Distributed Resource Distribution Credit Pilot Programs: Revealing The Value To Consumers And Vendors

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PREFACE

This paper is one of a series published by the Regulatory Assistance Project on Distributed Resource Policies for state and federal regulators. The reader is encouraged to read the others in this series which can found at RAP's website: www.raponline.org

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I. THE PURPOSE

The purpose of this paper is to describe implementation options for two concepts: deaveraged distribution credits and distributed resource development zones. The concepts are closely related, and both were first described in *Profits and Progress Though Distributed Resources* (NARUC, February 2000). We believe that developing workable programs implementing these policies can dramatically increase the deployment of distributed resources in ways that benefit distributed resource vendors, users, and distribution utilities.

Distributed resources, small scale generation and efficiency resources, can provide energy, capacity, transmission, and distribution value. If all of these values could be tapped by distributed resource vendors or users, the lights would not have dimmed in California and consumer costs would be lower. The overarching problem is that vendors and users determine the “value” of distributed resources by comparing their costs to retail electricity prices and those prices rarely bear a resemblance to actual marginal costs.

Although competition was supposed to open markets and opportunities for distributed resources, from the perspective of distributed resources, restructuring the power sector has been more like power sector destructuring. Breaking the industry into separate entities subject to different jurisdictions has made it harder for distributed resource vendors and users to the see the full value of distributed resources. Capacity and energy issues are worked out in the wholesale markets, PXs, ISOs, and the FERC. These markets do not want to be bothered with the needs of tiny generators. Transmission issues are further complicated with ISOs, RTOs, transmission owners, and uncertain FERC policy and jurisdiction. Amid the confusion, attention tends to be focused on large power and transmission projects rather than on the value offered by thousands, and perhaps millions, of distributed resources.

There is, however, some good news for distributed resources. First, distribution issues rest with the distribution utility and state regulators, and state utility regulators have been much more willing to remove barriers to the use of distributed resources. Second, in many locations the distribution value is so high that implementing the policies described in this paper may be enough to allow distributed resources to gain widespread use.

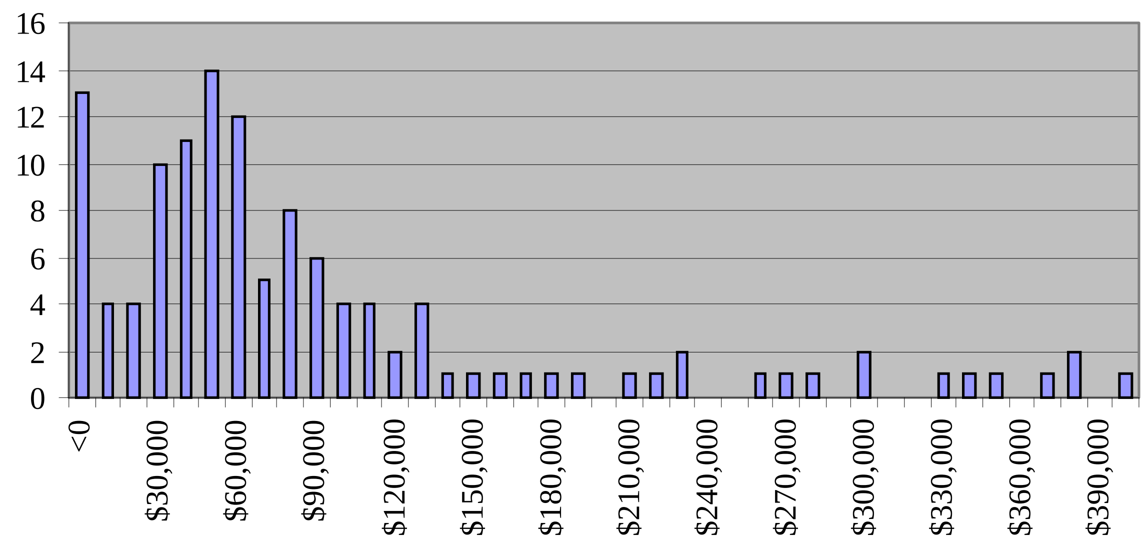
II. BACKGROUND

There are many reasons regulators care about distributed resources. High on the list are saving money, improving reliability, meeting customer needs, and improving the environment. There are many more cost-effective opportunities for distributed resource deployment than revealed by current pricing and cost recovery policies. Two important impediments are now well known: widespread deployment of distributed resources cuts distribution utility sales and puts profits at risk, and the high cost of strained distribution systems is not seen by consumers or vendors of distributed resources.

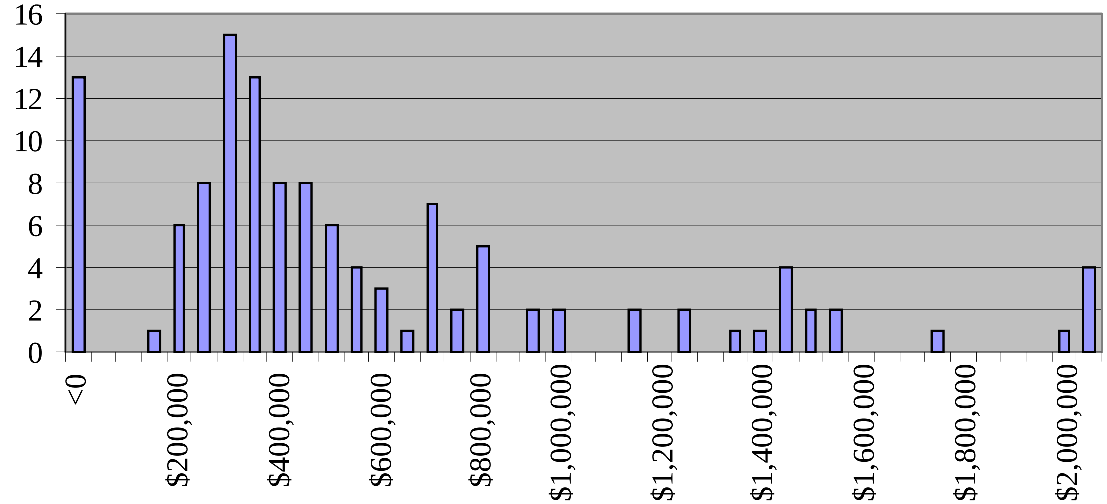
Average distribution rates are about 2.5¢ per kWh, but marginal distribution costs vary substantially from one place to another and from one time to another. Marginal distribution system costs range from zero to substantially more than 20¢ per kWh.

Figures 1 and 2, taken from *Distribution System Cost Methodologies for Distributed Generation (RAP 2001)*, a companion to this report in the RAP DR Series. These figures show the average marginal cost of transformers and substations and lines and feeders, respectively, for 124 utilities. On a company-wide basis, the marginal costs are high and variable. For the entire group of 124 utilities, the average marginal costs for transformers, substations, lines, and feeders exceeds $700 per kw.

Distribution of Growth in Transformers & Substation Plant Investment Per MW Growth in System Peak (1995-1999)



Distribution of Growth in Lines & Feeders Investment
Per Growth in System Peak
(1995-1999)



One of the main conclusions of *Profits and Progress Through Distributed Resources* is that deploying distributed resources only, or primarily, in high cost areas would be a win-win situation for consumers and distribution utilities. The challenge is to develop policies to concentrate the use of distributed resources in high-cost areas. De-averaged distribution credits and distributed resource development zones meet this challenge.

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 20¢ or more in areas with constrained distribution facilities. De-averaged marginal cost prices would send the “right” price signals to consumers and would ensure that distributed resources would be installed precisely when and where they make the most sense. De-averaging prices along these lines, however, is unlikely and undesirable for compelling practical and political reasons.

Assuming regulators do not de-average distribution prices, state regulators, especially regulators trying to create competitive markets wherever possible, will confront a regulatory dilemma that a de-averaged credit scheme could solve. On the one hand, distributed resources seem ideally suited to be delivered in a competitive fashion. They represent the antithesis of economies of scale. Distributed resources may be the ultimate form of retail competition because they can be used by consumers with or without industry restructuring.

On the other hand, if distribution prices are not de-averaged, monopoly distribution utilities will have an unbeatable competitive advantage. Distribution system savings are key drivers of distributed resource economics, and distribution utilities are the only entities that know where the high-cost distribution areas are. With de-averaged distribution prices, all distributed resource vendors and users would see the value of distributed resources, and a vibrant competitive distributed resource market would develop. Without de-averaged distribution prices, distribution utilities are the only entities positioned to “see” the distribution value of distributed resource deployment. (They “see” the value in the form of distribution cost savings.) Thus, states that wish to encourage competitive delivery of distributed resource are compelled to either 1) de-average distribution prices - unlikely for a long list of reasons, 2) prohibit distribution utilities from owning distributed resources - also unlikely, plus it levels the field at the cost of eliminating all suppliers, or 3) adopt de-averaged distribution credits - a low-cost, low-risk strategy that might yield large benefits!

De-averaged distribution credits and distributed resource development zones are practical alternatives 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 amount of the credit 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 grow to make construction of new distribution lines unavoidable.

The amount of the credits should, at most, equal the value (savings) derived from deferring or avoiding 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. For example, customers in an area with 20¢ distribution costs might be offered a 15¢ credit. 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.

The term “de-averaged credits” is being used as shorthand for a family of related policy options that provide cost-effective economic incentives to concentrate distributed resources in high cost areas. Distributed resource development zones, for example, would designate geographic areas and set a standard credit for all qualifying distributed resources that locate in the area. One could use a Distribution Value Bidding scheme to invite competitive proposals from distributed resource vendors. The amount of the credit requested in the bids would be one of the criteria used to select winning distributed resources.

III. OVERARCHING CONCEPTS

Regardless of the specific credit approach taken, regulators and distribution utilities need to know more about the underlying distribution costs and distributed resources need to be considered in the aggregate, not on an individual basis. Now is the time to begin learning from pilot programs.

A. Regulators and distribution utilities need to know more about the underlying distribution costs.

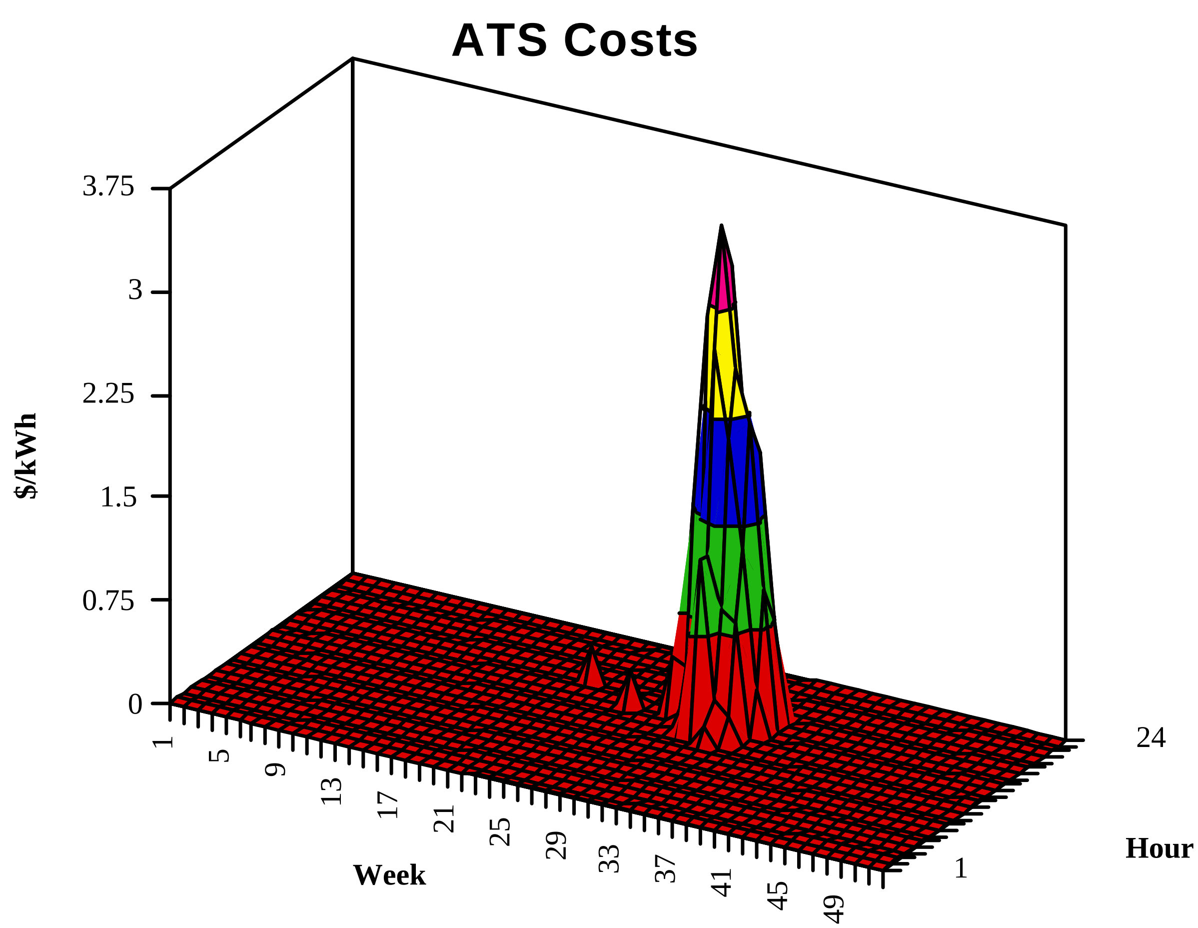
Every regulator has a good working knowledge of the cost of power from existing and new power plants. Increased attention to distributed resources in recent years means that regulators also probably have a reasonable sense of the cost of these resources. But the cost of upgrading and expanding distribution plants is not well known. Yet if distributed resources can serve as a substitute for distribution investment, it is important to have some simple way to compare costs.

As shown in Figure 3, distribution costs can be thought of as mountain of cash waiting to be mined by distributed resources. Concentrating distributed resources in these mountainous areas means there are large saving to be realized. These savings can essentially be shared by the distribution utility, the consumer, and the distributed resources vendor.

The first task is to determine where and when the distribution system experiences high costs in order to focus the distributed resource program on the right geographic areas and at the right time.

The value of distributed resources is determined by the answers to two questions: 1) what are the distribution marginal costs and 2) how will the aggregate performance of distributed resources lower or defer the costs? Two other reports focus of these questions. The first is *Costing Methodology for Electric Distribution System Planning, November 9, 2000*, and the second is a companion to this report entitled *Distribution System Cost Methodologies For Distributed Generation (RAP, 2001).*

Figure 3



B. Distributed resources need to be considered in the aggregate, not on an individual basis.

While distributed resources can be relatively large, say 30 MW or more, the difficult task, and hence the focus of this paper, is to develop policies that work for the smallest units, those below about 100 kW. At this size, the transaction cost of site-by-site, unit-by-unit consideration is high enough to kill even the most cost-effective installation. Unless we begin to approach these units the same way we have historically approached similarly sized customer loads, the potential of a distributed resource industry will never be realized.

Distributed resources need to be treated the same way we treat customer loads, in which broad aggregate customer uses are treated the same. Rate design, rate levels, and other tariff provisions are not considered on a customer by customer basis.

Thus, when we determine that a particular substation is or will soon be overloaded, it is not due to the load of any one customer; it is due to the aggregate load characteristics of a large group of customers.

Our ability and willingness to treat different customers differently is limited to the use of sophisticated time-of-use prices. With flat kWh prices, two customers that consume 1000 kWh per month pay the same bill even if one uses power on-peak and the other uses power off-peak. With more sophisticated time-of-use prices, customers that use more power during peak period pay more than customers that use less power on peak, even though the same prices apply to both. The decision to use flat or time-of-use prices is made based on the size of the customers, the cost-effectiveness of the added investment in meters, customer acceptance, and fairness.

Some Simple and Immediate Steps

Digging deep into distribution system costs can seem like a daunting and time consuming task. Fortunately, there are several simpler first steps that regulators can take immediately. First, require the distribution utility to file and periodically update a list of all major (more than $1 million) distribution upgrades. These are the areas that are most likely to have the highest cost areas. For each area, the distribution utility should state what load reduction would allow the planned upgrades to be avoided or delayed. These are the load reductions that distributed resource vendors and users should be given an opportunity to serve.

Second, require the distribution utility to file and periodically update a list of the areas (by substation and feeder) that have the worst reliability record (in terms of outages). These may or may not be the same areas scheduled for distribution upgrades. If they are not areas scheduled to be upgraded they may be candidates for distributed resources that can improve reliability.

Regulators in New South Wales in Australia have recently adopted rules along these lines. See *http://www.energy.nsw.gov.au /industry_performance/networks/ Recognised%20DM%20Code%20May%2001.pdf*

This is the same way we need to treat distributed resources. Small distributed resources prices or credits need to be considered on the basis of their aggregate performance or value.

It Helps To Consider How We Treat Loads

A typical electric water heater has a peak load of 4 kW. It is either on or off. It is not under the direct control of the utility or the customer. It turns on and off when it wants to.

From the perspective of the distribution utility, the water heater turning on looks like a 4 kW generator turning off and vice versa. One could say that an electric water heater has almost all of the electrical characteristics of a very bad 4 kW distributed generator that runs only at full load or zero and turns on and off intermittently.

While the operating characteristics of any one water heater is difficult to predict, the operation of all water heaters as a group is very easy to reliably predict. As a result, regulators have become very experienced at determining the cost the water heater imposes on the distribution system.

Imagine how many water heaters would be sold if each water heater had to be studied, separately metered, and had an individual rate determined for it before it was connected. No doubt the studies would show that houses with teenage children use more hot water than houses with no children. Perhaps there would be calls for child meters. Fortunately, the issue is handled in a much more practical way.

Regulators need to consider distributed resources using the very same approaches and techniques we use for water heaters.

The smallest residential scale distributed resources would not be separately metered, and their value would be determined using the same kind of aggregate load research data used to set prices now for this customer class. An average residential customer may have a peak load of 10kw and a diversified load of 3 or 4 kW. Adding a small fuel cell, PV unit, or a controlled water heater may lower the average peak load to 8 KW and the average diversified load to 2 or 3 kW. The value of these very small units should be determined in this broad aggregate manner.

The same principles apply for larger distributed resources of 10 kW to 100 kW that may be in commercial settings. The primary difference is that these customers are more likely to be metered on a TOU basis, which means the value of their distributed resources will also differ depending on when their units operate.[1]

C. Now is the time to begin learning from pilot programs.

Using distributed resources to avoid or defer distribution investment has solid theoretical and intellectual basis but very little practical experience. What is needed now are a variety of pilot programs aimed at documenting the extent to which distributed resources can defer or avoid investment while meeting customer needs in a safe and environmentally acceptable manner. Pilot programs by their very nature are experiments and need to be carefully designed to learn valuable information.

[1]The timing of the distribution peak may differ from the timing of the system peak. These timing differences need to be taken into account and perhaps reflected in the TOU prices.

IV. THREE STEPS TO A DISTRIBUTED RESOURCE CREDIT PILOT

A. Step one: Identify high cost areas.

Clearly the first step is to examine capital investment plans and identify parts of the distribution system that could most likely benefit from the deployment of distributed resources. The earlier the areas can be identified the better. Creating and implementing a pilot program will take some time, so at first it is better to look for areas that will require investment in the next 24 to 36 months rather than areas that need investment in the next 30 to 90 days.

It makes sense to select pilot areas that are typical rather than areas that have some unique characteristic. The purpose of the pilots should be to gain experience before expanding the program to full scale use. This is best achieved by conducting the pilots in areas that are similar to the conditions that generally prevail.

As a general matter, the credits that could be made available should be capped at the cost savings that the distributed resources can produce. Three considerations, however, argue against delaying pilot programs while the distribution cost savings estimations are refined and improved.

First, estimating distribution cost savings is an evolving science. It may be years before a consensus is reached on the precise level of savings. In the meantime, very significant distribution investment is being made, and much of this investment could be wasted because cost-effective distributed resource alternatives are not being actively pursued.

Second, by definition pilot programs are learning experiences. The pilot being cost-effective is less important than the pilot leading to cost-effective full scale programs. Possible losses resulting from using too high a distributed resource credit will be limited by the limited nature of a pilot program. Also, the possible losses are offset by the educational value of a pilot program.

Third, the credit pilots we suggest initiating use standard offer credits or competitive bidding. In either case, the level of the credit is likely to be less than the maximum credit possible. If standard offers are made, the credits could be lower for some distributed resource technologies than others. Similarly, if competitive bidding is used, the credit needed for some technologies will be less than the credit needed for other technologies. With either approach, the average credit is likely to be substantially less than the highest credit that could be justified.

B. Step two: Address design issues.

Designing a de-averaged credit, market-based pilot program requires consideration of a number of important practical questions. For most issues there is not a single right or wrong answer. The best way to proceed is to ask the distribution utility and the interested distributed resource vendors and users to collaborate on pilot program design. The top six issue areas that need to be considered are described below.

1. Type of distributed resources that can qualify.

Not all distributed resources are created equal. The utility and regulators need to decide which distributed resources can participate in a credit program. For example, the most common distributed resource today is an internal combustion (gasoline or diesel) engine connected to a generator. Environmentally, many of these types of units are very bad, yet because of their small size and historically very limited hours of operation they currently require no environmental permits.

It would be short-sighted to design and implement a distributed resource credit program if the result was to substantially increase the use of these types of distributed resources. It would not only be bad for the environment, but it would probably hasten new environmental regulations that could undermine the value of the units to the utility and to the customer. A more prudent course would be to designate a class of qualifying distributed resources that would be eligible for the program and exclude distributed resources that may cause environmental or other problems. Another option is to provide for graduated payments with higher payments to clean resources on the basis that these resources are more likely to result in the desired cost savings.

Qualifying resources should also include demand- and supply-side options. Some demand-side options, mostly load management options, will be easy to incorporate. Indeed, many utilities already have credit approaches that offer customers a payment or reduced electricity price if they agree to have part of their load under direct control. Detroit Edison’s controlled water heater program is a good example. These programs, however, have generally been designed with an eye toward reducing system peak energy and capacity costs rather than avoiding or deferring upgrades to the distribution plant. Changing the focus to distribution cost savings means that the loads may have to be curtailed during the distribution peak instead of the system peak.

2.Operating and performance standards.

Referring again to the “mountain” of potential cost-of-service savings shown in Figure 3, it is clear that distributed resources can save money if they either generate power or reduce demand during the high cost periods. Thus, the terms of a de-averaged credit program should specify that the credit is tied to the distributed resource’s ability to deliver its value during the hours that the substation or feeder is at or near peak load.

Several approaches can be taken depending on the size and nature of the distributed resource. For the smallest units that are not directly under the user’s control, such as PV, wind, CHP units, or units that are designed to run whenever available, this requirement should be determined in an aggregate, probabilistic manner. Some combination of load studies, manufacturer’s availability data, and warranty information can be used to estimate the likely contribution during peak periods. If, for example, only 60% of the installed generation is likely to be on-line during the peak periods, the credits paid to this class of facilities would be discounted. Special metering and individually determined credits could be options but they should not be required.

For small units that are directly under the user's control such as back-up generators, it may be necessary to require some type of metering to show that the unit operated.

For larger units installed on the premises of customers who are likely to have more sophisticated metering, credits could be paid on a metered time-of-use basis. This would result in higher credits paid to the distributed resources that are operating more when needed.

Also, many distributed resources are capable of being in direct two way communication with the utility. Microturbines, fuel cells, and radio-controlled loads can all be placed under direct utility control or at least can be monitored by the utility in real-time. This provides the best opportunity to manage the distributed resources to reduce distribution costs, and distributed resources with this type of capability should receive the highest possible credit.

3. Installation time, milestones, and minimum/maximum amount of response.

Distributed resources can save money by avoiding or deferring distribution upgrades **IF** enough distributed resources are in place in time to avoid conventional upgrades. Conventional distribution system upgrades are planned and installed in a fairly short time period; one to three years is common.

This has several implications for a de-averaged credit program. First, it means the utility should have a well developed distributed resource credit program prepared, approved by regulators, and ready to deploy in a given area as soon as it appears an upgrade will be needed.

Second, deploying distributed resources will take some time. How the market reacts to a credit program will only be known with certainty after the programs have been in use for some time. We believe, however, that the most likely scenario is that distributed resource vendors, rather than retail customers, will be the main users of the credit program. Once the availability and size of credits are known, vendors will begin the job of marketing their goods and services to end users. The credit will allow a distributed resource vendor to discount equipment and reach agreements quickly with end use consumers.

Third, there may be some minimum amount of distributed resources that must be made available before distribution savings can be realized. It seems reasonable that a de-averaged credit program would state the minimum amount of distributed resources that must apply and qualify for the credits before any credits are paid. To protect against the situation of sufficient distributed resources signing up for the credits but then not materializing, a reasonable set of milestones could also be established. If a project fails, another should be allowed to step into its place.

To avoid paying for more distributed resources than are needed, the program could also state the maximum amount of distributed resources that will receive the credits.

4. Duration of distributed resources performance.

In some cases, the value of distributed resources will be the ability to postpone distribution upgrades for a few years. In this situation, the persistence of the distributed resources should not be much of an issue. In other cases, the value may be in a more permanent substitution for distribution investment. This results in the long term reliability of the distributed resources being more important.

There are at least two approaches to matching the performance of the distributed resources to the needs of the distribution system: contractual requirements and payment terms. Contract, including standard contracts for small units, could specify performance requirements including long-term availability. Failure to meet the requirements could result in reduced or lowered payments or, if needed, fines and penalties.

For larger units with time-of-use metering, long-term availability can probably best be addressed through credit payments. Credits are paid on the basis of measured performance relative to the needs of the distribution system. For example, if the distribution system experiences its peak loads on weekday afternoons during the summer, payments could be made based on the measured performance of individual distributed resources during these designated periods. If the credits were based on three years worth of deferrals, the performance-based payments should be spread out over the entire three year period. If the credit payments have been in the form of large up front payments, the contract may provide for repayment of excess payments if the distributed resource ceases operation.

5. Standard Contract

To reduce transaction costs, it makes sense to have a simple, standard contract setting forth the duties and responsibilities of all parties. Having a standard contract also provides an opportunity for regulatory oversight and input from vendors and users into important contract terms.

Experience with small scale wind and interconnected PV facilities and net metered facilities provides substantial experience on reasonable and unreasonable contracts. Contract terms covering metering and insurance can be made too onerous to be successful.

6. Bidding or standard payments.

Credits could be paid on the basis of fixed preset credits, such as $/kW/year, for qualifying distributed resources. The fixed credits could be the same for all types of distributed resources, or they could differ for different classes of distributed resources. Higher credits for cleaner distributed resources or distributed resources using CHP would be one way to encourage these types of facilities.

The level of the payments could range from very low up to the estimated value of the distributed resources. The credits could also be the same in all designated areas or they could differ based on the relative need for distributed resources and the potential distributed resource cost savings. Offering different levels of credits in different locations (which is probably justified by differing distribution cost savings) would help create a supply curve for distributed resources.

Alternatively, payments could be made on the basis of competitive bids with the winning bids being the distributed resources requesting the lowest credits. This approach has the appeal of offering the most value to consumers, but it also may have the highest transaction and administrative costs.

C. Step three: Develop a monitoring and evaluation plan.

The purpose of pilot programs is to gather experience and information needed before policies are implemented on a broad scale. Pilot de-averaged credit programs are especially useful in answering questions in a number of areas.

1. Distribution plant performance.

How does the operation of the distributed resources affect substation and feeder loadings? How is distribution affected during high load periods? During low load periods? Are there any unanticipated affects on the distribution plant? Would direct control of the distributed resources by the utility add any value?

2. Distributed resource performance.

How well do distributed resources perform individually and in the aggregate? How many distributed resources does it take before aggregate performance is reliably predictable? How do distributed resources perform over time? Does the method of payment affect performance? How do different technologies perform? How well has distributed resource operation matched the needs of the distribution equipment? What types of distributed resources are able to be dispatched by the utility?

3. Distributed resource supply curve.

What is the relationship between the quantity of distributed resources and the level of the credits? Can supply curves for distributed resources be constructed? Can they distinguish between distributed resource technologies?

4. Distributed resource response time.

How long does it take from the time the need for distributed resources is determined to the time distributed resources can be installed? How does the response time vary with the credit approach taken (bidding versus standard offer)? How does the response time differ for different types of distributed resources? How does the response time differ based on varying levels of credit?

5. Service quality and outage performance.

Have the distributed resources had a discernable effect on outages, frequency, restoration times, or power quality?

6. Environmental performance.

What are the emission characteristics of the distributed resources? Did the operation of the distributed resources raise environmental concerns for local residents or local environmental agencies? Was there any relationship between the level of the credit and the type of distributed resources deployed?

7. Distributed resource vendor and user feedback.

What problems did the pilot pose to distributed resource vendors and users? What suggestions were received to improve the program? Did the siting and operation of distributed resources cause local noise, pollution, or other complaints? Did the distributed resource provide any other benefit to the user such as power quality, back-up service, heating, cooling, or motor drive?

8. Customer profiles.

What types of customers installed distributed resources? What types of customers were able to use CHP distributed resources? What kind of customer allowed the utility to dispatch the distributed resource?

9. Tracking cost savings and credit payments.

Have the estimated savings been achieved? At what cost to the utility? At what cost to the customer?

V. QUESTIONS/PROBLEMS

The de-averaged credit approach offers a practical way to give reasonable price signals to vendors and users of distributed resources. Still, there are a number of potential issues that may not be resolved until we have some practical experience. The questions include:

A. Do de-averaged credits get around the problems of de-averaged prices?

We do not believe that deaveraging distribution prices and fully reflecting locational marginal costs in consumer prices is a practical option. Prices for some customers would increase radically and decrease to nearly zero for others. Prices would also be very different from one neighborhood to another. Given the public's appetite for stable prices, price deaveraging is not feasible.

We believe de-averaged credits could give distributed resource vendors and users the same economic signal but without the wide scale disruption and public reaction of changing prices. We believe the credit scheme would be much more acceptable to the public for several reasons. First, the credit scheme would be more visible to vendors than consumers. Most consumers would not even be aware of the program, and if they were aware of the program, it would have no effect on their monthly bill. With de-averaged prices, every customer in the area would be notified of the their status in the most direct way possible - a large rate increase. Second, a high credit in one area and no credit in another area can be explained as an alternative, lower-cost option to adding new poles and wires. Consumers are probably already aware that some areas are receiving new distribution investment and others are not. All consumers benefit by using the credit approach rather than investing in more costly conventional construction.

Whether the de-averaged credit approach is accepted by the public will not be known with certainty until utilities begin to experiment with the approach.

B. Do the de-averaged credit approaches work in areas of greenfield construction or are they limited to areas in need of upgrades?

New distribution equipment is expensive, and the need for adding new equipment distinguishes high cost areas from low cost areas. There are two general types of high cost distribution areas: existing parts of the system that need upgrading, and new greenfield sites, subdivisions, and line extensions where new distribution equipment must be installed for the first time.

Most of the description of a credit program is in the context of existing distribution areas in need of upgrading. Nevertheless, a credit program may also be useful in greenfield situations. The fact that distributed resources are cost-effective substitutes for long line extensions is well known. Many studies have shown that PV and energy efficiency is cost-effective compared to residential line extensions as short as 1/4 mile. As regulators and distribution utilities have eliminated subsidies for line extensions, PUCs have adopted rules requiring the customer to receive full information before committing to a line extension. Some utilities also offer remote consumers stand alone electric service based on PV or other distributed resources. More recent and more surprising are the studies showing it is already cost-effective to serve new subdivisions using a combination of distributed resources.[2]

C. What if after x years the conventional upgrade is done and the distributed resources are no longer needed?

In some situations, distributed resources may defer rather than eliminate the need for distribution system upgrades. The "growth spurts" of distribution plants mean that, once completed, the marginal cost of distribution drops to zero. Assuming that the credit correctly reflected the value of the deferral, the payments would cease after the deferral period. The distributed resources installed would decide to operate or not operate based on the remaining (non-distribution related) economics.

[2]See " Why are Central Station Generation and T & D Power Systems being Challenged?" Murray Davis DTE Energy Technologies, IEEE Power Engineering Society, 2000 Summer Meeting, July 16-20, 2000, Seattle, Washington

VI. CONCLUSION

Designing and implementing distributed resource distribution credit-based pilot programs is a low-cost, low-risk opportunity to see how distributed resources can help defer or avoid costly distribution upgrades. Distribution utilities, distributed resource vendors and users, and other stakeholders should work together to design and run pilot programs to gain knowledge and experience in this area.