FINAL REPORT ON ESTABLISHING INTERCONNECTION STANDARDS:

A Report by the Michigan Public Service Commission Staff

October 2, 2000

INTRODUCTION

By its order dated June 19, 2000, the Michigan Public Service Commission initiated a proceeding (Case No. U-12485) to establish standards for the interconnection of merchant plants with the transmission and distribution systems of electric utilities. As a part of this proceeding, the Commission directed its Staff to consult with electric utilities, owners and operators of merchant plants and proposed merchant plants in Michigan and other relevant stakeholders. The Commission further directed the Staff to file a status report on the results of its consultations by August 31, 2000, and a final report by October 2, 2000. The Staff Status Report was filed on August 31, 2000. This document is the Staff's final report.

The promulgation of interconnection standards for merchant power plants by the Michigan Public Service Commission (MPSC) must be done in the context of a reasonable interpretation of the boundary between state and federal jurisdiction. As this report discusses, the Federal Energy Regulatory Commission has asserted authority in this area, at least as far as interconnection at the transmission level is concerned. This, however, leaves open the question of jurisdiction over interconnection at the distribution/subtransmission level. Staff recommends that this question be resolved by the Michigan Commission exercising authority over interconnection with local distribution facilities as those facilities are defined by the MPSC in its relevant orders. In addition, Staff recommends that the MPSC also find that it is authorized to hear complaints concerning the interconnection process for all interconnections irrespective of the point of interconnection.

Staff further recommends that all entities with local distribution facilities be directed to file proposed interconnection standards for interconnection to local distribution facilities. Moreover, these

interconnection standards should follow and be consistent with a set of guidelines ordered by the MPSC to minimize differences between the various sets of standards. These guidelines are based on comments by stakeholders, and include the following principles:

1) Safety, protection of equipment, and preservation of service quality

2) Timeliness in the review of applications for interconnection

3) Reasonable interconnection study costs

After the proposed interconnection standards are filed, a period of time should be allowed for interested parties to submit comments and replies to comments at which time the Commission may approve, approve with modification, or reject the proposed standards.

JURISDICTIONAL ISSUES

During Staff's interviews with stakeholders a number of commentators suggested that the Federal Energy Regulatory Commission (FERC) has asserted jurisdiction over interconnection standards. ("Status Report on Establishing Interconnection Standards," Michigan Public Service Commission Staff, August 31, 2000) In a recent order ("Order Dismissing Complaint," Tennessee Power Company, Docket No. EL00-12-00, March 15, 2000, 90 FERC p 61,238), the FERC stated that "interconnection is an element of transmission service and is already required to be provided under our pro forma tariff." The order goes on to say that the pro forma tariff procedures continue to apply even if interconnection is requested separately from the delivery component of transmission service, and that these procedures include arranging service, customer responsibilities, study procedures, compensation for new facilities, and service agreements. The FERC has reiterated this position in a more recent order. In a Southwest Power Pool order ("Order Accepting for Filing, as Modified, Revisions to Open Access Tariff and Providing Guidance", Southwest Power Pool, Inc., July 28, 2000, 92 FERC p 61,109) the FERC cited its Tennessee Power order and went on to state that interconnection agreements must be filed only as service agreements under the applicable open access transmission tariff.

Under Michigan Public Act 141 of 2000, the interconnection standards established by the Michigan Public Service Commission do not apply to "interconnections or transactions that are subject to the jurisdiction of the federal energy regulatory commission." MCL 460.10e(4); MSA 22.13(10e)(4). The Michigan Public Service Commission has, in the past, recognized that there is a

federal/state jurisdictional delineation between transmission and local distribution facilities and has issued orders defining the point of delineation. ("Opinion and Order," Case No. U-11337, January 14, 1998; "Opinion and Order," Case No. U-11283, January 14, 1998) The methodology used to make this delineation was based on the "seven factor test" outlined by the FERC in its Order No. 888 ("Order 888: final Rule," Docket No.s RM95-8-000 and RM94-7-001, April 24, 1996), an order which has been recently upheld by U.S. Court of Appeals for the District of Columbia (Transmission Access Policy Study Group, et al v FERC, Case No. 97-1715, 2000 WL 762706, June 30, 2000). Since the FERC has determined that interconnection is an element of transmission service, and that such agreements are to be part of the FERC transmission tariffs, then interconnection to the transmission system would be regarded as under the jurisdiction of the FERC. However, since the FERC has recognized that certain facilities are local distribution facilities [see also section 201(b) of the Federal Power Act, 16 USC s 824(b)], and thus are subject to state jurisdiction, interconnection to these local distribution facilities would be subject to state jurisdiction.

As a practical matter, in the case of interconnection with the Detroit Edison Company, interconnection to facilities operating below 120 kV would be interconnection with the local distribution system, i.e. at 41.6, 24, 13.2, and 4.8 kV and secondary voltages. ("Opinion and Order," Case No. U-11337, January 14, 1998, page 3) Thus, Michigan interconnection standards would apply to merchant plants interconnected at these lower voltages. In addition, 120 kV radial lines to end-use customers are also considered to be local distribution by the Michigan Commission ("Opinion and Order," Case No. U-11337, January 14, 1998, page 3), so interconnection to such facilities would also be under the jurisdiction of the Michigan Commission. However, for the larger facilities which are

likely to be interconnected at this voltage, the Commission should consider applying FERC standards for interconnection to the transmission system. Michigan standards should apply to the other, smaller facilities.

In the case of interconnection to the facilities of Consumers Energy Company, a similar analysis would apply. Interconnection to facilities operating below 120 kV or 138 kV would be considered to be interconnection to the local distribution system. Thus interconnection to facilities operating at 46 kV, 23 kV and at distribution voltages would be governed by Michigan interconnection standards. ("Opinion and Order," Case No. U-11283, January 14, 1998, page 4) Interconnections to higher voltage radial lines, as in the case of Detroit Edison, would also be within Michigan jurisdiction ("Opinion and Order," Case No. U-11283, January 14, 1998, page 3), but, again, the Commission should consider applying FERC standards for interconnection to the transmission system. Michigan standards should apply to the other, smaller facilities.

GUIDING PRINCIPLES

Safety, Protection of Equipment, and Preservation of Service Quality

It is clear that the addition of merchant plants or distributed generation facilities to the existing electric system should not result in unsafe conditions for utility workers or the general public. A safety issue which arises when independent generators are added to a system is the situation in which the independently owned generation continues to serve load during maintenance or an outage with the result that a portion of the transmission or distribution system can remain energized. This condition of isolated operation is often referred to as islanding.

In addition, protection of system facilities and the equipment of other customer and the prevention of service degradation for other customers are key considerations when generation is added to an existing system. For example, a generating facility which causes abrupt short term voltage fluctuations, "flicker", will interfere with the performance of lighting, televisions, and computer monitors . Over/under voltage, excessive harmonics, over-current, over/under frequency or lack of synchronization are all potential conditions which can also damage, or interfere with the operation of, system or customer equipment..

Thus there is a need for devices which can detect when these conditions exist and will isolate the independent generator from the system when they are present. In addition, there is a need for a safety disconnect switch at the point of interconnection. Such switches, which are standard practice, ensure that a generator is in fact isolated from the system when maintenance is to be performed.

Such requirements are typical of the interconnection standards used by electric utility companies. It has been argued that the specification and implementation of these requirements were originally designed for qualifying facilities under the Public Utilities Regulatory Policies Act of 1978 (PURPA), which tended to be larger, customized facilities. In practice, it is suggested, the implementation of these requirements have been too "cumbersome and restrictive" for smaller projects. ("Distributed Generation: Policy Framework for Regulators," Arthur D. Little, Inc, 1999, page13 - 14. See also "Making Connections", National Renewable Energy Laboratory, U.S. Department of Energy, May 2000)

In fact, a number of electric utilities specify different sets of protective equipment depending on the size of the interconnected facility. For example, Pacific Gas and Electric Company distinguishes between six different size classes: less than 10 kW, 11 - 40 kW, 41 - 100 kW, 101 - 400 kW, 401 - 1,000 kW, over 1,000 kW. (Pacific Gas and Electric Company, "Rule21--Nonutility-Owned Parallel Generation") ComEd Company has three size classifications: 25 - 2500 kVA, 2,500 - 10,000 kVA, over 10 MVA. (ComEd Company, Guidelines for Interconnection to the ComEd System) The Salt River Project has interconnection guidelines specifically for generators sized 1000 kW and smaller and further classifies generators into three size classes: less than 25 kW single phase, or less than 50 kW three phase; induction generators and line commutated inverters 50 - 100 kW and synchronous generators and force commutated inverters less than 100 kW; and all generators 100 kW - 1000 kW. (Salt River Project Agricultural Improvement and Power District, "Guidelines for Generators 1000kw and Smaller")

Similarly, the state of Texas, which has promulgated interconnection rules applicable to on-site distributed generation facilities up to 10 MW in size, classifies three phase facilities into four groups: 10 kW or less, 10 - 500 kW, more than 500 kW but less than 2,000 kW, and more than 2,000 kW but no more than 10,000. (Public Utility Commission of Texas, "Chapter 25. Substantive Rules Applicable to Electric Serve Providers," Section 25.212) New York's standardized interconnection requirements for facilities of 300 kVA or less also recognize that the design of protective equipment depends on a generator's size, load, and the characteristics of the part of the distribution system where the interconnection is to be made. (New York State Standardized Interconnection Requirements, Application Process, Contract & Application Forms for New Distributed Generators, 300 Kilovolt-Amperes or Less, Connected in Parallel with radial Distribution Lines," New York State Public Service Commission, December 1999)

In general, there is considerable overlap in the protective equipment required at the various generator sizes. This is to be expected, given the protection issues discussed above. However, some differences in interconnection requirements can be observed. For example, the Texas interconnection standards allow manual synchronization checks for generators under 500 kW in size. Pacific Gas and Electric also has rules which allow manual synchronizing for generators as large as 1,000 kW. In addition, PG&E rules waive the requirement for over-current relays for generators 400 kW or less in size.

Other companies have recognized that interconnection criteria should take into consideration the capacity of an independent generator. ComEd Company states that its requirements "range from a simple protection system, if the generator is small and energy is always intended to be delivered from

the ComEd System to the customer, to complex, high-speed schemes for larger generators connected to the high voltage transmission system." ("Guidelines for Interconnection to the ComEd System," ComEd Company, 1999, page 5)

American Electric Power in its interconnection requirements for distributed resources indicates several areas where the size of the generator should be recognized: whether a voice circuit is needed, the need for disturbance monitoring, and the need for several other items of "additional protection." The AEP requirements also state generally that requirements can vary based on size, technology, location, distribution system configuration and other factors, and that "special provisions" may be made with the operators of "small" power production facilities. ("Requirements for Connection of Distributed Energy Resources Facilities to the Local Distribution Company's Distribution System Three-Phase Application," American Electric Power Company, May 18, 2000, pages 4, 6, 7, 10, 26)

Both of the largest electric utilities operating in Michigan, the Detroit Edison Company and Consumers Energy Company, have interconnection guidelines for independently owned generators. These guidelines only formally distinguish between single phase generators sized 25 kVA or less and all other generators. (I.e. single phase larger than 25 kVA and all three phase facilities.) Nonetheless, these guidelines do implicitly recognize that differently sized generators should have different requirements.

The Consumers guidelines, for example, specify different main transformer connections, and main disconnect switches depending on whether the generator is connected at the distribution, subtransmission or transmission systems. Telemetering is required only for generators with the capability to supply one MW or more when selling power back to Consumers. Also, the guidelines

note that protective relaying requirements are influenced by the size and type of generator, among other factors. ("Interconnection Guidelines for Non-utility Generation," Consumers Power Company, June 1, 1995, pages 3, 6, 17)

The Detroit Edison guidelines also reflect distinctions based on the size of the independent generator's capacity. The telemetering requirement has the same one MW limitation. Relaying requirements are also to be, in part, a function of the size of the generator ("Protective Relaying, Operating and Telemetering Guidelines for Independently Owned Generation," The Detroit Edison Company, no date, pages 7, 13)

The preceding discussion suggests that the goals of safety, system protection, and preservation of quality of service can be achieved while recognizing that the specific technological requirements applied to achieve these goals can vary depending on the size of the independent generator being interconnected. This is not to say that the functional requirements are or should be different, but rather the means of achieving those requirements can vary based in part on size.

This being the case, it may be useful for the utilities operating in Michigan to modify their current interconnection standards in such a way as to make explicit the differences in technological requirements applicable to different sized independent generating facilities. Michigan jurisdiction would, as a practical matter, apply to facilities under approximately 40 MW. However, the largest size classification could be for facilities larger than just one megawatt. This would be consistent with the practice of other states, and is also consistent with at least some of the language currently used in Michigan. Two other size classes could be used as well, perhaps one class in the 100 to 500 kW range, and another for facilities between 500 kW and 1000 kW. The advantage of this approach

would be that it would provide clearer guidelines to the developers of smaller projects while preserving the needed protective requirements for projects with the potential to have wider impacts on the electrical system.

Timeliness in the Review of Applications

As noted in the Staff's "Status Report on Establishing Interconnection Standards", a frequently stated concern on the part of the developers of independent generation is the amount of time it may potentially take to review an application to interconnect. A review of the practices in some other states reveals that this is a concern in other places as well.

In Ohio, the Public Utilities Commission of Ohio has approved interconnection standards which require that interconnection service be provided within four weeks of a completed application if the interconnection does not require the construction of additional facilities. Where facilities must be added, a schedule is required to be provided. [Public Utilities Commission of Ohio, "Uniform Electric Interconnection Standards", Section 4901:1-22-04(C)]

The Public Utility Commission of Texas also has interconnection procedures with stated timelines for the approval of applications. For facilities using what the Texas rules refer to as "pre-certified" equipment, interconnection is required within four weeks of the receipt of a completed application. For all other facilities, the interconnection must be completed within six weeks. (Public Utility Commission of Texas, "Chapter 25. Substantive Rules Applicable to Electric Serve Providers," Section 25.211) (As discussed above these Texas rules apply only to facilities of 10 MW or less.) It should be noted that the Texas rules recognize that some interconnections will require upgrading certain facilities. In such cases, a cost estimate and time schedule must be provided, and interconnection must take place within two weeks of the completion of the upgrade.

The New York review process for the interconnection of distributed generators sized 300 kVA or less establishes timelines for the initial procedural steps of the process, but allows the parties more

flexibility in the final steps where site specific issues may arise. (See New York State Standardized Interconnection Requirements, "Application Process Steps") The utility must provide certain basic information within three business days of the initial contact with a potential applicant. The utility must also acknowledge receipt of a completed application with five days. The acknowledgment must also notify the applicant whether the application has been adequately completed. The utility then has four to eight weeks to perform an interconnection review and prepare a cost estimate. The applicant then submits a detailed design package which must be reviewed in ten days for "type-tested" systems, and in four weeks if the system is "non-type-tested."

When these steps are completed, the New York rules state that utility system modifications are expected to "vary in construction time", and that final testing of the interconnection is to be conducted at a mutually agreeable time. After the testing, operation is allowed to begin. Finally, after interconnection is in operation, a letter of acceptance is to be issued "within a reasonable time."

Also of interest are the American Electric Power interconnection requirements for distributed resources. These requirements indicate that an AEP local distribution company will respond to an application within four weeks for "pre-certified" equipment, and within six weeks otherwise, once certain information is provided. (See American Electric Power "Requirements for Connection", page 23)

In Michigan, the interconnection guidelines used by the Detroit Edison company do not specify timelines for most of the items on its "Interconnection Check List", though there are some exceptions. The guidelines specify that Edison will review certain relaying drawings within twenty days, and that Edison will perform its final inspection of the facility within 25 working days. ("General Procedures and

Related Information for the Interconnection of Independently Owned Generation," The Detroit Edison Company, no date, Attachment B.) The guidelines used by Consumers Energy Company make no mention of timelines. (See Consumers Power Company "Guidelines")

The lack of timelines in the interconnection procedures currently in use in Michigan probably reflects their origin as documents intended for use in the process of interconnecting facilities under PURPA which, as noted above, tended to be larger, customized facilities. Consistent with the proposal to differentiate between facilities of differing sizes, it would seem useful to adopt the approach of some of the other state commissions which is to set forth timelines for steps in the review process, at least for smaller facilities. Such an approach would be most applicable to those facilities using equipment which has been pre-certified as meeting a known technical standard such as that being developed by the Institute of Electrical and Electronic Engineers (IEEE).[1]

Furthermore, even for more complex projects, timelines for the procedural steps of the process would help project developers with their planning. For example, as in the New York rules, a requirement that the receipt of an initial application be acknowledged within a certain time would be useful. Also, as in the New York rules, parties should be required to agree to a schedule.

[1]The IEEE is in the process of developing a standard for the interconnection of distributed resources. The standard is being developed by a working group identified as P1547. The P1547 working group has set as a goal to have a final draft of the standard by March 2001. Consumers Energy and DTE Energy Technologies - an affiliate of Detroit Edison - are both represented in the working group.

Thus it should be considered whether the interconnection guidelines being used in Michigan should be modified to include timelines for the interconnection process which take into consideration the fact that projects vary in size and complexity.

Reasonable Interconnection Study Costs

Certain commentators interviewed by the Staff indicated that there was a concern about the cost of the facilities studies and system impact studies required for interconnection. By one account, the cost of such studies can range from $6,000 to $20,000 for a project of 5 MW. For a very large project costing hundreds of million of dollars, even $100,000 is a small fraction of project cost, but such costs could be a deterrent to a smaller project.

Again, it is instructive to review policies from other states. The New York interconnection standards express the desire that the cost of interconnection studies be minimized. (See New York State Standardized Interconnection Requirements, "Application Process Steps") The interconnection rules approved by the Texas Commission are more specific in requiring that the scope of an interconnection study should be related to the characteristics and location of a proposed project. In fact, under certain conditions, for "pre-certified" distributed generators sized up to 500 kW the rules specify that no fee is to be charged for a pre-interconnection study. In those instances where a study is required, an estimate of the cost of the study must be provided. Furthermore, the Texas rules provide that by agreement a third party may be used to conduct the study. [See Public Utility Commission of Texas Substantive Rules, Section 25.211(g)] The rules in place in Ohio are more general, but require interconnection tariffs which include "interconnection service system impact study standard fee schedule(s) to be approved by the commission for each type of interconnection service study required." [Public Utilities Commission of Ohio, "Uniform Electric Interconnection Standards", Section 4901:1-22-04(D)]

Also, as noted above, the American Electric Power interconnection requirements state generally that special provisions may be made for small facilities.

Based on the concerns which have been noted in the Staff's "Status Report" and the efforts being made in these other states, it seems reasonable that an effort should be made to determine the extent to which required facilities and system impact studies can be varied in their extent to match the size, type and location of a project. Thus it should be considered whether the interconnection guidelines being used in Michigan should be modified to include explicit fee schedules which take into consideration the fact that projects vary in size and complexity.