8. Distributed Energy Resource Affected System Study

8.1. Definitions

Distributed Energy Resource (DER): Any source of electric power located on the distribution system.[27]

DER Affected Systems Study (DER AFS): The MISO process to evaluate Transmission System impacts from DER interconnection requests.

DER Customer: The person or entity requesting RERRA-jurisdictional interconnection.

DER Net Injection: The DER Substation net injection, which is calculated by taking the DER Substation generation (cumulative amount) minus applicable substation loading (peak or shoulder peak) as viewed at the high-side of the distribution substation transformers.

DER Substation: Shorthand for the substation represented in MISO Transmission Expansion Planning (MTEP) models at which one or more DER will inject into the transmission grid. This is the most granular level that MISO reviews DER impacts.

Distribution System: All electric facilities owned by a Distribution Provider, as defined by the North American Electric Reliability Corporation (NERC), regardless of how such facilities are classified by the Distribution Provider that: (1) are connected to the Transmission System; (2) are not a part of the Transmission System, and (3) are not connected to the Transmission System solely through facilities under the control of another transmission provider.[28]

Electric Distribution Company (EDC): A company that distributes electricity to retail customers through distribution substations and/or lines owned by the company, as defined in MISO's tariff Module A.

Facilities Study: An engineering study conducted by the Transmission Provider or Independent Transmission Company in collaboration with the affected Transmission Owner(s) and Independent Transmission Company Participant(s) to determine the required modifications to the Transmission System, including the cost and scheduled completion date for such modifications, that will be required to provide the requested Transmission Service. The Transmission Provider shall have the final determination and ultimate responsibility for any such studies. Facilities Studies for any transmission facilities not under the operational control of the Transmission Provider shall be performed by the Transmission Owner, or Independent Transmission Company, or any entity it designates to perform the studies, as defined in MISO's tariff Module A.

[27] NERC SPIDERWG Terms and Definitions Working Document. Last Updated: June 2020. Available at: https://www.nerc.com/comm/RSTC/SPIDERWG/SPIDERWG%20Terms%20and%20Definitions%20Working%20Document.pdf

[28] MISO, Re: Midcontinent Independent System Operator, Inc. Order No. 2222 Compliance Filing Docket No. ER22-___-000. Available at: https://cdn.misoenergy.org/2022-04-14%20Docket%20No.%20ER22-1640-000624051.pdf

Network Upgrade: All or a portion of the modifications or additions to transmission related facilities that are integrated with and support the Transmission Provider's overall Transmission System for the general benefit of all Users of such Transmission System, as defined in MISO's tariff Module A.

Transmission Owner: Each member of the Independent System Operator whose transmission facilities (in whole or in part) make up the Transmission Provider Transmission System, as defined in MISO's tariff Module A.

Relevant Electric Retail Regulatory Authority (RERRA): An entity that has jurisdiction over and establishes prices and/or policies for providers of retail electric service to end-customers, such as the city council for a municipal utility, the governing board of a cooperative utility, the state public utility commission or any other such entity.

8.2. Scope

MISO's DER AFS processes pertain only to DER as defined by this document. This definition covers sources of power while excluding controllable load and energy efficiency, which are sometimes considered to be DER in other industry definitions (e.g., the Federal Energy Regulatory Commission (FERC)).[29] MISO's DER AFS is intended to evaluate the impacts of DER newly proposed for interconnection through the applicable EDC and RERRA process. DERs that have an existing interconnection service agreement, according to the applicable EDC and RERRA processes, are not intended for inclusion in the impacts evaluation group under MISO's DER AFS studies, consistent with the outcome of the Lake Substation example included in Appendix F.

Accounting for DER interconnection being a RERRA jurisdictional process, MISO's role in the electric system, and evolving wholesale market rules (e.g., FERC Order 2222), limitations exist as to what is addressed through MISO's DER AFS proposal. MISO seeks to provide clarity on two key limitations:

- **RERRA-jurisdictional matters** — DER interconnection is a RERRA jurisdictional process. MISO understands that RERRAs can be different entities including state commissions, municipal governments, and cooperative boards. Further, RERRAs have independent laws and rulemaking processes over DER interconnection, resulting in different available information, processes, and outcomes.
- **Market Participation —** MISO's DER AFS does not confer transmission rights or allow access to wholesale markets without further action on behalf of a DER Customer. DER

[29] NOPR, 157 FERC ¶ 61,121 at P 104; see supra Section IV.B. (Definitions of Distributed Energy Resource and Distributed Energy Resource Aggregation).

Customers may access the Energy and Ancillary services markets by registering as a MISO Market Participant[30] and by enrolling DER assets in market product for which the DER is eligible. By contrast, capacity market participation requires the DER customer to secure appropriate transmission rights, which can be done by procuring Network Resource Interconnection Service (NRIS) through MISO's Definitive Planning Phase generator interconnection process[31] or by obtaining Firm Transmission Service[32].

At a high level, the scope of this document and MISO's DER AFS proposals include three areas: (1) screening, (2) studies and reports, and (3) facilities studies and network upgrades (Figure 8-1)~~(Figure 5)~~. See Section 8.3 for a more detailed process view.

Figure 8-1 High-level overview of MISO's DER AFS proposal scope

8.3. Procedure

MISO is aware that some RERRAs define transmission studies and affected systems studies within RERRA-jurisdictional interconnection rules. MISO considers the MISO DER AFS to be a type of affected system studies and recognizes that other TO studies may be appropriate based on TO local planning criteria and applicable RERRA rules.

The MISO DER AFS process starts with screening, carried out jointly by MISO and the TO, which leads to a DER AFS should screening results show violations in technical criteria found in Sections 8.2.1.2 and 8.2.1.3. MISO will conduct quarterly DER AFS cycles to efficiently manage the expected growing volume of DER in coming years.

[30] See MISO Tariff Module A for Market Participant definition. Available at: https://docs.misoenergy.org/legalcontent/Module_A_-_Common_Tariff_Provisions.pdf
[31] See MISO BPM-015 for DPP process. Available at: https://cdn.misoenergy.org/BPM%20015%20-%20Generation%20Interconnection49574.zip
[32] MISO, Long Term Transmission Service Requests webpage. Information available at: https://www.misoenergy.org/planning/transmission-planning/long-term-transmission-service-requests/

MISO will issue a DER AFS report showing steady state analysis results for voltage and thermal impacts. The DER Customer, EDC, and TO will have an opportunity to share feedback on the draft study report. If study results indicate DER-caused impacts exceeding defined thresholds, indicative cost estimates for Network Upgrades will be provided in advance of kicking off a more detailed Facilities Study. Figure 8-2 illustrates key DER AFS milestones and timeframes.

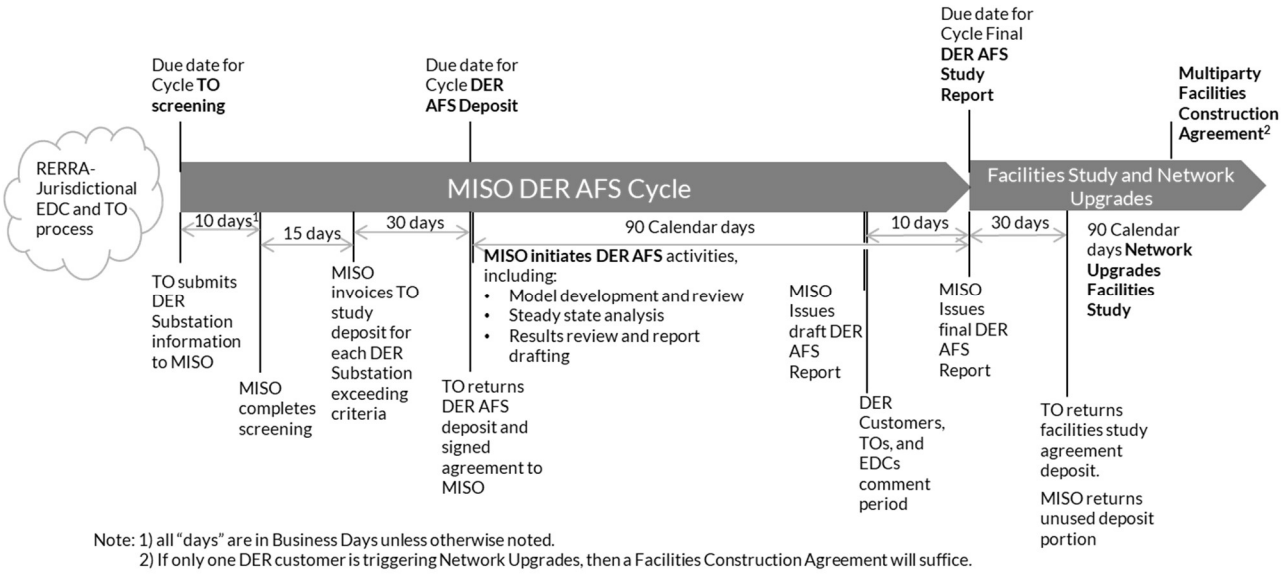

Figure 8-2 Illustration of DER AFS timeline view

8.3.1. Screening

8.3.1.1 Screening Assumptions

The TO and MISO shall assume full injection of DER resources when applying DER screens. Full injection could mean the full DER nameplate or be a lesser value should operational capacity limitations be proposed. The TO, in concert with the EDC, determines the DER injection level submitted to MISO for screening.

The TO and MISO shall select summer peak and/or shoulder peak load conditions, drawing from MISO's fuel dispatch philosophy in Section 6.1.1.1.2 of this BPM for DPP studies. Table 8-1 shows an adaptation of summer peak and shoulder peak selection for DERs from Table 6-1. Should the DPP study fuel dispatch philosophy change, MISO will update the DER AFS screening approach to align with the DPP study dispatch assumptions.

Table 8-1 DER AFS screening adaptation for summer peak and shoulder peak selection

DER Fuel Type for Screening	Summer Peak Dispatch	Shoulder Peak Dispatch
Solar	**100%**	**0%**
Storage	**100%**	**100%**
Wind	**100%**	**100%**
Hybrid[33]	**100%**	**100%**
Diesel Engines	**100%**	**0%**
Combustion Turbine	**100%**	**0%**
Waste Heat	**100%**	**100%**
Oil	**100%**	**0%**
Hydro	**100%**	**100%**

The load considered in the summer peak and shoulder peak conditions shall be consistent with the most current Load Serving Entity (LSE) information submitted for MTEP modeling.

Examples in Table 8-2 illustrate the application of the screening model selection concepts. The examples assume levels of DER Net Injection that would require screening.

Table 8-2 Example applications of DER screening model selection

Example situation at a given DER Substation	**Model selection**
5 MW solar only	Summer Peak
4 MW solar and 1 MW battery storage	Summer Peak and Shoulder Peak
10 MW hybrid (solar and combustion turbine)	Summer Peak
10 MW hybrid (solar, wind, and storage)	Summer Peak and Shoulder Peak

[33] Hybrid Exception: a combination of only diesel, solar, combustion turbine, or oil would only be dispatched for summer peak. Otherwise, the full amount of DER is dispatched under both shoulder peak and summer peak conditions. As a simplifying assumption, the full hybrid capacity would be dispatched during each condition for screening. The dispatch allocation would be more granular for affected system studies, in accordance with BPM-15 practices.

8.3.1.2 Transmission Owner Screening

When an EDC approaches a TO with information on potential DER Transmission System impacts, the TO shall perform a screen for DER Net Injections exceeding zero megawatts (0 MW) using the screening assumptions outlined in Section 8.2.1.1. DER Net Injection screening shall use the applicable model(s) load and assume full injection of all DER at the DER Substation.

If TO screening of a DER Substation indicates DER Net Injections exceeding zero megawatts (0 MW), the TO shall submit to MISO the following information for that DER AFS: (1) Substation name and associated bus number; and (2) DER capacity, in megawatts, categorized by the fuel types shown in Table 8-1. The information shall be submitted by the screening deadline milestone for consideration in the next DER AFS cycle.

Once a DER Substation has exceeded the Net Injection screening threshold, and a DER AFS completed showing no impacts, MISO will not perform an additional DER AFS on that substation until the DER Net Injection at the DER Substation goes up by one megawatt (1 MW) or greater. Similarly, if a DER AFS-identified Network Upgrade is completed at a DER Substation, MISO will not perform an additional DER AFS on that substation until the DER Net Injection at the DER Substation goes up by one megawatt (1 MW) or greater. Should an identified Network Upgrade not be funded, any incremental DER Net Injection will trigger another MISO DER AFS. An example of this process can be found in Appendix F.

8.3.1.3 MISO Screening

MISO will compile all DER Substation information submitted by TOs and perform screening to determine which DER Substations require DER AFS. MISO will use the same screening assumptions as the TO and outlined in Section 8.2.1.1.

MISO will identify DER Substations with DER Net Injection exceeding 5 MW and forward these DER Substations to the next quarterly DER AFS without additional screening.

For DER Substations in the 0-to-5 MW range, MISO will apply the 1%-line loading change screen and forward any DER Substations that exceed the threshold for DER AFS. The 1%-line loading change screen evaluates the net change (positive or negative) in loading on modeled lines using the DER screening assumptions outlined in Section 8.2.1.1.

Figure 8-3 shows a depiction of the overall screening process.

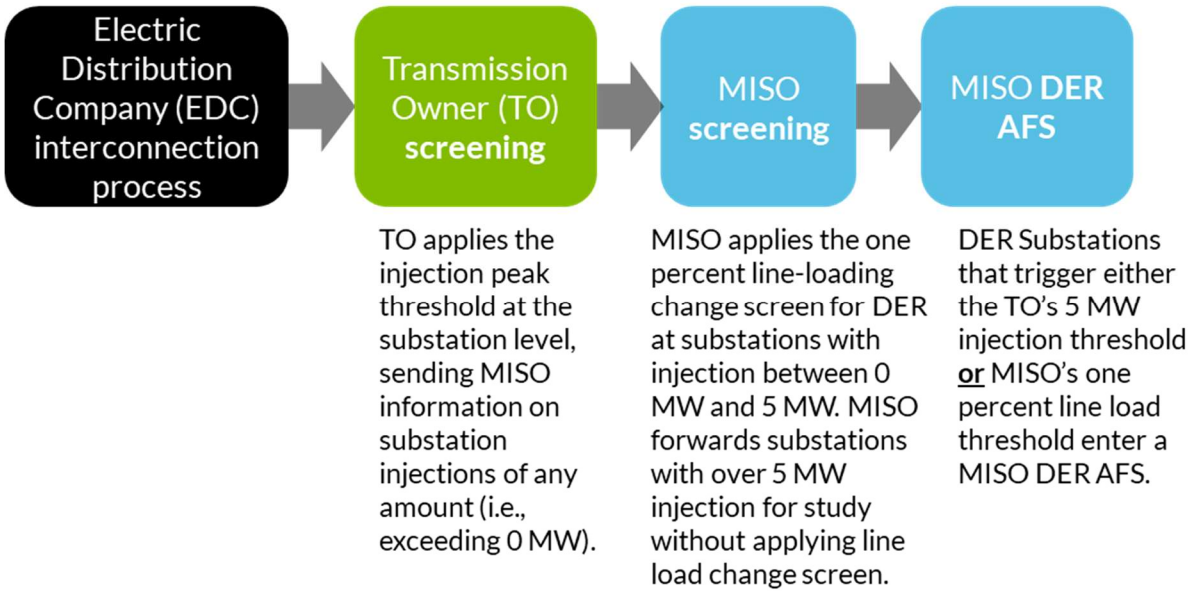

Figure 8-3 Summary of TO and MISO screening process and thresholds

After the TO requests MISO screening or study, MISO will perform line loading change screening, as applicable, within 10 business days of the TO screening deadline. For DER Substations that require a DER AFS, MISO will invoice TOs within 15 business days of screening completion. The TO may be reimbursed for any DER AFS Costs consistent with RERRA regulatory requirements and TO utility structures. The TO shall provide a DER AFS deposit, for $60,000 per DER Substation, to MISO within 30 business days of MISO invoice.

8.3.2. Study Process

MISO will carry out DER AFS cycles with at least a quarterly cadence. If there are no requests for a DER AFS at the beginning of a quarterly cycle, a study cadence may be skipped. The DER AFS process shall be allocated 90 calendar days, with steps such as screening, agreements, and deposits occurring outside of the 90 calendar days. Figure 8-4 shows DER AFS process steps with respect to the 90 calendar days. Not shown in this figure are the screening steps leading up to the DER AFS agreements and deposit, as discussed in Sections 8.2.1.2 and 8.2.1.3.

Figure 8-4 Overview of DER AFS process in relation to 90 calendar day study timeframe

8.3.2.1 Agreement

The TO and MISO will enter into a DER AFS A~~a~~greement that will outline the study scope, cost, and timing milestones as well as the responsibilities of each party.

8.3.2.2 Deposit Amount and Payment Methods

The TO shall provide a DER AFS deposit for $60,000 per DER Substation within the timeframes defined in this document. MISO shall track study expenses and refund any unused DER AFS deposit amount. While MISO anticipates the requested amount covers most DER AFS situations, there may be instances where MISO needs to request additional funding from the TO to complete the study. Consistent with other MISO Generator Interconnection practices, the interconnection customer is charged actual study costs. The TO may be reimbursed for any DER AFS Costs consistent with RERRA regulatory requirements and TO utility structures. MISO will reconcile study costs with deposits upon completion of each quarterly cycle. The deposit amount is independent of the number of DER requesting interconnection at a given DER Substation.

Automated Clearing House (ACH) payments and wire transfers are MISO's required methods for receiving deposits and refunding unused deposit portions.

8.3.2.3 Data Exchange

The DER information submitted to MISO for screening is sufficient for MISO to carry out the DER AFS. The minimum~~is~~ information required for each screening cycle includes: (1) Substation name and associated transmission bus number; (2) DER capacity, in megawatts, categorized by the fuel types found in BPM-015; (3) equivalent short circuit impedance by fuel

type; and (4) reactive power control mode and settings by fuel type. The entity submitting information may choose to submit assumptions for equivalent short circuit impedance by fuel type and reactive power control mode and settings by fuel type to be used for all DER submitted by that entity until further notice of assumptions changes by that entity.

The DER information shall be submitted in IDEV or PSSE (*.raw) format, representing the aggregate DER connected and proposing interconnection at the transmission bus using the data record for generators.

DER being studied through DER AFS shall be submitted via email to DER-AFS@misoenergy.org.

8.3.2.4 Modeling Assumptions and Inputs

MISO selects the latest DPP Phase 3 model at the time a new DER AFS cycle is initiated. MISO selects peak and shoulder peak models based on Section 6.1.1.1.2 of this BPM.

MISO has a partial view of existing DER, which is included as negative load in the MTEP models when reported by members. MISO will include all new DER information submitted for a given cycle but will not include previous cycle information unless submitted by the TO for the current DER AFS cycle or submitted as part of MISO's modeling business practices.

DER will be dispatched against local area generators as defined by the MTEP model "area number."

8.3.2.5 Voltage and Thermal Analysis and Constraint Criteria

MISO will perform thermal and voltage analysis that include each DER Substation qualifying for a DER AFS.

MISO shall use the same thermal analysis and constraints outlined in Sections 6.1.1.1 and 6.1.1.1.8 in this BPM, respectively. The deliverability analysis in Section 6.1.1.1.9 of this BPM is not included in the DER AFS study.

MISO will use the same voltage analysis and constraints outlined in Section 6.1.1.2 of this BPM, which references Local Balancing Authority criteria.

MISO plans to use PSSE and TARA to perform steady state powerflow analysis and transfer limit calculations, aligned with the current business practice in Section 6.1.1.1.7 of this BPM.

8.3.3. Report

MISO will prepare two versions of the DER AFS report:

- A **Public version** of the draft DER AFS report will be posted on MISO's public-facing website for the TO, EDC, DER Customer(s), and other interested parties (e.g., RERRA) to view high-level results. This version will document any system impacts found along with indicative estimates for any Network Upgrades needed to mitigate the impacts.
- A **Confidential version** of the DER AFS report with Critical Energy/Electric Infrastructure Information[34] (CEII) will be available to the TO, EDC, and DER Customer(s), as appropriate, with restricted access.
    a. CEII version is only needed if network upgrades are required
    b. Parties with access could view detailed study contingency and network upgrade information which would be shared with the EDCs as needed

Since the DER AFS consider cumulative DER at the substation level, MISO does not attribute impacts to specific DER. The entity responsible for managing the RERRA-jurisdictional interconnection process (e.g., EDC) would be responsible for disaggregating the results, when relevant, to assign impacts and Facilities Study deposit funding.

The DER AFS report will provide information needed to disaggregate DER Substation impact results. The thermal impacts can be disaggregated using simple linear impacts and cost assignment methodology, applying a dollars per kilowatt ($/kW) of DER capacity. Voltage impacts will be shown in a table, similar to MISO's SPP study Steady State Voltage Violations tables in Appendix B of the MISO-SPP study[35], to allow for impacts assignment. If cumulative impacts are 1% or greater, study report impacts are assigned per DER Substation based on voltage impact contributions.

[34] FERC, Critical Energy/Electric Infrastructure Information (CEII). Accessed 10/12/22. Information available at: https://www.ferc.gov/ceii
[35] MISO, Leidos, MISO Affected Systems Studies for SPP Projects Phase II April 2021. Available at: https://opsportal.spp.org/documents/studies/files/2017_Generation_Studies/FinalReport-MISO_AFS-2017-DISIS_v2.0.pdf

If the DER AFS finds constraints, MISO will contact the TO to collaborate on mitigations and planning-level estimates before the DER AFS draft report is posted.

MISO will hold a 10 business day comment period for affected TOs, EDCs, RERRAs, and/or DER Customers to share comments. Affected parties are invited to send feedback to MISO via email with the unique DER Substation study identifier in the subject line. MISO will respond to all feedback.

When impacts are identified that require a Facilities Study, the DER Substation has 10 business days to fund the Facilities Study deposit in order to remain active in that cycle of MISO's DER AFS process. Should the DER Substation not fund the Facilities Study deposit, the DER at the DER Substation may be submitted to the next DER AFS cycle.

8.3.4. Facilities Studies and Network Upgrades

The Facilities Study process is used to estimate cost and timeframes for constructing Network Upgrades. Details of the process are currently found in Sections 5.4.3 and 5.4.5 of this BPM. The Facilities Study will list the required upgrades and include a categorized detailed cost breakdown of identified facilities, consistent with Sections 6.2.2 and 6.2.3 of this BPM. Facilities Study cost is not included in the original DER AFS study deposit for MISO study. Therefore, if the MISO DER AFS study identifies violations and Network Upgrade mitigations, additional funding for Facilities Study will be required. The TO will have 30 business days to return the Facilities Study agreement and deposit after MISO issues the final DER AFS Report. After the Facilities Study, a MISO MPFCA[36] is needed between MISO, the TO, and DER Customers. If there is only one DER Customer, then a MISO Facilities Construction Agreement[37] in Section 7.2 would be used in place of the MISO MPFCA.

MISO is not proposing a cost-sharing mechanism between the DPP and DER AFS process.

[36] MISO, Tariff Attachment X: Appendix 9, Multi-Party Facilities Construction Agreement. Available at: https://docs.misoenergy.org/legalcontent/Attachment_X-Appendix_9_-_Multi-Party_Facilities_Construction_Agreement_%28MPFCA%29.pdf

[37] MISO, Tariff Attachment X: Appendix 8, Facilities Construction Agreement. Available at: https://docs.misoenergy.org/legalcontent/Attachment_X-Appendix_8_-_Facilities_Construction_Agreement_%28FCA%29.pdf

8.3.5. Tracking and Reporting Information

MISO will make reporting information to be publicly available and updated with each DER AFS cycle. The following information will be reported for each DER Substation included in screening or study activities:

- Transmission Owner
- Total Connected DER
- Date of last MISO Screen
    a. 1% Screen (Pass/Fail)
    b. Net Injection (0 – 5 MW) Screen (Pass/Fail)
    c. Net Injection (greater than 5 MW) Screen (Pass/Fail)
- Ongoing AFS (Y/N)
- Total Pending DER in current DER AFS
- Number of completed DER AFS Studies
- Upgrades Identified (Y/N)

8.9. Non-binding Dispute Resolution

All disputes arising under section 13.5.2 of Attachment X are initially subject to the informal dispute resolution process described in 13.5.1 of Attachment X. All requests that proceed to Non-binding Dispute Resolution shall be initiated through the submission of a properly completed Request for Non-binding Dispute Resolution form (Appendix GF hereto) to the [ginterconnection@misoenergy.org] email address. The Party initiating a dispute shall provide the following information at the time of dispute initiation:

- The identity of the party making the request;
- The identity of the party with whom the dispute is being raised;
- The identity, if known, of any other parties who may be impacted by the outcome of the dispute being raised;
- A summary of the factual information giving rise to the dispute, including steps taken to resolve the dispute;
- Citations to any authority governing the dispute (i.e., applicable sections of the Tariff, MISO Agreement, Business Practices Manuals and/or any other applicable authority);
- The desired outcome of the Non-binding dispute resolution process; and
- Contact information as specified in Appendix GF.

Appendix F

Example Screening of DER Substation After a DER AFS

1. "Lake Substation" has DER interconnection requests that equate to 5.5 MW of DER Net Injection onto transmission at summer peak and/or shoulder peak.
2. TO performs 5 MW Net Injection screen and requests a MISO study.
3. MISO performs DER Affected Systems Study and determines no impacts.
4. An additional 0.5 MW of DER Net Injection is proposed at Lake Substation.
5. The TO considers the aggregate 6 MW of DER Net Injection with the new 1 MW screening dead band limit (currently set at 6.5 MW for Lake Substation) and determines no request for study is needed. Should the TO request a study, MISO would review records and respond that none is needed.
6. An additional 0.75 MW of DER is proposed at Lake Substation.
7. The TO applies the aggregate 6.75 MW of DER Net Injection against 6.5 MW dead band limit and requests a MISO study for new/incremental 1.25 MW of DER Net Injection with impacts assignment applicable to the 0.75 MW triggering a DER AFS.