas may be an order of magnitude higher than the average distribution cost. Our discussions with distribution companies suggest 20 cents per kWh distribution costs are not unreasonable.

Second, we assume that costs associated with the high cost areas are mostly capital costs or fixed O&M. The higher costs are due to the need to add or replace poles, wires, transformers and the like and not to higher variable operating cost (with the exception of higher line losses).

Third, we assume that if the use of distributed resources is unprofitable for the regulated utility there will be barriers to their deployment. If, on the other hand, the deployment of distributed resources is made profitable to the distribution company, barriers that currently exist are likely to be quickly overcome with the active assistance of the utility.

Finally, we consider that distributed resources cost effective to the utility when the capacity, energy, T&D and system reliability savings exceed the cost of the distributed resources. We also consider that distributed resources are cost effective to the customer when the capacity and energy savings plus the customer reliability value plus any non electricity benefits exceed the cost of the resource.

SAVING MONEY

The potential savings from distributed resources fall into a number of categories and can be viewed from the perspective of the system or the customer. The energy and capacity output of distributed generators are the most obvious benefits. From the perspective of the system, the capacity and energy output of distributed generators are generally not competitive with other sources of generation at the wholesale level. For example, the Allied Signal micro turbine produces power for about 6 cents per kWh. Although 6 cent power will be cost effective in some applications, in most utility connected markets power costs are closer to 3 or 4 cents. From the customer's perspective, the value of the electrical output of a distributed resource is measured by the retail rate that the customer can avoid paying less any new or special charges for standby, back-up, or similar services. In many high cost states distributed generating resources are cost effective as measured in this way.

If located in the right place, distributed generation can also produce savings by reducing the investment required in transmission and distribution systems. Savings depend on the location of the distributed resources (on a nearly exhausted distribution line or on the right side of a transmission constraint) and on the time the generator is run. Because distribution peaks and transmission peaks may occur at different times running a generator at one time may help the distribution system and running it at another may help the transmission system.

Savings may also come in the form of reliability savings to the system, to the customer, or both. With respect to system reliability, distributed resources come into play in three ways. First, most readers are familiar with the notion of reserve requirements. Reliability in terms of an adequate supply is achieved by making sure that the installed capacity of generating equipment exceeds the expected demand by some reasonable margin. The level of the reserves required to deliver a given level of reliability is a function of two primary considerations: size of generating unit on a utilities and the forced outage rate of those units. As a general matter, the larger the unit size and the poorer the forced outage rate, the greater level of required reserves to deliver a given level of reliability to consumers. Distributed resources because of their very small size and low forced outage rates almost always reduce the amount of reserve capacity needed to meet a given level of reliability. A system consisting of many small generators would require a much lower reserve requirement than one consisting of larger generating units. System reliability is also influenced by the capability of large transmission facilities. In this respect, distributed resources can add or detract from reliability depending on their precise location and when the resources are operated.

Another aspect of reliability is seen from the customer's perspective. Consumers can save money (in more ways than one) when distributed generation is located on their site and provides them an opportunity to continue to receive electric service when the remainder of the electric system is down for whatever reason. If a customer experiences an outage due to capacity shortages, an outage in the distribution system, or any other cause, an on-site distributed generator can restore the customer's power instantly and automatically as opposed to the reliability of the overall system.

PROFITABILITY TO WHOM

The focus of our paper is the profitability implications of the deployment of distributed resources. We use the word "deployment" instead of "investment" because the distributed resources may be installed and owned by the utility, customer, an energy service provider, or any other entity. Our focus is on the effect of deployment on utility profitability, regardless of who installs and owns the distributed resources.

We recognize that the term “utility” is somewhat vague, given the industry restructuring that has occurred and will continue to go on. For the purposes of our paper “utility” is the regulated entity which may be a wires only DISCO, a vertically integrated utility or something in between. The key thing to focus on is the regulated entity. Many regulated utilities also engage in unregulated activities, but when we look at the question of profitability in distributed resources we do not include the profits from the unregulated businesses when determining whether the deployment of the distributed resources are profitable or unprofitable. For example, consider a utility affiliate in the business of installing and selling distributed resources. If the distributed resource was not profitable to the regulated utility we expect that the affiliate would find opportunities to install distributed resources and profit from them in all parts of the country except in their own distribution service territory. Similarly, the regulated utility would create barriers to others trying to install the same types of facilities within its local service territory.

HISTORY OF PROFITABILITY ISSUES

NARUC has a long and rich history of exploring profitability issues. In the mid 1980's utility regulators around the country faced with very high marginal costs, significant environmental concerns, and the demonstrated ability of demand side resources to reduce cost and pollution began telling utilities to use least cost planning and later integrated resource planning principles to find the right mix of demand and supply side resources to minimize overall system cost. Not withstanding regulatory decisions, utility investment in demand side demand side resources remained disappointingly low. Then, in 1989 NARUC adopted its ground breaking resolution calling for regulatory reforms that would render the successful implementation of the utilities least cost plan as the most profit course of action. In the report *Profits and Progress of Least Cost Planning* regulators pointed out that traditional systems of regulation provided very powerful disincentives to utilities investment in energy efficiency. The report pointed out that as energy efficiency was deployed, whether by the utility or anyone else, utility profits dropped significantly. The report also pointed out the half dozen or more structural options that were available to regulators to amend regulatory system in its accounting principles so as to make investment in low cost energy efficiency at least as profitable as investment in more costly supply side resources.

The affects of these regulatory reforms can be fairly immediate and dramatic. Utility investment in energy efficiency went from less than 800 million dollars in 1988 to over 4 billion dollars by 1995. Experience shows that utility profitability has a profound effect on whether the “barriers” to the deployment of low cost resources are present and how fast they are removed.

KEY DISTRIBUTED RESOURCE FACTORS

A number of factors relating to distributed resources will influence whether deployment of distributed resources is profitable to utilities. The main factors are:

whether the distributed resource is on the utility’s side as opposed to the customer’s side of the meter;

whether distributed resources are owned or not owned by a utility, and
whether its distributed resource delivers electricity or one that delivers electric plus other useful consumer benefits such as heat, hot water, air conditioning, etc.

KEY UTILITY FACTORS

Key factors that are likely to determine whether or not the deployment of distributed resources are cost effective to utilities generally spring from whether it interrupts a flow of revenue to the utility and whether it reduces a cost for the utility. Specific factors include:

the cost and prices for the utility (the worst situation is a utility that has low distribution costs and high distribution prices).
whether the distributed resources are owned by the utility
whether the utility is vertically integrated
whether the utility has divested itself of generation but is otherwise remains in the retailing merchant function business
whether the utility is wires only and is not engaged in the retailing business
whether the utility is engaged in related competitive businesses inside or outside of its service territory.

KEY REGULATORY FACTORS

They key regulatory factors include:

whether the utility is subject to cost-of-service as opposed to performance based regulation
the type of performance based regulation
whether or not the utility has fuel clause or anything like it
the nature of stranded cost recovery provisions, including the level of stranded cost, how the stranded costs are recovered, whether on a volume metric, whether there are exist fees or other types of provisions for stranded cost recovery, and
whether there are balancing accounts in particular for stranded costs

REGULATION TODAY

By far, the predominant form of regulation currently in use in the US is price regulation. Notwithstanding the fact that rate cases involve detailed examinations of costs, rate base, rate of return, and revenues, once a rate case is concluded the only matter of consequence is the fact that prices have been set. Once prices are set the utility's actual revenues are dictated entirely by sales. Revenues equal price times sales. If sales go up, revenues go up and vice versa.

Since profits are the difference between revenues and cost it is also important to know what happens to costs. Again, costs that were examined in a rate case are totally irrelevant once the case has ended. The only costs that matter to utility profitability are the costs the utility actually incurs. With respect to transmission and distribution costs, we know that these costs are fixed; they neither increase nor decrease with varying levels of sales.

Profits, which are the difference between revenues and costs, are at risk whenever an activity reduces revenue without reducing costs by an equal or greater amount. Distributed resources located on the customer side of the meter result in revenue losses. They will be profitable to a distribution company if, and only if, the deployment of the distributed resource on the customer side of the meter also reduces utility cost. For the most part, the deployment of these resources on the customer side of the meter will have little or no impact on the utility's transmission and distribution costs, the exception would be in congested areas—an issue which we describe more fully below.

REGULATORY REFORM OPTIONS

There are a number of regulatory options available to try to align utilities' profit motive with the deployment of distributed resources.

1. Performance based regulation - Price caps vs. Revenue caps

A number of states have experimented over the years with performance based regulation (PBR). While performance based regulation can take many forms, the predominant structural feature that distinguishes one class of PBR's from another is whether it is price or revenue based. Performance based regulation 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 (sometime fixed revenues per customer), either of way may be adjusted by a predetermined formula. Price based approaches make distributed resources deployed on the customer side of the meter very unattractive to utilities, as every lost kWh sale is a loss of revenue. Revenue based approaches make utilities indifferent to customer side distributed resources.

2. Targeted incentives for distributed resources

PBRs can be designed to have targeted incentives for the deployment of distributed resources. 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. If a utility can demonstrate that it has reduced its distribution cost by installing distributed generation or targeted demand side investments, regulators could allow the utility to keep some fraction of the savings as a reward mechanism. Targeted incentives of this nature worked successfully for demand side options in the past.

4. Price reforms

One of the reasons that utility profitability does not align well with the deployment of distributed resources is because the prices charged for the services displaced by distributed resources do not reflect the cost of those services. If all utility prices where exactly reflective of marginal costs, the deployment of distributed resources would have a very different impact on utility profits. For example, recall that average distribution rates are about 2.5 cents per kWh and that in high cost areas distribution rates are as high as 20 cents 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 impossible for the compelling practical and political reason that such de-averaging it is a keystone of universal service..

De-averaged buy-back rates are a practical alternative that achieves most of the same economic price signals without the unacceptable policy approach of de-averaging all distribution prices. Geographically de-averaged buy back rates means the utility stands ready to but back power (or power savings). The amount of power they offer to buy will be limited and the prices will vary by location of the power supply. The prices paid for buy backs would be high for customers that are located in high cost areas and low for customers located elsewhere. For example, customers in an area with 20 cent distribution costs might be offered a 15 cent buy back rate. This would certainly produce a strong economic incentive for customers and others to invest in distributed generation in the right location. Because the company paid 15 cents instead of the 20 cent cost it would have incurred in upgrading the facilities there is an opportunity for savings to be shared with the utility.

5. Pricing flexibility

A number of utilities have asked and received "pricing flexibility" to discourage individual customers from installing distributed generation. This is very similar to a pricing practice that was fairly wide spread a few years ago referred to as "co-generation deferral rates". In both cases, utilities argue that the distributed generating facility is not actually cost effective when compared to the utility's own marginal cost of supply, and that the co-generation (or in this case distributed generation) appears cost effective to the customer because retail prices are well above the utility's actual marginal cost. In these cases utilities have asked for flexibility to lower prices to the point that would discourage customers from installing non-cost effective on-site generating options. We expect that many states will be inclined to approve these pricing practices, in part because the revenue loss that occurs when customers self generate will (or may) be borne by other customers.

One option for regulators is to allow pricing flexibility for low cost areas along the lines just described, but only if an utility simultaneously increases the prices (perhaps through de-averaged buy back rates) for high cost areas. It does not make sense to have a utility actively discouraging the installation of distributed generation in low cost areas if it is not simultaneously encouraging distributed generation in areas where costs are clearly above retail prices.

6. Stranded cost balancing accounts

How stranded costs are recovered play a role in 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.

The details also matter from the utilities' perspective. Most states collect stranded cost on a per kWh charge. In some states the stranded cost charge is fixed and can be imposed for a stated period of time. Lost sales in these states due to customer side distributed resources or any other reason reduce the utility's stranded cost recovery. 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 utilities disincentive to the deployment of distributed resources.

MATCHING COSTS AND BENEFITS

One of the most challenging problems stems from the fact that distributed resources produce benefits that typically flow to more than one entity, e.g., customer and utility. This produces a split incentive where no single entity sees all the benefits from distributed resources. As a result, no one entity is in the position to conduct a comprehensive cost benefit analysis. The following table illustrates the range of benefits and the individual's or entity's who see the benefit.

Matching Costs and Benefits	
Type of Benefit	**Who Sees Benefit**
Capacity and energy	Anyone
Reliability	Mostly customer, but also the system
Environmental	Public except for private values such as credits
Heat and other useful outputs	Customer
Distribution	Mostly utility, but can move to customer with pricing

Utilities are generally able to take advantage of most, but not all of the benefits of distributed resources. In particular, utilities can directly or indirectly benefit from capacity and energy value of the electricity, the system reliability improvements, and distribution cost savings. They may be able to take advantage of transmission benefits but they are unlikely to realize the benefits of customer reliability or the non-electric benefits provided by co-generation or efficiency.

INITIAL PROFITABILITY CONCLUSIONS

Our initial conclusions take into account the primary variables: utility structure, nature of the distributed resources, and the form of regulation. With respect to utility structure, it appears that the structure of the utility is not a critical factor. At one extreme the utility may be a wires only disco and at the other extreme it may be a vertically integrated monopoly. In any case, our basic conclusion is the same.

The nature of the distributed resources matters a great deal. Distributed resources installed on the utility side of the meter do not jeopardize profitability. The primary, and perhaps only, negative impact on utility profitability of deployment of distributed resources occurs when distributed resources are installed on the customer side of the meter. This is true whether it is a demand side or supply side type of resource. From the utilities' perspective, demand or supply side resources installed on the customer side of the meters have the same effect, sales go down and revenues go down.

The form of regulation also matters a great deal. The most important variable is whether the utility is subject to PBR and more important whether the PBR price or revenue based. Price regulation generally discourages distributed resources and revenue regulation does not.

The effect of utility ownership of distributed resources on profitability is a complex issue which is made even more confusing by the commonly held and erroneous view that adding to rate base (investing in capital, "gold plating") improves profitability. There are a few simple economic concepts that inform us on this issue. First, profitability (as distinguished from profits) improves when the rate of return, or earning per share go up. Adding $1 million to profits doesn't help if the associated costs mean the rate of return dropped from 10% to 9%. It follows that profitability goes up 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 grow revenues without growing costs.

Apply this to a situation where distributed resources are located on the utility side of the meter and hence revenues are unaffected. In this case, investment in cost effective distributed resources can substitute for even higher levels of investment in distribution plant. Less investment with the same level of revenues means higher profits. It also follows that if another entity built and owned the distributed resources, the utility would see the same revenues and would have no investment. This logic suggests that the most profitable course of action **when revenues are unaffected** is to have someone else own the distributed resources. The next most profitable option is utility ownership where it is less costly than investment in distribution plant. The least profitable option is invest in poles and wires even though less investment in distributed resources would do the job.

If the distributed resources are on the customer side of the meter, revenues are affected. In this case, ownership will not influence the outcome for the utility by much. As a general matter, any benefits of utility ownership of resources installed on the customer side of the meter are outweighed by the revenue losses to the utility.

Although ownership of the distributed resources may not matter much, control of the distributed resource (when they run) matters quite a bit. When a generator runs (or when load management opportunities are triggered) will dictate whether transmission and distribution costs are incurred or whether transmission and distribution investment can be deferred.

LIMITATION OF PROFITABILITY

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 1990's. A number of powerful PBR's 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 utility focus to these issues substantially detracted from the effectiveness of PBR's and notwithstanding the profitability of investment in energy efficiency, utility investment in efficiency dropped substantially.

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