ERCOT ISO
INDEPENDENT SYSTEM OPERATOR
Reliability - Competition - Comparability

GENERATION INTERCONNECTION PROCEDURE

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PROPOSED IMPLEMENTATION DATE: SEPTEMBER 1, 1999

ERCOT ISO
2705 West Lake Drive
Taylor, Texas 76574-2136
Main Office Phone (512) 248-3000
Main Office FAX (512) 248-3095

PURPOSE

Facilitate the interconnection of new generating plants to the Electric Reliability Council of Texas, Inc. (ERCOT) transmission system. Identify security concerns with interconnecting new generation. Increase communications between the Generating Entity (GE), Transmission Service Providers (TSP) and Independent System Operator (ISO). Provide information on future capacity additions for use in reviewing projected total ERCOT capability, demand and reserve. Provide data to help identify possible future transmission constraints and propose related transmission projects.

INTRODUCTION

A GE requesting transmission interconnection must submit an application to the ERCOT ISO. The request shall include information necessary to allow timely development, design, and implementation of electric system enhancements needed to reliably serve the generation entity requirements. System modeling is the first step toward reliable interconnected transmission systems. The timely development of system modeling data to realistically simulate the electrical behavior of the components in the interconnected networks is the only means to accurately plan for reliability. The data must include sufficient detail for use in establishing transfer capabilities, operating limits and planning margins to provide both reliability and operating efficiency, design future system facility additions, and facilitate coordinated planning. Applicable ERCOT and National Electric Reliability Council (NERC) standards, guides and/or procedures for accurate system representation and modeling shall be followed.

The major question that a GE would like answered is what transmission limits/constraints will affect operation of their proposed generation facility. They would also like to know what transmission additions would be required to provide full delivery of their generation, the time required to build such facilities and the probability that such facilities can be constructed. The new rule requires a TSP to build facilities to interconnect a new generating plant. The transmission rule indicates that the interconnection planning will include transmission line interconnection and grid upgrading. See Public Utility Commission of Texas (PUCT) Substantive Rules §§25.191(e)(4) and 25.195(e)(2). But, how much transmission should be built to interconnect a new generation facility? A key is common understanding of the phrase "build to interconnect". Does this mean "build direct connects", "build to allow sales somewhere", or "build to allow sales anywhere"? There is a big difference in the amount of facilities to build for each of these different scenarios. The rule does not address what additional transmission facilities may be required for the new generator to reach the market or all customers in ERCOT and outside of ERCOT. The TSPs shall provide transmission service including the construction of the transmission line and upgrading the transmission grid within reasonable effort considering economics and good faith utility practice.

Direct connects can probably be built by TSP without obtaining a Certificate of Convenience and Necessity (CCN). If they have to build a substation or short span of transmission line, for example, the Commission's rules may not require a CCN. Building full interconnection facilities may or may not require a CCN, depending upon the circumstances specific to the individual project and is addressed in the appropriate sections of the PUCT rules. When the ISO identifies specific transmission expansion that will facilitate the competitive market while mitigating any constraints, the ISO will develop transmission additions using the ISO transmission planning procedures. The generation owner should identify expected markets, and the ISO and the TSPs would identify transmission constraints that impair the generator's ability to reach those markets. In many instances, additional transmission lines would be needed for the generator to reach the market. In such cases, the ISO's evaluation of need would be important, but the Commission would decide whether the transmission line should be built via the CCN process.

Both new transmission line construction and some line reconstruction require the approval of the PUCT, granted in the form of a CCN. The present PUCT rules allow the PUCT up to 12 months for processing a CCN (PUCT Substantive Rules §§25.101(c)(4)). The need to use a consultant to route future transmission lines and the TSP to hold public meetings also adds around 12 months to the time required to certificate and build a new transmission line. In most new transmission projects the acquisition of right-of-way and construction will take 10 to 12 months after a CCN is granted by the PUCT. As a result, firm commitments must be made **at least three years ahead** of required in-service dates for most transmission line projects and some projects may require commitments four to five years in advance of system needs. To address concerns about CCN processing times for critical reliability projects, the PUCT has adopted rules that require CCNs to be processed in six months for projects designated as critical to reliability by the ISO.

STUDY TIME TABLE

Every interconnection may be different and unique to the particular project. A timetable for studies will be developed and included in the study scope. Interconnection requests requiring major improvements to the transmission system should be identified early in the process so project validity can be considered before going ahead with extensive studies. Adjustments to the completion date of review may be necessary for the study scope. If adjustments are necessary for the study scope, the ISO shall notify as soon as practicable both the GE and the TSP, indicating the revised expected completion date. Some areas of these procedures may be done in parallel with other parts, example: interconnection agreement negotiations can be conducted while studies are being performed. TSP and the GE are encouraged to optimize the process to reduce the time necessary for the studies.

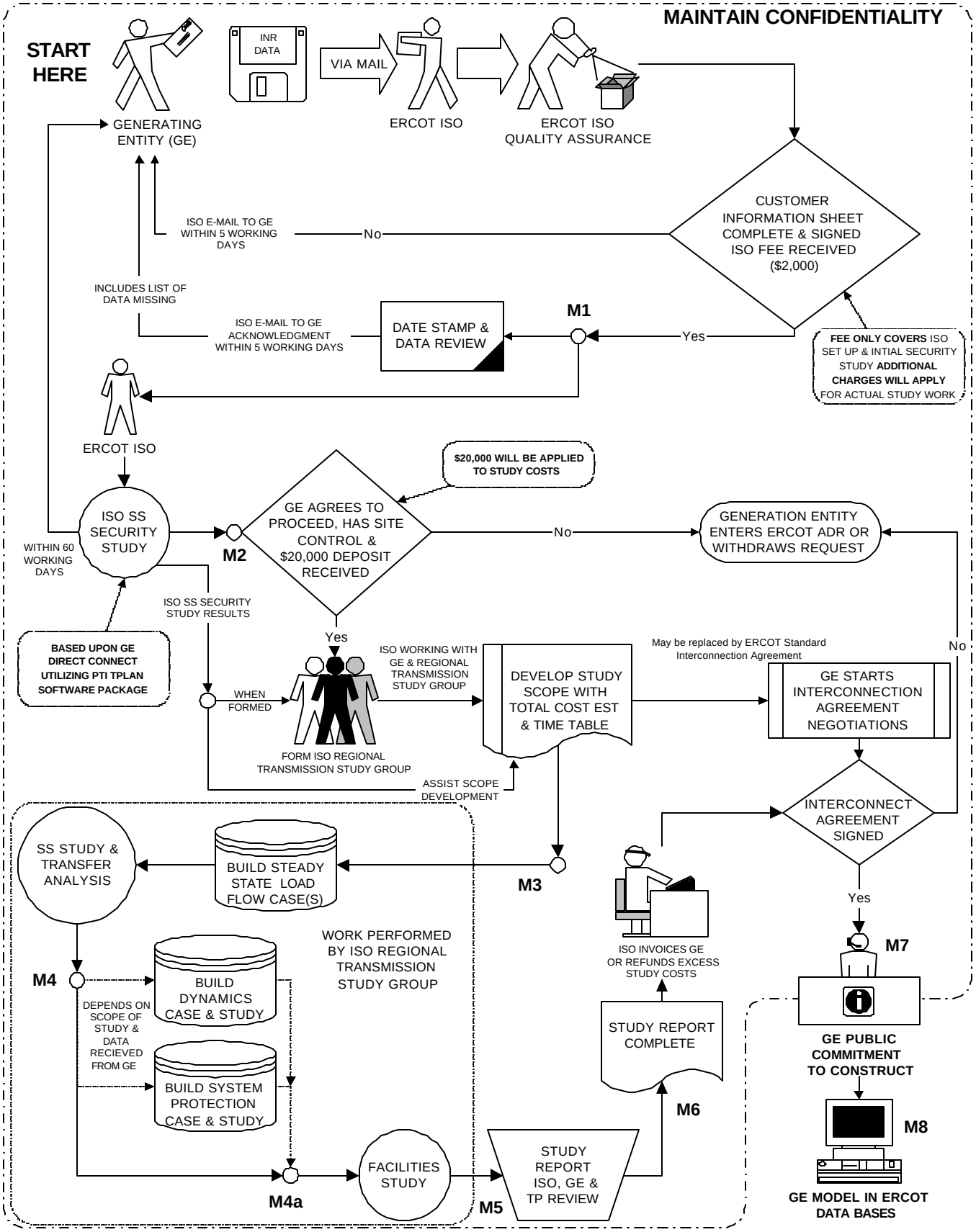
Sample Study Time Table:

M1	ISO Review of Request and Acknowledgement	1 to 5 working days
M2	ISO Performs Steady State Security Study	3 to 59 working days
M3	GE Agrees to Proceed, Deposit & Site Control Received	?
	Form ISO Study Group and Set Meeting	1 to 5 working days
M4	Develop Study Scope	2 to 10 working days
	Perform Full Interconnection Study	
	M5 Steady State & Transfer Analysis Study	10 to 60 working days
	M6 Dynamics Analysis	10 to 60 working days, after Steady State Study
	M6 System Protection Analysis	10 to 20 working days, after Steady State Study
	M7 Facilities Study	10 to 20 working days
M8	Study Report Review	5 to 15 working days
	Total Range of Possible Study Time	52 to 254 working days
	Typical Study Time	60 to 90 working days

INTERCONNECTION AGREEMENTS

The ERCOT ISO is the proper place to submit the request for generation interconnection. However, the negotiation of an interconnection agreement shall be addressed directly between the GE and TSP. The ERCOT ISO does not arrange interconnection agreements. An ERCOT Standard Interconnection Agreement is being developed and will be promulgated by the PUCT.

ERCOT Generation Interconnection Process



CONFIDENTIALITY

Generation interconnection information and data are considered proprietary and market sensitive information and should not be publicly released until appropriate authorization has been received. To preserve the integrity of the marketplace, it is essential that such proprietary and market sensitive information not be disclosed to other market participants. This information will not be made public until transmission providers reviews are completed and the generating customer has made a public commitment to construct. To insure that such data, documents and/or information continue to keep its confidential nature, the following guidelines shall apply:

Confidentiality Guidelines

1. The Transmission Service Providers (TSP) shall keep any data, documents and/or information provided by the ISO and generation entity (GE) confidential and will not disclose it to anyone outside the TSP organization except at the written direction of the GE, and only to those TSP employees and/or TSP appointed officials who require its review to accomplish the goals in obtaining the information. Information and data shall be provided only to those individuals within the TSP who need to act on it.
2. The TSP will not copy, by mechanical reproduction, in writing or in any other form, any of the data, documents and/or information provided for dispersion within the TSP unless copying is performed by one of the employees or officials allowed to receive the information or their assistants. Any documents provided and/or copied by the TSP will be dispersed to the TSP employees in a secure manner.
3. The TSP shall keep the data, documents and/or information in a safe and secure manner during its use of the information.
4. The TSP shall destroy, in a confidential manner, the data, documents and/or information provided at the time the data, documents and/or information is no longer needed.
5. The data and information shall not be stored or posted on any unsecured computer network, Intranet or Internet. Data should only be shared between individuals within the TSP who need it to perform studies; review study results or negotiates an Interconnection Agreement.
6. Generation project data and information should not be discussed at any open meeting (TSP, ERCOT, etc…).
7. Generation projects shall not be discussed outside of the work environment or with any other TSP not included in the study group. Informal discussions within TSP companies should be discouraged.
8. TSP shall not discuss or disclose information about generation projects to outside parties even if the project has been publicly announced, unless authorized by the GE to do so.
9. TSP should include all generation projects under construction and may include all known generation projects in an area in their studies. General information should be provided to the GE if it has significant impact on the study results. But, specific project information (net amounts, number of units, type of units, fuel type, generating company, specific location, etc…) shall NOT be included in the study report or discussed with generating customers.
10. When an interconnection agreement is reached, the project will be regarded as a confirmed project. At this time, the ISO and TSP will add the project to ERCOT databases as a summation of the plant. Detailed plant & unit specific data shall be withheld from the ERCOT databases until the plant goes into commercial operation. When the plant goes into commercial operation, all detailed data will become public and added to the ERCOT databases (including power flow base cases, stability, system protection, CDR, etc…).

A failure by the TSP to observe these guidelines is not to be construed as a waiver by the ERCOT and/or the ISO of the confidential nature of the information.

The GE should understand that Interconnection Agreements and Transmission Line CCN applications are filed at the Public Utility Commission of Texas by TSP. When these applications are filed at the Public Utility Commission of Texas, TSP can request confidentiality for proprietary or sensitive information. Most of the information contained in these documents becomes public record unless confidentiality is requested.

ISO & TSP REVIEW

After a request, fee and data have been received; the ISO will date stamp the request. This date stamp is <u>not</u> a reservation of transmission capacity, planned or unplanned. The ISO acknowledges the request via email and notifies the GE of missing data within five working days. The ISO will then perform a steady state security study (including load flow and transfer studies) to determine the feasibility of the site for interconnection. This study will indicate the level at which the generator can expect to operate simultaneously with other generation in the area before significant transmission additions are made.

Based upon the security study, the ISO will make a very rough estimate of the transmission needed to integrate the new generation. This information will be presented to the GE requesting interconnection and the ISO will inform the GE about the basic system additions for the security and reliability that will be required. The ISO will inform the GE if it considers the proposed site to be inappropriate to the point that the ISO will not support the addition of transmission needed to integrate it into the transmission system. Based on this information, the GE provider can decide independently whether it wants to request interconnection or withdraw the application. If the GE decides to go forward at the named site, the ISO will then initiate a full interconnection study.

Before a full interconnection study begins, the GE must submit to the ISO a deposit of $20,000 and demonstrate and maintain control of the site on which the generator is to be constructed. The applicant must demonstrate, through an affiliated company, through a trustee or directly in its name: (a) that it is the owner in fee simple of the real property for which new interconnection is sought; or (b) that it holds a valid written leasehold interest in the real property for which new interconnection is sought; or (c) that it holds a valid written option to purchase or leasehold property for which new interconnection is sought; or (d) that it holds a duly executed written contract to purchase or leasehold the real property for which new interconnection is sought. Site control must be maintained throughout the duration of the study until the establishment of an Interconnection Agreement. Otherwise, the request will be deemed withdrawn as of the date of loss of site control, unless the applicant can show within 30 days that it has re-established site control or has established control of a new site which would not result in the material modification of any study requested under these procedures.

The $20,000 deposit will be applied toward study costs when the study is completed. The ISO will invoice the GE for any additional work that was necessary greater than the deposit or will refund any remaining funds not used to perform in the study.

To perform the full interconnection study the ISO will utilize the assistance of the TSPs where necessary. This is often driven by the need to study the effects on the more localized transmission systems of bulk power facility outages after new generation is in service and operating. The TSPs are also aware of actual physical circumstances in the area of the project that can support or counter the interconnection of generation. The assistance of more than one TSP may be required in areas where transmission facilities are provided by multiple entities. In that event the ISO will lead a regional planning effort. The ISO will maintain the lead role in this study and may include additional load flow analysis, transient analysis, system protection analysis and facilities analysis.

The full study group made up of one or more TSP and the ISO will be formed with the ISO as study group leader/manager. The GE along with the ISO study group will develop the study scope that includes assumptions, timetable, study cost estimate(s) and determination of requirements for interconnection. The study scope can be minimal, very detailed or a phased study. The ISO steady state security study and other preliminary studies provided by the GE shall be considered when developing the study scope. Providing these studies may reduce the work and/or the time necessary for the studies. The phased study can be separated in several sections with notice to proceed from the GE required for each section. This can limit the GE's costs if the project is not viable at the selected location. When assistance is required, the appropriate TSP will submit a cost proposal to the ISO for their part of the study. The ISO will determine a final estimate to the GE for the full study. If the GE approves the study proposal and scope, provides the required deposit and site control, the ISO will initiate and supervise the full study. The generation entity requesting interconnection is responsible for all costs of the study. A payment methodology and cancellation provision will be included in the study scope. If the GE cancels the generating project during the study they are required to immediately notify the ISO. The GE is responsible for all costs associated with any work performed or non-cancelable commitments made prior to the notice date.

When the full study is completed, the GE and study group shall examine the results and provide any comments within ten working days. The study report shall be produced and provided to the GE and all TSPs in the study group. When interconnection agreement is reached, this project will be regarded as a confirmed project. At this time, the ISO and TSP will add this project to ERCOT databases as a summation of the plant. Due to market considerations, detailed plant & unit specific data shall be withheld from the ERCOT databases until the plant goes into commercial operation project. When it goes into commercial operation, all detailed data will become public and added to the ERCOT databases (including power flow base cases, stability, system protection, CDR, etc…).

Generation Interconnection Study Guidelines

Each generation resource which constitutes a separate generation interconnection will be an individual study analyzed separately from all other such requests unless additional studies are specified and agreed to by the GE.

With the concurrence of the ISO, the GE may specify any reasonable allocation of the resource's output among load serving entities (LSE) in the study cases. Absent such specification by the GE, the ISO, for study purposes, will assume the output is used to displace proportionately unspecified generation resources in ERCOT. The ISO will determine how to treat any output remaining after displacement on a case-by-case basis. (e.g., the ISO could proportionally increase all ERCOT loads in an aggregate amount to balance the resource's output).

Since Generation Interconnection Requests are not transmission service requests, every GE should understand that another security study might be necessary when/if a load serving entity (LSE) requests Planned Service from this generating resource. The ISO, TSP and LSE must mutually agree upon this additional study.

Simulation of the future transmission grid is necessary to develop these studies. Such simulation, however, requires several types of forecasted information that is supplied by the ERCOT transmission customers. Diversified station load forecasts are derived from the customers' total system load forecasts and undiversified station load forecasts. The customers' distribution requirements, including new substations as well as the load forecasts mentioned, are all communicated to the ISO through the Annual Planned Service Request (APSR) process. The schedule of future generation resources is also provided to the ISO via the APSR process. A large number of the future generation resources shown by LSEs for years 2 through 5 or 10 are unspecified, that is, no commitments have been made. Forecasted generating unit commitment schedules and output levels are formulated with guidance from each customer.

The performance criterion used in evaluating system security includes the NERC Planning Standards and the ERCOT Planning Criteria.

The study process begins with computer modeling of the generation and transmission facilities, and loads under normal conditions. Contingency conditions that might be expected to take place in future operation of the transmission grid are also modeled. To maintain adequate service and minimize interruptions of service during facility outages, model simulations are used to identify adverse results and examine the effectiveness of various alternatives in alleviating those adverse results.

The effectiveness of each grid configuration and facility change must be evaluated under a variety of possible operating environments because future loads and operating conditions cannot be predicted with certainty. As a result, repeated simulations are often required. In addition, alternatives considered for future installation may affect other alternatives so that several different combinations must be evaluated, thereby multiplying the number of simulations required.

Once feasible alternatives have been identified, the process is continued with a rough cost comparison of those alternatives. In comparing these costs to determine the most favorable alternative, the short-range and long-range effectiveness of each alternative must be considered from both a cost and reliability standpoint. Consideration is also given to operating flexibility and compatibility with future plans. The ISO will propose the most effective transmission additions to the GE and TSP.

To define the additional transmission facilities necessary to reliably accommodate the addition of the generation resource; that is the subject of the request, the guidelines below shall be used unless otherwise directed by the ISO.

Steady-State Analyses (load flow, power flow, transfer analysis)

1. Approved ERCOT SSTF Base Cases shall be used as the starting point for the creation of study base cases. Any non-existing transmission facility expected to significantly affect the study results and not already determined by the ISO to be necessary shall be removed. The expected generation resource commitment/dispatch for each year and load condition represented by the base cases, to the extent such is not already included in the SSTF Base Cases, shall be provided by the LSEs and included in the study base cases; however, the aggregated output of an LSE's resources shall not exceed that LSE's expected total load (including losses) in any study. Each resource included in the base cases must be either a) approved by the ISO as a designated planned resource, b) an unspecified resource whose location has been approved by the ISO, or c) other resource specifically directed by the ISO to be included. Unless otherwise directed by the ISO, other information in the study base cases shall be consistent with information submitted by the LSEs in the ISO's Planned Service Request procedures. (The study base cases shall incorporate the resource that is the subject of the generation interconnection request as described above.)

   The ISO shall consider unspecified resources existing in the SSTF Base Cases and, if and as appropriate, shall direct the specific relocation of such resources in the study base cases to ensure that their influence upon the study results is minimal. In addition, the ISO may direct that resources proposed in other prior Generation Interconnection Requests be included in the study base cases if and, as it deems appropriate.

2. Using the study base cases, the ISO shall perform contingency analyses as outlined in the ERCOT Planning Criteria (includes NERC Planning Standards) and identify any additional transmission facilities necessary to ensure that expected system performance conforms to the standards in that criteria. Transmission facility additions that are infeasible due to time constraints or other reasons will not be studied. If transmission service cannot be accommodated due to project lead-time, such information will be communicated to the GE by the ISO. This inability to export the full amount of power during the first years of operation may be acceptable to the GE and should be fully discussed.

   Loss-of-generation analyses shall assume that the lost generation will be replaced from all remaining ERCOT units in proportion to their nominal capacity (i.e., inertial response) and respect generation limits.

3. In addition, for each study base case condition, the ISO shall attempt to identify for each LSE a reasonable alternative commitment/dispatch of the units designated by that LSE which, if implemented, would result in the more severe violations of the ERCOT Planning Criteria. Such alternative resource use shall be used to create an alternative base case that shall be analyzed by the ISO as in 2, above. Only the resources of a single LSE shall be altered in any single alternative base case.

4. Additional alternative base cases shall be created and studies performed as described in 3) until all transmission facilities necessary to reliably accommodate anticipated alternative commitment/dispatch by an LSE have been identified.

5. For study purposes, a reduction in the output of one LSE's Planned Resource shall not be a condition for the reliable accommodation of the Planned Resource of another LSE or the resource which is the subject of the generation interconnection request.

6. The ISO is responsible for analyses of any contingency outages anticipated to result in study criteria violations, regardless of which TSP owns the facilities involved. If outages appear to result in ERCOT Planning Criteria violations that involve the facilities of other TSP, they are responsible for attempting to verify the validity of the indicated violations and notifying the other TSP.

Transient Analyses (unit stability, voltage, subsynchronous resonance)

7. Transient stability studies will be performed where stability concerns exist. In the performance of such studies, all existing or committed generation in the area of study will normally be represented at full net output, including resources for which Planned Service has not been requested. Any resulting increase in generation will be balanced as addressed in the study scope. The study scope shall be defined by the ISO study group, the ISO, and the GE.

8. Stability study base cases shall be formed from the latest available approved ERCOT SSTF Base Cases which are consistent with the most recently approved ERCOT DTF Stability Data Base. The transmission configuration in the area of study included in a stability study base case shall be identical to that used in the steady-state studies of the same period.

9. Any generation resource in a stability study base case for which data is not available in the most recently approved ERCOT Stability Data Base or for which data is not otherwise provided to the ISO and ERCOT SSTF will be removed from the case, and a corresponding reduction to the load in the LSE utilizing such resource will be uniformly applied.

10. Stability studies shall be performed in accordance with requirements of the ERCOT Planning Criteria and shall identify additional transmission facilities or other actions necessary to ensure conformance to that standard.

11. Other types of analyses, such as voltage stability or subsynchronous resonance studies, will be defined in the study scope, if and as warranted.

System Protection (short circuit)

12. The study scope will specify where short circuit fault duties will be calculated and documented. The ISO along with the TSP shall determine if the interconnection of the generating plant and associated transmission system modifications cause any transmission facility to violate the TSP short circuit criteria. The ISO along with the TSP shall then determine what system improvements, if any, are necessary to address such violations. The ISO along with the TSP shall also determine the available fault currents at the interconnection substation for relay setting purposes

Study Schedule

13. The ISO shall complete studies of Generation Interconnection Requests on a schedule mutually agreeable to the GE and the study group.

GE REACTIVE POWER REQUIREMENTS

Sufficient reactive resources must be located throughout the electric systems, with a balance between static and dynamic characteristics. Both static and dynamic reactive power resources are needed to supply the reactive power requirements of customer demands and the reactive power losses in the transmission and distribution systems, and provide adequate system voltage support and control. They are also necessary to avoid voltage instability and widespread system collapse following certain contingencies. Transmission systems cannot perform their intended functions without an adequate reactive power supply.

Dynamic reactive power support and voltage controls are essential during power system disturbances. Synchronous generators, synchronous condensers, static var compensators (SVCs and STATCOMs) and series capacitors can provide dynamic support. SVCs and similar equipment are shunt devices and are not equivalent in all cases to synchronous machines. Transmission line charging and series and shunt capacitors are also sources of reactive support, but are static sources.

Reactive power sources must be distributed throughout the electric systems among the generation, transmission, and distribution facilities, as well as at some customer locations. Because customer reactive demands and facility loadings are constantly changing, coordination of distribution and transmission reactive power is required. Unlike active or real power (MWs), reactive power (Mvars) cannot be transmitted over long distances and must be supplied locally.

Generation Reactive Capability

Generator reactive capability is commonly derived from the generator real and reactive capability curves supplied by the manufacturer. Reactive power generation limits derived in this manner can be optimistic as heating or auxiliary bus voltage limits may be encountered before the generator reaches its maximum sustained reactive power capability. Manufacturer-provided design data may also not accurately reflect the characteristics of operational field equipment because settings can drift and components deteriorate over time. Field personnel may also change equipment settings (to resolve specific local problems) that may not be communicated to those responsible for developing a system modeling database and conducting system assessments. It is important to know the actual reactive power limits, control settings, and response times of generation equipment and to represent this information accurately in the system modeling data that is supplied to those entities responsible for the reliability of the interconnected transmission systems. Any limitations shall be reported to the ISO and TSP before the generation facility goes into commercial operation. **Any updates to this information must be provided to the ISO and TSP within 60 days as changes or upgrades are made during the life of the plant.**

Generation owners and transmission service providers should work jointly to optimize the use of generator reactive power capability. These joint efforts should include:

A. Coordination of generator step-up transformer impedance and tap specifications and settings,
B. Calculation of underexcited limits based on machine thermal and stability considerations, and
C. Ensuring that the full range of generator reactive power capability is available for applicable normal and emergency network voltage ranges.

Unless otherwise specifically approved by the ISO, new synchronous generator installations shall have the following reactive capability requirements at the generator's continuous rated power output:

1) an overexcited power factor capability, measured at the generator terminals, of 0.9 or less and an underexcited power factor capability of 0.95 or less; and
2) an overexcited power factor capability, measured at the unit main transformer high voltage terminals (transmission voltage side), of 0.95 or less and an underexcited power factor capability of 0.95 or less.

If specifically approved by the ISO, a synchronous generator may be exempted from this requirement, however, if such an exemption is approved, the GE and TSP provider must make alternate arrangements for supplying an equivalent dynamic reactive power capability as necessary to meet the area’s reactive power requirements.

GE HARMONICS REQUIREMENTS

PUCT Substantive Rule §25.51. Power Quality

(c) Harmonics. In 60 Hertz electric power systems, a harmonic is a sinusoidal component of the 60 Hertz fundamental wave having a frequency that is an integral multiple of the fundamental frequency. "Excessive harmonics," in this subsection, shall mean levels of current or voltage distortion at the point of common coupling between the electric utility and the customer outside the levels recommended in the IEEE standard referenced in paragraph (1) of this section. Each electric utility shall assist every customer affected with problems caused by excessive harmonics and customers affected in exceptional cases as described in paragraph (5) of this section.

(1) Applicable standards. In addressing harmonics problems, the electric utility and the customer shall implement to the extent reasonably practicable and in conformance with prudent operation the practices outlined in IEEE Standard 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems, or any successor IEEE standard, to the extent not inconsistent with law, including state and federal statutes, orders, and regulations, and applicable municipal regulations.

(2) Investigation. After notice by a customer that it is experiencing problems caused by harmonics, or if an electric utility otherwise becomes aware of harmonics conditions adversely affecting a customer, the electric utility shall determine whether the condition constitutes excessive harmonics. If so, the electric utility shall investigate and determine the cause of the excessive harmonics.

(3) Excessive harmonics created by customer. If an electric utility determines that a customer has created excessive harmonics that causes or are reasonably likely to cause another customer to receive unsafe, unreliable or inadequate electric service, the electric utility shall provide written notice to the customer creating excessive harmonics. The notice shall state that the utility has determined that the customer has created an excessive harmonics condition and that the utility has explained the source and consequences of the harmonics problem. The notice shall give the customer two options to cure the problem.

(A) The electric utility may cure the problem by working on the customer's electric facilities at a mutually agreeable time and assess the repair costs to the customer.

(B) The customer may elect to cure the problem at its option and its cost, but the remedy must occur within a reasonable time, which will be specified in the notice.

(4) Failure of the customer to remedy the problem. Failure of the customer to remedy the problem may require the electric utility to disconnect the customer's service. The electric utility shall then remedy the excessive harmonics condition, or the electric utility may determine that the customer has remedied the condition within the time specified. In the event the customer refuses to allow the electric utility to remedy the problem and does not stop creating excessive harmonics within the time specified, the electric utility may disconnect the customer's service. Before disconnecting pursuant to this subsection, the electric utility must provide written notice of its intent to disconnect at least five working days before doing so, unless the customer grants the utility access to its electric facilities or ceases creating excessive harmonics. The electric utility may disconnect the customer five working days after providing the notice, unless the customer grants the electric utility access to its electric facilities or ceases creating excessive harmonics.

(5) Excessive harmonics created by an electric utility or third party. If an electric utility determines that its operation or facilities, or the operations or facilities of a third party other than a customer, created excessive harmonics that causes or is reasonably likely to cause a customer to receive unsafe, unreliable or inadequate electric service, the electric utility shall remedy the excessive harmonics condition at the earliest practical date.

(6) Excessive total harmonic distortion created by two or more harmonic sources within IEEE 519 limits. If, in its investigation of a harmonics problem, an electric utility determines that two or more customers' harmonic loads are individually within IEEE 519 limits but the sum of the loads are in excess of the IEEE 519 limits, the utility may require each customer to reduce its harmonic levels beyond the limits specified in IEEE 519.

GE POWER SYSTEM STABILIZER REQUIREMENTS

Many studies of the ERCOT transmission system have been or are currently being performed. Several of these studies have indicated that with the addition of new generation the transmission system will be utilized up to or near its maximum capability. Several recent studies have indicated dynamic stability and small signal stability oscillations that can be mitigated by applying power system stabilizers (PSS) at existing and new generation sites. The incremental cost for a PSS is minimal and should be included for all new generation additions in ERCOT. The GE shall install a PSS on each new generating unit added unless specifically exempted from this requirement by the ISO. Many times the cost of a determination study is about the same cost as adding a stabilizer to the generation project.

Maintenance and periodic tuning of the stabilizer along with the exciter system is the only way to sustain the benefits of the PSS. It is necessary to re-tune the stabilizer/exciter system anytime the voltage regulation system (including field windings) is modified and/or local transmission system changes are made. The PSS and exciter system should also be tested every three to five years with the longest time period between testing being no longer than five years. A poorly tuned PSS and exciter system will adversely affect system stability and may result in oscillations. If these oscillations continue, it could result in separation of the transmission system, loss of generation and/or damage to generation units.

Generation owners and transmission service providers shall work jointly to prevent these possible adverse conditions by communicating changes in a timely manner.

ERCOT OPERATING GUIDES

The GE and any future owners of the project must comply with all applicable ERCOT & NERC requirements, including, without limitation, those contained in the ERCOT Operating Guides. It is understood and agreed that such requirements are subject to change from time to time, and such changes shall automatically become applicable to the GE based upon the effective date of the approved change.

Each GE is obligated to supply the generation capability and ancillary services for which it is contractually committed and to operate its facilities in compliance with operating requirements contained in the Operating Guides. Each GE will designate and make arrangements with a Generation Host Control Area to ensure its compliance with operating requirements, and will provide appropriate information, including its ability to provide emergency assistance, to its Generation Host Control Area and the ERCOT ISO.

Following is a checklist of some current ERCOT Guides information for generating units. This list is for the convenience of the GE and does not relieve the GE of the responsibility of complying with all requirements of the ERCOT Operating Guide:

- ❑ Generation facility is in an ERCOT Control Area and is being reported by that ERCOT Control Area to the ERCOT ISO in the manner as specified in Introduction - Section C of the ERCOT Guides, or any other applicable ERCOT agreement requiring information on generation
- ❑ MW telemetry is in place & operational to host control area & interconnected TSP
- ❑ Mvar telemetry is in place & operational to host control area & interconnected TSP
- ❑ MWh telemetry is in place & operational to host control area & interconnected TSP
- ❑ Mvarh telemetry is in place & operational to host control area & interconnected TSP
- ❑ Substation Status telemetry in place to host control area & interconnected TSP
- ❑ Voltage telemetry in place to host control area & interconnected TSP.
- ❑ Reliable voice communications in place to host control area & interconnected TSP
- ❑ Daily MW schedules being provided to host control area & interconnected TSP
- ❑ Fuel limitations being provided to host control area & interconnected TSP
- ❑ Hourly Capacity schedules being provided to host control area & interconnected TSP
- ❑ Seasonal capability where applicable, planned maintenance schedules, and anticipated capacity factor being provided to host control area & interconnected TSP
- ❑ Testing of unit performance in accordance with ERCOT Operating Guide No. I performed.
- ❑ Generation facility provides dispatchable output consistent with the operation of the facility and needs of the host Control Area and interconnected TSP in order that such entities can prevent system loading problems.
- ❑ Generation facility has automatic voltage regulators and power system stabilizers in service per ERCOT Operating Guide No. I.A.2.
- ❑ The appropriate host Control Area System Operator and TSP is able to dispatch the reactive output (VARS) of this generation facility within its design capability to maintain adequate voltage on the transmission system.
- ❑ The generation facility machine characteristics and plant design incorporate the underfrequency load shedding philosophy and criteria of ERCOT Operating Guide No. I.F. and ERCOT Operating Criteria (Section C of the Introduction). Inherent in this philosophy is the idea that all generators remain on line until all three load-shedding steps have been executed.
- ❑ The generation facility has protective relaying necessary to protect its equipment from abnormal conditions and is consistent with the interconnected TSP protective relaying criteria as described in ERCOT Operating Guide No. V.C.

INTERNET INFORMATION ADDRESS LIST

Our primary means of distributing data is via the Internet. The GE is encouraged to periodically review updated information on the various ERCOT & NERC sites.

ERCOT Home Page	*http://www.ercot.com*
ERCOT OASIS	*http://oasis.ercot-iso.com*
ERCOT Operating Guides	*http://www.ercot.com/eguides.htm*
ERCOT ISO Transmission Market Operations	*http://oasis.ercot-iso.com/tmoindex.htm*
Public Utility Commission of Texas	*http://www.puc.state.tx.us/*
North American Electric Reliability Council	*http://www.nerc.com/*
NERC Operating and Planning Standards	*http://www.nerc.com/standards/*

SUBMITTING YOUR REQUEST

ADDRESS TO SUBMIT REQUEST

All interconnection requests should be sent to the following address:

GENERATION INTERCONNECTION REQUEST
ATTN: DAVID KASPER
ERCOT INDEPENDENT SYSTEM OPERATOR
2705 WEST LAKE DRIVE
TAYLOR, TEXAS 76574-2136

In order to clearly identify the application and timely process the request, GENERATION INTERCONNECTION REQUEST should be the first line of the address.

The request for service and complete data must be received in writing at the ISO. Facsimile (FAX) and Internet email or other electronic request for interconnection will not be accepted. This is necessary to maintain a fair and consistent date and time stamp.

REQUEST FEE

To cover preliminary ERCOT ISO costs, a $2,000.00 nonrefundable fee should be included with the request. Checks should be made out to Electric Reliability Council of Texas, Inc. This fee is based upon 24 hours of work and only covers ISO setup and steady state security study. Additional charges will apply if more than 24 hours of work is required for the security study and for the full interconnection study.

QUESTIONS

Any questions concerning the Generation Interconnection Procedure should be directed to David Kasper at (512) 248-3014 e-mail: dkasper@ercot-iso.com or Ken Donohoo at (512) 248-3003 e-mail: kdonohoo@ercot-iso.com

NAMING CONVENTION

To facilitate reliable communication between the ISO, eligible customers and transmission providers, all interconnection requests will be named by the ISO according to the following convention:

YR**INR**XXXX

where:	YR	Calendar Year the Generation is online (98, 00, 01)
	INR	Indicates Interconnection Request
	XXXX	Sequence Number beginning with 1

The ISO will assign a name, and send an acknowledgment in response to each request. All correspondence relating to a specific request should refer to this application name.

Applications for generation interconnection will be stamped according to the date and time that the application is received at the ISO. This date and time stamp is not a reservation of transmission capacity, planned or unplanned. Transmission can only be reserved for planned service from designated resources to a specified load by reason of ownership or contractual entitlement. Transmission reservations for unplanned service are based upon when an unplanned transaction is submitted to the ERCOT OASIS. Unplanned Transactions are scheduled if there is sufficient capacity available on the transmission system to reliably deliver the power. These requests for unplanned transmission are time stamped and prioritized for approval on a first-come first-served basis according to PUCT rules. Unplanned service is always available subject to the availability of transmission capacity and can be curtailed at any time.

GENERATION PLANT DESCRIPTION & DATA REQUIREMENTS

The acquisition of data to realistically simulate the electrical behavior of system components is a fundamental requirement for the development of a reliable interconnected transmission system and accurate studies. Therefore, the GE is required to submit specific information regarding the electrical characteristics of their facilities along with their request. Failure to supply the required data may result in delay of the study. Data in the initial submissions shall be the most current facility design or expected performance data. Data submitted for stability models shall be compatible with the ISO standard models (PTI PSSE). If there is no compatible model, the GE will work with a consultant to develop and supply a standard model and associated data.

Prior to Commercial Operation, GE shall supplement the initial data submissions with any and all as-built facility data or as-tested performance data, which differs from the initial submissions, or, alternatively, written confirmation that no such differences exist.

Subsequent to Commercial Operation, GE shall provide ISO and TSP any data changes made appropriate by equipment replacement, repair, or adjustment. The GE shall provide such data no later than 60 days after the date of the actual change in equipment characteristics.

Each request should include the following information or best estimate about the generating facility when submitted to the ISO. Required data is indicated below:

- ✓ **GENERATION ENTITY INFORMATION SHEET – required with request**
- ✓ **GENERATION SUMMARY – required with request**
- ✓ **DETAILED GENERATION INFORMATION - BY UNIT FOR EACH UNIT – required with request**
- ✓ **GENERATOR DATA FOR TRANSIENT STABILITY STUDIES**
- ✓ **GENERATOR STEP-UP OR UNIT MAIN POWER TRANSFORMER DATA – required with request**
- ✓ **SUBSYNCHRONOUS RESONANCE (SSR) DATA – BY UNIT FOR EACH UNIT**

GENERATION STABILITY DATA FORMS

In order to perform transient analyses, unit stability information and data will be required by the study group. Provision of complete data for stability studies are the responsibility of the GE. Typical data is permissible for security studies, but actual data must be provided prior to interconnection. Four sets of forms have been developed to aid the requester in providing this information. These forms are provided with the procedures as separate files included in the zip-compressed file that you downloaded. These forms represent models currently in common use in ERCOT. If an appropriate model is not represented herein, the GE should contact the study leader to obtain forms for other models. If no appropriate model exists, the GE must provide both an appropriate model and the associated data.

EXCMODEL.PDF – Exciter Model Forms

GENMODEL.PDF – Generator Model Forms

GOVMODEL.PDF – Governor Model Forms

STABMODL.PDF – Stabilizer Model Forms

These forms are in Adobe Acrobat Portable Document Format (PDF) format and require a reader to view and print them. A free viewer is available at the following Internet address:

http://www.adobe.com/prodindex/acrobat/readstep.html

GENERATION ENTITY INFORMATION SHEET – PLEASE PRINT CLEARLY

Transmission Customer (Generating Entity):
_____

Contact Person (Requester):
_____

Title:
_____

Company:
_____

Mailing Address:
_____

City: _____ State: _____ Zip: _____

Street Address:
_____

City: _____ State: _____ Zip: _____

Company Internal Mail Code(s):
_____

Telephone Number: (_____) _____

Facsimile (FAX) Number: (_____) _____

Internet email Address: _____

Requested Transmission Energization Date (MM/DD/YYYY): _____

Generation In Service (MM/DD/YYYY): start _____ through _____

_____: (generating entity) is, or will be upon commencement of service, an eligible customer. An eligible customer is any of the following: the transmission provider (for all uses of its transmission system) and any electric utility, federal power marketing agency, exempt wholesale generator, qualifying facility, or power marketer. An eligible customer may designate an agent to represent it in arranging for interconnection.

Actual information and test data about generator step up transformers, all generator data including data for transient stability studies and subsynchronous resonance (SSR) data will be provided to the ISO and interconnected TSP before the generation goes into commercial operation. I understand that all of this data will become public and added to the ERCOT databases (including power flow base cases, stability, system protection, CDR, etc…) when the plant goes into commercial operation. Any updates to this information will be provided within 60 days to the ISO and transmission provider as changes or upgrades are made during the life of the plant.

The generating entity and any future owners of the plant agrees to comply with all applicable ERCOT & NERC requirements, including, without limitation, those contained in the ERCOT Operating Guides. It is understood and agreed that such requirements are subject to change from time to time, and such changes shall automatically become applicable based upon the effective date of the approved change.

Authorized Signature,
_____ Date:
_____

_____
(Name printed or typed)

By:_____

GENERATION SUMMARY – by generation entity

Plant Location County (please provide more specific information and maps, if available)	
Control Area Four-Letter Acronym (may be different from transmission service provider)	

PLANT CAPABILTY						
	Summer (Net)			**Winter (Net)**		
	Maximum Total MW	**Maximum Mvar lagging**	**Maximum Mvar leading**	**Maximum Total MW**	**Maximum Mvar lagging**	**Maximum Mvar leading**
Total Plant Net Capability						
MW to be used for Transaction		N/A	N/A		N/A	N/A

TRANSACTION INFORMATION **(used to identify transmission constraints)**	
Generation plant intended customer load location(s) inside or outside of ERCOT	
Expected Generation Off Set Location if known. (What transactions do you wish to simulate in the studies? What generation would you like to replace in these simulations?)	

DETAILED GENERATION INFORMATION – by unit for each unit

Plant Name				Unit ID		
Manufacturer			**Date**			
			Turbine #			
Type Steam Reheat Non-Reheat Combustion Turbine Other (Specify)						
Generator Capability						
	@ 100° F (Summer)			@ 40° F (Winter)		
	MW	Mvar (lagging)	Mvar (leading)	MW	Mvar (lagging)	Mvar (leading)
Capability – Gross (data for Pmax) (measured at generator terminals)						
Capability – Gross (data for Pmin) (measured at generator terminals)						
Unit Auxiliary load						
Station service load (not included in auxiliary load)						
Annual Peak Self serve load @ plant site (if any)						
Net Capability						
MW to be used for Transaction		N/A	N/A		N/A	N/A
Unit MBASE in MVA: _____						
Machine Impedances on MBASE	R			X		
Positive Sequence						
Negative Sequence						
Zero Sequence						
Unit WR^2 ($lbs\text{-}ft^2$)		(Combined Turbine-Generator)				
H-Constant						
Rated Turbine kW With Primary Fuel: (for rated conditions)						
Ambient Temperature	Pressure			Condenser Vacuum		
Primary Fuel: GAS OIL COAL RENEWABLE						
Rated Turbine kW With Secondary Fuel: (for rated conditions)						
Ambient Temperature	Pressure			Condenser Vacuum		
Secondary Fuel: GAS OIL COAL						
Speed (rpm)	Speed Regulation (%)			Power Factor (pf)		

DETAILED GENERATION INFORMATION – by unit for each unit - Continued

Rated Generator	kV	MVA	@ PSIG H_2
Frequency	Full Load Field Amperes @ Rated pf		
Short Circuit Ratio		Max. Field Amperes	
Field Resistance (Ohms -)		Temperature Coefficient	
Exciter Type		**Exciter kW Rating**	
Voltage Regulator Type		**Voltage Response Ratio**	
Underfrequency protection for generator set at _____ Hz **with a time delay of** _____ cycles.			
Undervoltage protection for generator set at _____ kV **with a time delay of** _____ cycles.			

Operating Restrictions

Any periods of restricted operations during the year:	
Any must-run unit designations:	
Any limits on operation:	
Other-Specify:	

Please supply copies of any manufacturer's test reports on the turbine, generator and exciter for rated conditions.

Please supply copies of the following curves for rated conditions:
1.Saturation curve 2.Vee curve
3.Capability curve 4.Expected Turbine kW output vs Ambient Air Temperature Curve.

GENERATOR STEP-UP OR UNIT MAIN POWER TRANSFORMER DATA

Plant Name			**Unit ID(s)**	
Manufacturer		**Date**		
Number of Transformers		**Phase**	**Frequency (Hz)**	

	Type of Cooling *	H-Winding	X-Winding	Y-Winding
Rated kVA 55° C Rise				
65° C Rise				
Connection (Yground)				
Rated Voltage				
BIL				
Available Taps				
Present Tap Settings				

		H-X	H-Y	X-Y
Positive Sequence Impedances	Percent			
	MVA Base			
Negative Sequence Impedances	Percent			
	MVA Base			
Zero Sequence Impedances	Percent			
	MVA Base			
Winding Resistance	Ohms ( )	**H =**	**X =**	**Y =**
MVA Ratings for each windings				

Current Transformer Ratios

H =	**X =**	**Y =**	**Neutral =**

	Rated Voltage @ 100%	@ 110%
Percent Exciting Current		

Please supply copies of nameplate and manufacturer's test report when received.

* -- Type of Cooling: OA OA/FA OA/FA/FA OA/FOA FOA Other (Specify Type)

SUBSYNCHRONOUS RESONANCE (SSR) DATA – BY UNIT FOR EACH UNIT

Please provide data for SSR studies:

- Identification of the masses, such as, HP, IP, LP1, LP2, EXC, etc.
- The inertia constant of each mass, either in MW.s/MVA, or lbm.ft**2
- The damping associated with each mass, either in pu torque/pu speed deviation, or lbf.ft.sec/rad
- The stiffness (spring constant) between each two mass, either in pu torque/rad, or lbf.ft/rad

Unit ID:
Unit Name:

Mass Name	Mass Inertia	Inertia Units (MW.s/MVA or lbm/ft**2)	Associated Damping	Damping Units (pu torque/pu speed or lbf.ft.sec/rad)	Stiffness Between Masses (Spring Const.)	Stiffness Units (pu torque/rad or lbf.ft/rad)