

The Regulatory Environment for Small, Independent Micro-grid Companies

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New technology, including low cost solid-state electronic sensors, control systems and power electronics, as well as cost-effective distributed co-generation technology, holds the potential to open new commercial opportunities for micro-grids that would operate on a small-scale underneath traditional regulated distribution utilities. Several electric equipment manufacturers, including ABB and GE, are actively developing these technologies¹ and various research organizations such as the Department of Energy, the National Science Foundation, the Office of Naval Research, and the Electricity Innovation Institute (E2I) are exploring their potential.

In principle, these technologies would make it possible for commercial, co-op and other entities to develop micro-grids in an unregulated competitive market that operated underneath traditional regulated distribution systems. In much the same way that the FCC's 1968 Carterphone decision unleashed a flurry of customer-side innovation, such a development could result in a wide range of new products and services, especially for customers with special electric power needs such as high reliability, high power quality, or large amounts of DC power for electronic systems or customers who want to achieve high end-use energy efficiency through the use of combined heat and power.

What is the regulatory environment that would be faced by non-utility parties that might wish to develop and run small micro-grids that contain distributed generation? In the spring of 2002, this question was explored with a survey administered to eight current and former state utility regulators who serve on the EPRI Advisory Board. Respondents in this study were Bob Anderson (Montana), Susan Clark (Florida), Michael Dworkin (Vermont), Edward Garvey (Minnesota), Richard Hemstad (Washington), Greg Rislov (South Dakota), James Sullivan (Alabama) and David Ziegner (Indiana). The survey outlined several different business models under which a small micro-grid might be operated, and asked similar questions in each case.

Business Model 1: A commercial micro-grid company

Model 1 was a for-profit firm, not associated with the local utility, which proposes to install a micro-grid with distributed generation that will serve about twenty customers in a new commercial and industrial park that is about to be built. The distributed generation would be natural gas-fired internal combustion engines, a technology which is in widespread use today in Europe, especially in the Netherlands² and which looks extremely cost competitive in new applications in both northern and southern parts of the U.S.³ In addition to producing electric power, these devices also produce heat and sometimes cooling. Because they use the "waste" heat of generation for this purpose, their overall energy-use efficiency is significantly higher than that of traditional central generation facilities. Because the micro-grid company would match the size of the distributed generation to the heating and cooling load, there would often be periods when the micro-grid would have excess electrical capacity that it could sell to the local utility. There might also be times when the micro-grid would want to buy electric power from the local utility.

The micro-grid firm would serve all the customers in the commercial and industrial park. It would also supply other services such as ultra high reliability power, power free of waveform distortion and high frequency interference, and low voltage DC power, to a number of high-tech firms that would be located in the park.

The proposed micro-grid would be operated by a highly intelligent computer control system. The micro-grid firm is willing to cooperate with the local utility to provide distribution system support at times when the local distribution company has problems and needs support. Within the limits of its own needs, the firm is also willing to perform intelligent dispatch of its external power sales in cooperation with the local distribution company.

The survey first asked the current and former regulators whether it would be possible under current regulatory law in their states to build and operate this micro-grid system. Of the eight respondents, only the three from Minnesota, Montana and Washington said yes.

If it were small enough, the micro-grid could operate as an unregulated entity in Minnesota because regulatory law in that state specifies that no generating entity shall be deemed to be a public utility if it produces or furnishes services to fewer than 25 persons. There is some ambiguity about whether "persons" refers to people, meters or facilities. If the firm met the 25-persons requirement, and avoided classification as a public utility, then the rates it charged, including rates for the special electrical services, would not have to be subject to regulation. Commissioner Garvey of Minnesota went on to note that "if the generating source is over 50 Mw, it would need a certificate of need determination and go through the state's siting and permitting requirements."

None of the seven other states had such an exemption from regulation for small numbers of customers. While the business model would be feasible in Montana and Washington, the micro-grid would be treated as a regulated utility in those states and all rates it charged its customers would be subject to PUC review and approval. Montana would also regulate the heating rates charged by the micro-grid company because state law covers "heat, light, power, water or regulated communications services..." Cooling is not explicitly mentioned.

The reason that the business model is not feasible in the other five states, is that they grant exclusive service areas to incumbent utilities. In cases where utilities have such an exclusive service area, the proposed micro-grid would result in a territorial dispute and the existing utility would have precedence and would probably move to block entry. In some cases, the existing utility could waive its rights to its exclusive territory in return for fees or other concessions, such as the right of customers to leave the micro-grid and return to the utility. Commissioner Ziegner indicated that, if the existing utility waived these rights, then in Indiana the firm might be able to avoid regulated rates under Alternative Regulation statutes.

The survey asked whether it would matter if the customers of the proposed commercial and industrial park were free to leave the micro-grid and purchase their electric power directly from the local utility. None of the respondents believed that this would be a deciding factor in determining whether the business model was feasible under current regulatory law.

It next asked whether the terms and conditions for interconnection with the existing utility (e.g., stand-by charges, reservation fees, and facility requirements) would be clear and predictable. None of the eight respondents gave a simple yes, a finding that is entirely consistent with results reported in a recent review by Alderfer et al.⁴ Three respondents indicated that the utilities would have a standard tariff established. However, Commissioner Garvey of Minnesota indicated that further terms and conditions for interconnection would be negotiated on a case-by-case basis. He also noted that the Minnesota PUC has a pending docket on creating a standard interconnection agreement for certain types of generation less than 10 Mw. Two other respondents replied that the terms would be negotiated entirely on a case-by-case basis and be subject to PUC approval. One respondent argued that it would actually be FERC and not the PUC that would have jurisdiction since the load-serving entity would either be a generator selling to the utility or a wholesale purchaser for resale.

Finally, in connection with this first business model, the survey asked: "What other issues arise that are relevant in this case? For example, would the amount of the installed distributed generation, or the number of customers served, be important considerations?" With the exception for Minnesota noted above, the respondents did not think that any of these issues were relevant under current regulatory law in their states. It was noted that the number of customers had to be more than one (i.e., this was not simply a case of generating energy for self-use). It was also noted by one respondent that the larger the project, the more likely the opposition from the incumbent utility.

Alternative Business Models

In order to examine how dependent answers were on the specifics of the business model, the survey outlined three other models.

Business Model 2 involved the exact same story - a micro-grid and distributed generation system in a new commercial and industrial park - however, in this case, rather than the system being operated by a for-profit firm, it was to be operated as a co-op formed by the customers (a for-profit firm would install the system and be paid a fee to maintain and operate it). Business Model 3 was identical to Business Model 1 except that it involved an existing facility in which customers were currently served by the local distribution utility. Finally, Business Model 4 also involved an existing facility. In this case, the customers had organized themselves into a co-op that would operate the system.

Whether the entity is a cooperative appears to make a difference in fewer than half the states. Alabama, Montana and Washington do not regulate cooperatives so Business Models 2 and 4 would be allowed, however, any transaction with the local utility, or any use of utility facilities (e.g., for distribution) would be regulated. Commissioner Ziegner of Indiana indicated that it was unclear if being a co-op would make a difference. Commissioner Dworkin noted that while Vermont generally treats cooperatives the same as investor-owned utilities, there is a State Attorney General's Opinion of 30 years ago that "a cooperative that does not offer to sell to the general public is not a regulated utility." Other respondents indicated that the different business models would not change their response.

What Would be Desirable?

Anticipating that the four business models outlined would not be feasible in many states under current regulatory law, the survey then asked, "If it were possible - perhaps as a result of a change in state law - for any of the four models...to operate as an unregulated business - would this be desirable? What restrictions, if any, do you think should be imposed (on size of installed capacity, number of customers, etc.)?"

Responses to this question were mixed. Some of the current and former regulators felt it would be desirable to have an unregulated micro-grid business, but only if limited in size, with customer participation voluntary, and with no penalties for switching to traditional utility power. Other respondents did not consider unregulated micro-grid businesses to be desirable because they believed that any firm in this business should be subject to some regulation because of their connection to the distribution system or other factors. One respondent questioned the desirability of unregulated for-profit micro-grid companies on the grounds that they would behave just like a monopoly utility and attempt to exercise monopoly power. Another noted that there were a large number of open policy questions that would have to be resolved before any decision could be taken. Some argued that while an unregulated business could become possible, this should only occur in the context of larger deregulation, in which case the micro-grids would be treated like any other participant in an open market. Commissioner Dworkin noted that retail choice was not currently allowed in Vermont, and suggested that the hypothesized change would probably not be feasible unless such choice were introduced - an outcome that currently seems unlikely given the mood in the legislature after the California and Enron experiences.

In discussing the mechanisms by which such business models could be made feasible, one respondent said that they would prefer not to go to the legislature unless absolutely necessary. They would prefer to wait until a problem arose and attempt to handle it within the current structure of regulatory law.

The survey asked: "If it were possible to operate some micro-grids as unregulated businesses, should the existing distribution company be allowed to compete in this market? If so, are there issues of "market power" that would need to be considered?"

Former Commissioner Clark of Florida noted that the answer would depend on the impact the new entrants would have on the general body of ratepayers. If the micro-grids were few and small there would probably not be a problem. But, she argued, "if this business model is repeated to a significant degree, issues of remaining customers bearing the burden of paying for customers who have left the system will become important." In a similar vein, Commissioner

Dworkin of Vermont noted that "the impact on the original utility's stability of load (for both operation and planning purposes) would need to be addressed in order to protect 'remaining' utility customers."

While all but one respondent thought the incumbent utility should be allowed to enter the micro-grid market if it were created, many voiced concern about market power and the possible need for oversight (though not necessarily rate regulation) by the PUC to avoid issues such as cross-subsidies from regulated to unregulated businesses (i.e., affiliate transactions) and "cherry-picking" of the most profitable customers. Commissioner Garvey of Minnesota indicated that he was inclined to think that the incumbent should not be allowed in this market but could see it being done under an arrangement that is similar to the FCC's and the state PUCs requirement that the Baby Bells open up to local competition before being allowed to enter the long-distance market. One respondent again raised the question of why the micro-grid company should be unregulated arguing that, unless it was a cooperative, the same monopoly power problems would arise as with a traditional utility.

The survey asked: "If a change in State Law would be required to allow some or all of the four business models outlined above, what would be likely politics associated with such proposed legislation? For example, could the existing regulated distribution company be expected to oppose such legislation?"

All respondents felt that existing utilities would oppose any legislation - with more than one stating that such opposition would be very "vigorous." Consumer groups might also be expected to raise concerns. However, Commissioner Anderson of Montana suggested that this resistance could be reversed if the incumbent utility were on a "performance-based regime with incentives for cost cutting instead of throughput." Two respondents argued that a change of the magnitude suggested should only be done as part of larger restructuring efforts, which are unlikely to occur at the moment. One respondent noted that the overall benefits for both the micro-system and the utility customers would have to be positive or else it would be highly likely to be opposed by others, in addition to the utility.

Finally, the survey asked "As a Commissioner (or former Commissioner) you have a broad perspective on such matters. Your staff may have rather different views. If your staff had been responding to this survey, do you think the answers would have been significantly different?"

All respondents thought their responses would be representative of the responses their staff would have given. One noted "given the detail of the questions, I had to ask staff for help, so our answers are the same." One stated that while the views would be the same on the current status quo, because they try to maintain a diversity of views within the PUC staff, the responses might be considered the middle-of-the-road view on the more speculative questions. Another stated that they doubted the responses would be different, with the possible exceptions of the policy questions about the desirability of making these business models possible.

Discussion

While this informal survey sampled only eight states, the picture it provides is probably reasonably representative of the situation in the U.S. as a whole. Clearly, the model of small commercial micro-grids with distributed generation in an unregulated competitive environment

underneath traditional distribution systems, faces large regulatory barriers in much of the U.S. today. Micro-grids operated as co-ops appear to face similar, though somewhat smaller, barriers.

This situation could be changed with new law that allowed micro-grids to operate as unregulated entities - complying, of course, with appropriate safety, interconnection and environmental codes. Such law would certainly need to specify a limit to both the amount of installed capacity and the number of customers that each micro-grid could serve. It would need to provide an opt-out option so that an unregulated monopoly provider could not trap customers. And, it would also need to address issues of interconnection.

The design of the bi-directional tariff that would govern transactions between the micro-grid and the incumbent distribution utility would also require careful attention. Because the micro-grid would contain distributed generation, if it were run under cooperative control with the incumbent utility, it could provide important distribution system support. At the same time, some micro-grids would occasionally need to draw on power from the distribution company during times of mechanical breakdown or maintenance. The relative size of costs and benefits that the two systems would present to each other should be reflected in the design of the bi-directional tariff. The magnitude of these costs and benefits would depend on the size of the micro-grids, their number, and the nature of the distribution utility's system and loads. Clearly, these are issues that would need to be carefully addressed in any new law.

Finally, such a law would need to address the issue of whether and how the incumbent distribution utility would be allowed to enter the micro-grid market, and how issues of cross-subsidy and market power would be managed.

Such a change in regulatory law holds the potential to unleash interesting innovative forces, and new product and service offerings. However, as several of the survey respondents suggested, efforts to make such a change in the regulatory environment would likely face stiff opposition by at least some distribution utilities. Such efforts might also face opposition from at least a few state regulators, concerned about issues of market power, or a further erosion of their domain of responsibility. However, the possibility of making such changes is a topic that warrants greater visibility in ongoing state and national debates on the restructuring of the electric power industry. The development of a piece of model legislation, which attempts to address the issues discussed above, might be one way to advance national discourse on this topic.

Endnotes:

1. G. W. Baker, "Electricity Supply in the New Economy: Micro-grids and virtual utilities," Proceedings of the Delft 2001 Conference on Critical Infrastructures, pp. 146-7, Faculty of Technology, Policy and Management, TU Delft, 2001.
2. Neil D. Strachan and Hadi Dowlatabadi, "Distributed Generation and Distribution Utilities," *Energy Policy*, 30, pp. 649-661, 2002.
3. Neil D. Strachan and Hadi Dowlatabadi, "A Green-Field System Optimization of Distributed Generation," *Energy Policy*, 2002 (in press).
4. R. Brent Alderfer, M. Monika Eldridge, and Thomas J. Starrs, *Making Connections: Case Studies of Interconnection Barriers and Their Impact on Distributed Power Projects*, National Renewable Energy Laboratory, NREL/SR-200-28053, May 2000 (Revised July 2000).
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