**2705 West Lake Drive**

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# Network Operations Modeling Expectations for TSPs, REs, and QSEs.

Version 3.0

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# Overview

ERCOT Protocols broadly delineate modeling requirements for different segments of the ERCOT market. The information in this document is intended to more clearly define the expectations ERCOT has for market participants as they help to maintain the accuracy of the ERCOT Network Operations Model through the submission of model and outage data.

# Data Submission Guidelines for Network Model Changes

## NOMCR submissions

Changes to ERCOT’s Network Model Management System (NMMS) database will be made using Network Operations Model Change Requests (NOMCRs). Transmission Service Providers (TSPs) will submit changes directly into the NMMS using NOMCRs. Resource Entities (REs) will make submit their model changes in the Resource Asset Registration Form (RARF). ERCOT will convert RARF submissions into NOMCRs. Qualified Scheduling Entities (QSEs) will submit telemetry changes for the model using service requests (SRs) in Siebel. ERCOT will convert the SRs into NOMCRs.

### Timeline for RARF submissions

RARF submissions by REs are subject to the same Protocol mandated deadlines as directly submitted TSP NOMCRs.[[1]](#footnote-1) RE RARF submissions may be considered Interim Updates if they fail to pass RARF validation prior to the normal timeline for data submission described in Protocols for NOMCRs. RARF submissions failing to pass RARF validation will be rejected as “Needing Additional Data” and sent back to the RE.

Successful RARF submissions will be converted by ERCOT into NOMCRs and processed as part of the model update process and schedule required in the protocols. REs will receive status updates for the NOMCRs representing their RARF data submissions. If the RARF-NOMCR has significant problems passing the validation rules within the NMMS system it can be rejected even though it passed the validation for submission in the RARF hub. In this event, the RE will be notified and required to submit a new RARF. It is likely that this RARF resubmittal will not be able to meet the normal Protocol timeline for data submission. REs wishing to avoid having data submissions potentially identified as Interim Updates should submit RARF information with enough notice to avoid this conflict.

## Interim Updates

ERCOT expects requests to modify the Network Model to meet the Protocol timelines for Network Model changes[[2]](#footnote-2). NOMCRs that are submitted outside of the normal timelines will be classified as Interim Updates and included in the Network Model if they are needed to correct unintentional modeling inconsistencies, are required for system restoration after a storm, or are a correction to previously submitted impedances or ratings. Interim Updates will be reported to the Public Utility Commission of Texas (PUCT) Staff and the Independent Market Monitor (IMM).[[3]](#footnote-3)

Per Nodal Protocols[[4]](#footnote-4), Interim Updates will be incorporated in the Network Model at the discretion of ERCOT. Many considerations will be made in determining the overall impact of the Interim update to the Network Operations model. ERCOT has outlined a guideline that will be applied to every requested interim update to consistently assess a level of risk and raise transparency to criteria by which interim updates are evaluated.

ERCOT will also critically evaluate other risk items such as system conditions, staffing, volume of requested changes, etc. prior to determining if the interim update will be accepted.

### Guideline Definition

The type and timing of the update will be considered when evaluating Interim Update requests. In some cases, requestors may be required to change the model ready date of the request so that the submittal falls within normal data submission guidelines. In these cases the update would no longer be classified as an Interim Update.

In order to evaluate the impact an Interim Update will have on the Network Operations model, the request will first be classified according to when it was submitted. This classification quantifies how much notice is provided for each request. An Interim Update request that requires an Emergency Database Load will be more difficult to grant than a request that is only a few days past the normal submittal deadline. ERCOT will classify Interim Updates into four periods of time as illustrated below.

Each Period is applicable to the submission timeline for the Target Month as defined in the Nodal Protocols Section 3.10.4.

**Period 1** requests would be submissions that miss the normal deadline by ten days or less. At this point in the validation process ERCOT is still processing the NOMCRs for the Target Month and has not completed the models that will be used in production.

**Period 2** immediately follows Period 1 and ends on the tenth of the month prior to the Target Month. During Period 2, the Operational Models undergo Initial Validation and are posted. In addition, the information needed to build the CRR models is exported.

**Period 3** immediatelyfollows Period 2 and ends when the affected model goes into production. At this point in the validation process the final production models have been completed and are being validated for use in production. Period 3 will vary in length depending on when the affected model goes into production.

**Period 4** immediatelyfollows Period 3, beginning two days before the affected model is scheduled to be loaded into production. Interim Updates allowed during Period 4 will require an Emergency Data Base load.

In addition to classifying updates by the period in which they are submitted, Interim Update requests will also be categorized by class. The classes represent the impact the model change will have on both the market and reliability. ERCOT will use four classifications to categorize Interim Update requests. Appendix A contains examples of modeling request categories and how they might be classified. The classes are described below.

**Class 1** Interim Update requests will have no impact to market or reliability after implementation.

**Class 2** Interim Update requests will have an impact to market or reliability that can be mitigated in real-time with changes to data in downstream systems that can be managed by ERCOT. In some cases ERCOT may request assistance from the Interim Update requestor in mitigating the effects of the change.

**Class 3** Interim Update requests will have an impact to market or reliability that cannot be mitigated in real-time with changes to data in downstream systems.

**Class 4** Interim Update requests are those that if not incorporated in the model at the requested time will have a severe impact to either the market or reliability. Class 4 updates should always be a result of circumstances that could not be reasonably anticipated.

ERCOT will classify both the Period and Class of each Interim Update. These classifications will be included in the comment section of the NOMCR. ERCOT will use the following chart as a basis for including the Interim Update into the model at the model ready time requested by the data submitter.



### Data Submissions not Subject to the Interim Update rules include:

#### ICCP data object names.

Changes to an existing NOMCR that modify only Inter-Control Center Communication Protocol (ICCP) data object names may be submitted outside the normal timeline for NOMCRS.[[5]](#footnote-5) This includes SRs submitted into Siebel by QSEs to add or modify ICCP data names. NOMCR modifications containing only ICCP data object names can be made up to the 15th day of the month prior to the month in which the equipment associated with the ICCP name is energized in the field without incurring Interim Update status for the ICCP update.

#### Dynamic rating changes for new and existing lines

TSPs and REs will be able to dynamically rate a statically rated line or adjust previously submitted dynamic ratings in production within 48 hours. Model changes that dynamically rate lines will not be subject to Interim Update status.[[6]](#footnote-6)

#### Remedial Action Plans

Remedial Action Plans are able to be updated/implemented in the EMS immediately upon approval when necessary; therefore, modeling them in NMMS shall be allowed outside the normal timeline for NOMCRs. When a Remedial Action Plan is approved by ERCOT, ERCOT shall create a NOMCR to build the Remedial Action Plan into NMMS per its procedures. Note that any changes to the Remedial Action Plan database will not be reflected in the MMS system until the next model load.

#### Special Protection Systems

Special Protection Systems modeling shall follow the process indicated in the *Procedure for Approval and Distribution of RAP, MP, and SPS* procedure which is posted on the MIS Secure Area. When an SPS proposal is approved by ERCOT, the TSP shall submit a SAMR, attaching to it the approved SPS documentation. Upon receipt of the SAMR, ERCOT shall create a NOMCR to build the Special Protection Systems into NMMS. Once the NOMCR has been accepted, the TSP shall submit a second NOMCR associating the ICCP data object names to the Special Protection Systems definition in the database. Implementing the Special Protection Systems in the EMS can be done on the fly, similar to Remedial Action Plans, however a model load is necessary to tie in any telemetry to the Special Protection Systems. As with Remedial Action Plans, a model load is required to reflect any Special Protection Systems modeling modifications in the MMS system.

## Ownership

Typically, ownership of equipment in the NMMS system refers to the physical owner of the equipment. Equipment may have multiple owners.

## Operatorship

Typically, operatorship of equipment in the NMMS system refers to the entity that is responsible for the physical operation of that piece of equipment. Equipment may have multiple operators. REs and Private Use Networks (PUNs) owning transmission equipment must identify in the RARF the connecting TSP as an operator. The TSP designation will be used by ERCOT to enable TSPs to enter outages on behalf of the RE for RE-owned transmission equipment.

# Model loads

## Frequency

ERCOT will publish a schedule for model loads at least one year prior to the date for each load. The normal periodicity for a new load will be weekly. There will also be a load on the first of every month (unless the first falls on a weekend). The normal weekly load schedule will be adjusted to accommodate this first-of-the-month load. If ERCOT needs to perform additional model loads, (see III.B.2 Supplemental Loads) ERCOT will update the schedule so that the additional dates are included.

TSPs and REs will coordinate the modeling of new and retiring equipment to correspond with scheduled model load dates.

## Model load Types

### Scheduled Loads

Model loads are listed in the published model load schedule found on the MIS. These loads will normally correspond with the weekly load periodicity. First-of-the-month load will also be incorporated into the schedule.

### Supplemental Loads

Supplement Loads are model loads that ERCOT deems necessary in order to represent Network Model changes that cannot be modeled using a model load periodicity of one week. TSPs or REs submitting changes that may require a Supplemental load will coordinate this need with ERCOT at the time of the data submission by indicating the need for a Supplemental load in the information field of the affected NOMCR(s). ERCOT will contact the data submitter for further details by phone or email. Supplemental Loads will be at the sole discretion of ERCOT and will not be scheduled for data submissions that are outside of the normal data submission deadlines. When a Supplement Load date is agreed upon ERCOT will include that load in the published list of scheduled loads so that it can be used by other data submitters.

### Emergency Loads

Emergency Loads will be scheduled at the discretion of ERCOT. It is expected that some Emergency Loads will be necessary to correct unintentional inconsistencies or to model system restoration configurations after a storm or hurricane that cannot be replicated with outages. Emergency Loads will always be associated with Interim update NOMCRs that will be reported to the PUCT and IMM.

In extreme situations, if approved by ERCOT management, Emergency Loads may be scheduled to facilitate modeling requests from REs or TSPs that require additional loads of the network model. These Emergency Loads will be at the discretion of ERCOT.[[7]](#footnote-7)

## Model load Content

In general, the model for each period will be “back-loaded”. This means that the last day of the database load period will be used for the snapshot of what is included in the model for the entire period.

For example, if model loads are scheduled for April 1st and April 8th then the model that is loaded on April 1st would normally include all model additions between April 1st and the end-of-day on April 7th that have been scheduled in NMMS. A new piece of equipment that is scheduled to be energized on April 5th would be included in the April 1st model and be associated with an outage recorded in the Outage Scheduler that is scheduled to end on April 5th.

Changes to the model that are both introduced and retired within the life cycle of a single model will not be captured. In these circumstances data submitters should coordinate with ERCOT for a Supplemental Load or modeling of pseudo devices.

It is expected that TSPs and REs will use the published list of Scheduled Loads to coordinate the modeling necessary to accurately represent expected construction schedules in the field. However, if there are circumstances in which new equipment or configuration changes cannot be handled with planned outages a Supplemental Model load may be scheduled. Supplemental Model Loads will not be allowed to input new or revised transmission system connectivity that was not provided to ERCOT according to the submittal schedule required in the Protocols. Pseudo modeling techniques may also be used in these circumstances. It is expected that TSPs and REs will coordinate with ERCOT in order to find a feasible and efficient solution.

## Scheduled Model Load Time-of-Day

Scheduled Model loads will normally occur at 12:00 AM on Thursdays. The day of the week for first-of-the-month loads will vary.

## ERCOT discretion for Emergency Loads

ERCOT may implement an emergency model load into the production environment if significant errors are uncovered during validation of the model. It will be at ERCOT’s discretion to determine if an Emergency Load into the production environment is necessary.

### Emergency Loads due to Unintentional Modeling Errors

Errors in the model may be found at any point in the model validation process. ERCOT will coordinate with TSPs and REs in order to correct errors through the submission of revised data in NOMCRs. A NOMCR update may be required even if an Emergency Load is not made in the production environment. Any NOMCR submission not meeting the normal submission timeline will be reported to the PUCT and IMM as an Interim Update.

### Emergency Loads due to Safety or System Restoration Conditions

Emergency Loads may be used to represent the system during emergency conditions. In most cases, outages can be used to represent these conditions using the existing model. However, ERCOT will coordinate with TSPs and REs in order to modify the model used in the production environment when necessary so that conditions in the field can be represented. Adherence to the normal timelines for NOMCR submittal will still be required. Any NOMCR submission not meeting this timeline will be reported to the PUCT and IMM as an interim update.

# NOMCR and Model Validation Process

## NOMCR Integration into Models

The modeling year is divided into ten periods in Protocols. Each non-summer month represents one period with the summer months (June, July, and August) representing another period[[8]](#footnote-8). Each period will be divided into weekly models. There are three stages of validation that each model completes. The overall model validation process is illustrated below for a hypothetical month of April.

Individual NOMCRs are integrated into the appropriate model based on the model-ready date of each NOMCR. ERCOT has 15 days from the receipt of the NOMCR to either approve or reject the submission. It is during and prior to this NOMCR processing period that the first four levels of validation occur. ERCOT may request additional data be submitted during this 15-day period.

*Level 1 Validation-* The Level 1 Validation is performed automatically by the NMMS system whenever a NOMCR is submitted or resubmitted. The system will not accept submissions unless they pass the Level 1 Validation criteria. The Market Information System (MIS) Secure postings required by Nodal Protocols are achieved when the NOMCR is submitted.

*Level 2 Validation-*The Level 2 Validation is performed by the ERCOT Model Coordinator as a visual inspection to ensure that all data in a NOMCR has been provided in a coherent manner.

*Level 3 Validation-*The Level 3 Validation is performed by the ERCOT Model Tester, who will generate a test network model, transfer it to the Transmission Networks Application (TNA) test bed, and validate that the NOMCR under test will pass a Power Flow and will not corrupt any other portion of the model.

*Level 4 Validation-*The Level 4 Validation is performed by the ERCOT Model Tester, who will generate a test network model, transfer it to the TNA test bed, and validate that the NOMCR under test, when compiled with other NOMCRs that have the same Model-ready date will pass a Siemens® Power Flow and not corrupt any other portion of the model.

After the NOMCR processing period, models are exported from the NMMS system according to the schedule for Scheduled and Supplemental database loads published on the MIS. These models are then subjected to the Initial Validation that is performed by ERCOT’s Network Modeling Group. Errors found during this validation period will require the submission of NOMCRs outside the normal timelines. Responses to these types of requests will be categorized as Interim Updates. It is during this validation period that ERCOT will apply level 5 validation to the weekly models.

*Level 5 Validation-*The Level 5 Validation is performed by the ERCOT Model Tester in the same manner as the Level 4 Validation but using a copy of the Areva Energy Management System (EMS) software that will include State Estimator testing. Validation of new or changes to ICCP telemetry are re-verified with the requestor in a point-to-point data check. A price validation on the model will also be conducted using the Market Management System (MMS) software.

ERCOT has approximately forty-five days from the NOMCR submission deadline until the validated models that will be used for the target month Network Operations Model are posted. A period of Market Validation follows the public posting and is scheduled for approximately thirty days. The CRR Auction corresponds with the completion of the Market Validation.

The final phase of validation is facilitated by ERCOT’s Energy and Market Management System (EMMS) group. This is a final check before the model is placed into the production environment. It will be necessary for this set of models to include all final ICCP object name changes[[9]](#footnote-9). Failure to provide final ICCP data will result in Emergency Model loads and notification to the PUCT and IMM.

# Approval to Energize Process

In order to describe the “Approval to Energize Process” two concepts must be defined.

The first concept is the **model-ready** date which is found in the NMMS database and corresponds with the energization date associated with a NOMCR. The model-ready date is the date that the new piece of equipment first appears in the ERCOT production environment. The model-ready date should correspond with a Scheduled or Supplemental Model load date. The model-ready date will also correspond with the date that new piece of equipment can initially be outaged in the ERCOT Outage Scheduler.

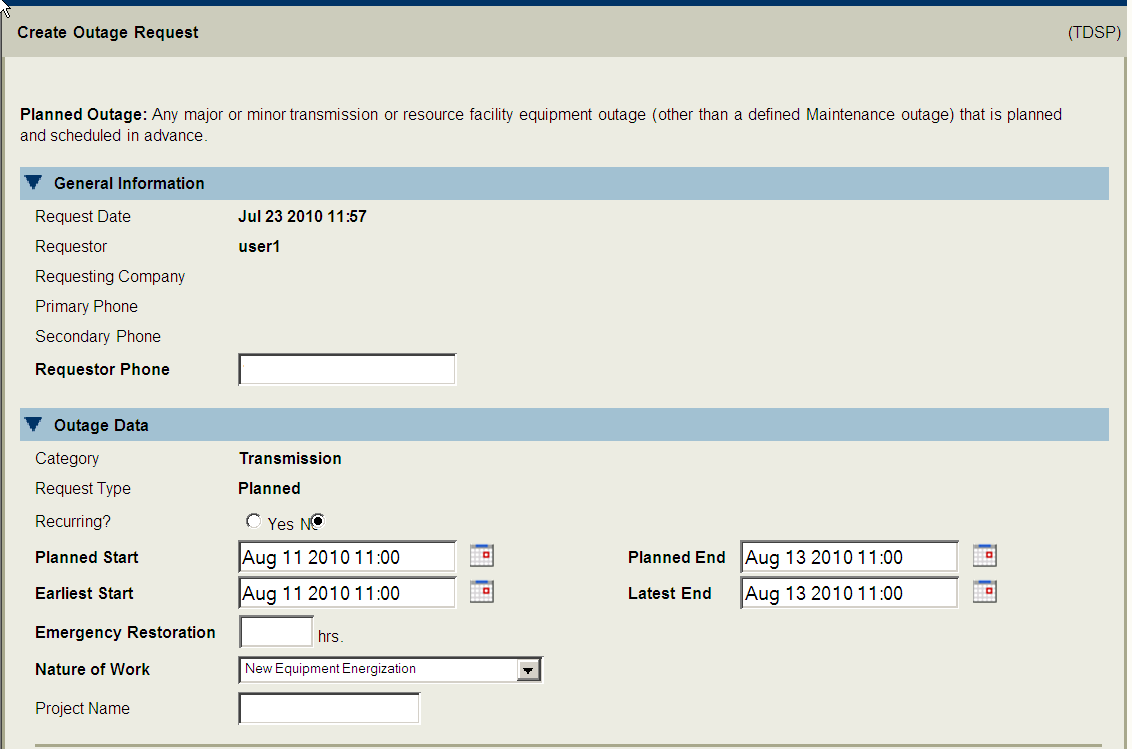
The second term is the date that corresponds with the **field-energization** of a piece of new equipment. The field-energization date is the date the new equipment is energized in the field and is ready for normal service.

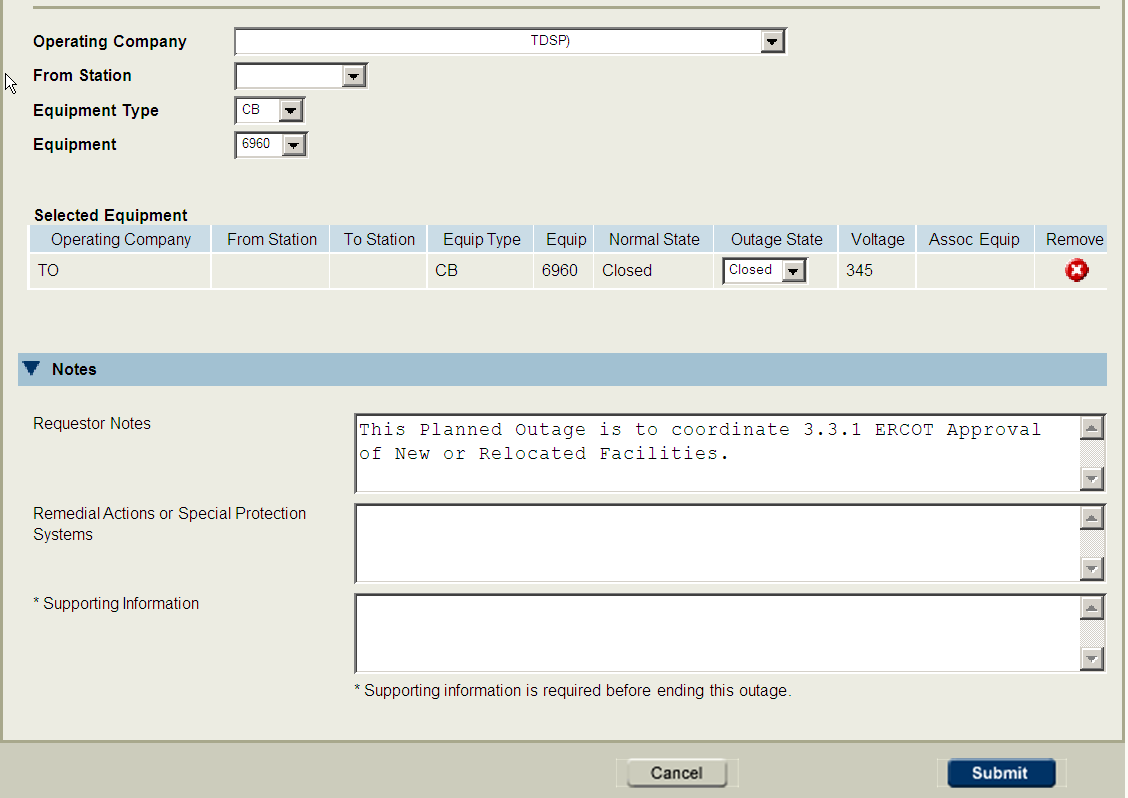
The energization of new equipment in the production environment will be preceded by two conditions. First, the equipment must be included in the production model in its normal state prior to energization. Secondly, a Planned Outage whose end time corresponds with the energization of the new equipment must be entered in the Outage Scheduler.

Each week or as required by the ERCOT Operations Support Engineering (Operations Support Engineering) Supervisor and the Network Model Engineering Supervisor, the ERCOT Network Model Group shall provide the ERCOT Operations Support Engineering Staff with an easily accessible, understandable, and updated list of the model changes for new or relocated facilities scheduled for the next database implementation date. The lists shall reflect the date dependent changes currently proposed by Market Participants.

The Operations Outage Coordination Supervisor will supply Operations Support Engineering information from the Outage Scheduler regarding the energize date. If the ERCOT Operations Model has been updated with the changes, the ERCOT Operations Support Engineering shall determine the model change activation status (i.e. can/should the change occur) with the date of approval being the Planned Outage in service date.

Example use of outage scheduler to coordinate New Equipment Energization.





The ERCOT Operations Support Engineering shall inform the ERCOT Shift Supervisor and the ERCOT Operations Planning Engineer of the proposed model change activation status and any other recommended actions verbally or via e-mail.

Market Participants are required to notify ERCOT for requested approval prior to the activation of any new equipment or a relocated transmission facility that is connected to the ERCOT Transmission Grid, according to ERCOT Protocols Section 3.3.1. The request notification shall be by phone or email from the Market Participant to the ERCOT Shift Supervisor or designee. The ERCOT Shift Supervisor or his designee will verify whether or not the ERCOT Operations Model has been updated. If the ERCOT Shift Supervisor already knew of the pending equipment installation, he/she will allow the equipment to be energized. If the ERCOT Shift Supervisor was not informed of the pending equipment, he/she will contact the ERCOT Operations Support Engineer. If the ERCOT Operational Model has been updated with the equipment, the ERCOT Operations Support Engineering will verify the model and study the new equipment or relocated facility and authorize the Shift Supervisor verbally or via e-mail to approve energization of the new equipment or relocated facility as system conditions allow. If the ERCOT Operational Model has not been updated, the ERCOT Shift Supervisor shall contact the ERCOT Operations Planning Engineer for studies to determine if the equipment can be energized. The ERCOT Shift Supervisor shall not proceed with the energization of the new equipment or relocated facility without the approval of the ERCOT Operations Support Engineering or the ERCOT Operations Planning Engineer performing the study verbally or via e-mail. The Engineer doing the study will contact the Network Model Engineering Supervisor or his designee to expedite updating of the ERCOT Operational Model.



The following is a description of scenarios and the process flows:



**Scenario 1 - Energization Request, Model Change NOT in current Operations Model**

If the equipment is not modeled in the ERCOT Operational Model (i.e. the Operations Support Engineering staff has not approved the model change activation), the ERCOT Shift-Supervisor or designee shall not approve the energization of the new equipment or the relocated facility.

**Scenario 2 - Energization Request, Model Change in current Operations** **Model**

If the new or re-routed equipment is modeled and the model change activation has been previously approved by ERCOT Operations Support Engineering staff, the ERCOT Shift-Supervisor or designee shall approve the energization.

 **Scenario 3 - No Energization Request, Model Change is in current Operations Model**

If ERCOT discovers that any new equipment or a relocated transmission facility is in the current Operations Model AND is energized without ERCOT’s approval, the ERCOT Shift-Supervisor or designee shall ask the Market Participant to submit an Approval to Energize Notification. ERCOT Operations Support Department shall then contact the Market Participant informing them of the apparent violation of Section 3.3 of the ERCOT Protocols, and work with them to reach a mutually acceptable resolution to avoid future violations. When appropriate ERCOT shall issue an Incident Report and report the incident to ERCOT Compliance.

**Scenario 4 - No Energization Request, Model Change is NOT in current Operations Model**

If ERCOT discovers that any new equipment or a relocated facility is energized without ERCOT’s approval and, in addition, the new or relocated facility does not exist in ERCOT’s Operational Model, the ERCOT Shift-Supervisor or designee shall ask the Market Participant to submit, or verify the submittal of a Network Operations Model Change Request (NOMCR) to the ERCOT Network Modeling Coordinator as soon as possible. ERCOT Operations shall then contact the Market Participant informing them of the apparent violation of Section 3.3 of the ERCOT Protocols, and work with them to reach a mutually acceptable resolution to avoid future violations. When appropriate ERCOT shall issue an Incident Report and report the incident to ERCOT Compliance.

The Market Participant is responsible for providing the Approval to Energize form via email AFTER receiving the approval from ERCOT.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ercot Logo**Approval to Energize Notification** | | | | | | | | | | |
| NOMCR Number: | | | |  | | | | | |  |
| Station Code (i.e. BBSES): | | | |  | | | | | |  |
| Station Name (i.e. Big Brown): | | | |  | | | | | |  |
| List of equipment being energized: | | | | | |  | | | |  |
| Date work completed: |  | | | | | | | | |  |
| Does this complete the entire NOMCR? | | | | | Yes | | | | No | |
| If not, please provide the expected energize date of the entire NOMCR. | | | | |  | | | | |  |
| Other work required for completion: \_\_\_ | | | | | | | | | | |
| **Submitted by:** | | | | | | | | | | |
| Company name reporting: | |  | | | | | Date submitted: |  | |  |
| Company representative | |  | | | | | Phone number: |  | |  |
|  | | | | | | | | | | |
| **Please email to ERCOT (Taylor): NetworkModelCoordina@ercot.com** | | | | | | | | | | |
| For ERCOT use only: | | | | | | | | | | |
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## Modeling Equipment Prior to Field-Energize Date

ERCOT expects the model-ready date to precede the field-energization date in all circumstances. New equipment must be entered into the Network Operations Model in its normal operating state. For example, a normally-closed breaker will be initially modeled as normally closed.

### Use of the ERCOT Outage Scheduler

The ERCOT Outage Scheduler will be used to coordinate the energization of all new equipment in the Production Environment.[[10]](#footnote-10)

#### Planned outages

TSPs and REs should remember that Planned Outages on new pieces of equipment will be possible only after the new piece of equipment is modeled in NMMS. Future equipment will be available in the Outage Scheduler one week after the NOMCR is submitted. The model-ready date for a piece of equipment is the earliest planned start date that can be entered for an outage on that same piece of equipment in the Outage Scheduler.

#### Forced outages

The ERCOT Forced Outage Detector will notify operator anytime the telemetered status of a piece of equipment differs from the modeled state for more than two hours.

#### Coordinating Model and Outage Scheduler Entries

#### Protocols require data submitters to use Planned Outages to coordinate model-ready and field-energization dates for new equipment[[11]](#footnote-11). The use of Planned Outages is essential in the evaluating security in all study cases preceding real-time. In addition, the lack of Planned Outages in association with new equipment energization may result in the increased withdrawal of approval for previously approved outages.

## 2) Modeling of Islanded Equipment

Data submitters should not model future equipment in the NMMS model that is not connected to the rest of the ERCOT grid. For example, an islanded station that will eventually be connected to other equipment in the Network Model should not be modeled until the physical ties it has to the system are also modeled. It is acceptable to model future equipment as long as it is connected to the rest of the system and proper entries are made in the Outage Scheduler for the equipment.

1. **Modeling of Single Terminal Switching Device**

Switching devices that only have a single terminal connecting to the network Model such as ground disconnectors or hanging switches should not be included when submitting modeling changes to ERCOT. The Protocols only required that devices that can change the flow of power be included in the model.[[12]](#footnote-12)

# Retiring Equipment

Similar to the energization process, two terms need to be defined in order to describe the retirement process for existing equipment.

The first is the **model-retirement** date and the second is the **field-retirement** date. The model-retirement date is the date that an existing piece of equipment is retired or removed from the NMMS model. This date is governed by the submission of a NOMCR. The field-retirement date is the date that the equipment is de-energized in the field in order to be permanently removed from service and is controlled by entries in the Outage Scheduler. In general, NOMCRs that retire equipment from the model should be separate from those that make other changes.

The field-retirement date should precede the model-retirement date. In addition, the model-retirement date should be associated with a Scheduled or Supplemental model load date. If a TSP mistakenly enters a model-retirement date for a existing piece of equipment that does not match a model load date, that piece of equipment will not be included in that model (models are back-loaded with data).

For example, assume a model is to be loaded on April 1st and then a subsequent model will be loaded on April 8th. A breaker is to be field-retired on April 6th. If the TSP retires the equipment on April 6th from the model, that equipment will not be included in the April 1st model load. The April 1st model load only includes what is in service on April 8th (this is the backloading mentioned earlier). See illustration below.

In this example, ERCOT expects the model-retirement date will be scheduled for April 8th. A planned outage will be entered for April 6th until April 8th in order to represent the fact that the equipment has been retired from service. Similar to outages associated with model-energization dates the outages associated with model-retirement dates need to be entered well in advance in order to facilitate any analysis done before real-time. If the CB that is field-retired on April 6th is also model-retired on that date it will not be included in the model used for April 1st to April 7th resulting in an energized breaker not being represented in the model for six days.

# General Modeling Principles for Submitters

Scheduled Model load dates should be utilized for all topology changes, the energization of new equipment, the retirement of existing equipment, and changes to ICCP data telemetry. ERCOT will work with data submitters to schedule Supplemental Loads if possible to simplify the modeling demands for data submitters provided the protocol required data submittal timelines are met.

In cases where topology changes or additions cannot be coordinated with scheduled Model Loads, a series of outages and duplicate (pseudo) modeling can be used to accurately represent in the model changes that occur in the field.

Adherence to the following modeling principles will be useful in minimizing the use of pseudo equipment in the Network Model.

* Model-ready dates for new equipment should coincide with a scheduled model load.
* Model-ready dates for new equipment should precede field-energization dates for that same equipment.
* Model-retirement dates should coincide with a scheduled model load
* Field-retirement dates for equipment that is to be retired should precede the model-retirement date for that same equipment.
* The Outage Scheduler will be the primary tool to coordinate the difference between the model-ready dates and field-energization dates (as well as model-retirement dates and field-retirement dates). In general, unforeseen changes in construction schedules should be accounted for by modification of outages in the Outage Scheduler.
* ERCOT suggests that the model-ready date precede the field-energization date by approximately two weeks in order to give the NOMCR submitter flexibility to bring the new equipment into service earlier than anticipated.
* ERCOT suggests that the field-retirement date precede the model-retirement date by approximately two weeks in order to give the NOMCR submitter flexibility to keep a piece of equipment in service past the expected field-retirement date.

## Pseudo Device Modeling

Protocol requirements make it impractical for ERCOT to model pseudo devices. ERCOT expects to be able to minimize the use of Pseudo Device Modeling by publishing well in advance a list of Scheduled Model Loads and working with data submitters to add Supplemental Model Loads when feasible. However, there may be some cases it is advantageous for the data submitter to model pseudo transmission elements. If pseudo device modeling is desired, the modeling and maintenance of that equipment will be completed by the data submitters.[[13]](#footnote-13) These pseudo devices will need telemetry[[14]](#footnote-14) and their use must be consistent in both the ERCOT production environment as well as in the native EMS systems of TSPs.[[15]](#footnote-15)

## Modeling Examples

Included below are several examples of common additions and changes to the ERCOT Network Model. For each of these examples a model load schedule of April 1st, April 7th, April 14th, and April 21st will be used.

#### New Line Termination

#### Line terminates in a different station on April 10th and requires a 5-day construction outage

The sequence of events would be as follows:

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 7th for L2, SW-3, and CB-3.
* Before January 1st, a NOMCR should be submitted to retire L1, SW-2, CB-2 with a model-retirement date of April 7th
* Outages should be submitted on CB-1, SW-1, L1, SW-2, and CB-2 starting date on April 5th. These outages will de-energize the existing equipment from the model. The TSP has the flexibility to enter the outages earlier than expected. However the new line cannot be energized until after the model load on April 7th. Ideally these outages should be submitted prior to January 15th to facilitate model validation. The outages on SW-2, CB-2, and L1 should end on April 7th (the model load in which this equipment is retired from the model).
* A second outage should be entered on L2, SW-3, and CB-3. These outages should begin on April 7st (model load date in which the new equipment first appears in production) and end on April 10th (field-energization date for the new equipment).
* On April 10th, the Approval to Energize process is followed to energize the new equipment.

The following illustration shows the sequence of outages and modeling needed to represent this change in topology in the field.

IMPORTANT NOTE: The sequence of outages and NOMCRs illustrated above gives the TSP to ability move the beginning of the construction outages as early as needed. The TSP also has the flexibility to extend the outages to anytime past April 10th using entries in the Outage Scheduler. Restrictions include the fact that the Field-energization of the new line cannot occur before the model load on April 7th, and the entire process requires a model load to occur during the construction outage.

#### New Tapped Station

#### New Station built in the middle of existing line to be energized on April 10th. Construction requires a 9-day outage.

The sequence of events would be as follows:

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 7th for L2, L3, Station X, SW-3, and LD-1
* Before January 1st, a NOMCR should be submitted to retire L1, SW-2, CB-2 with a model-retirement date of April 7th
* Outages should be submitted on CB-1, SW-1, L1, SW-2, and CB-2 starting date on April 2nd. These outages will de-energize the existing equipment from the model. Ideally these outages should be submitted prior to January 15th to facilitate model validation. The outage on L1 should end on April 7th (the model load in which this equipment is retired from the model).
* A second group of outages should be submitted on L2, L3, SW-3, and LD-1. These outages should begin on April 7st (model load date in which new equipment first appears in production). The outages should end on April 10th (field-energization date for the new equipment).
* On April 10th, the Approval to Energize process is followed to energize the new equipment.

The following illustration shows the sequence of outages and modeling needed to represent this change in topology in the field.

#### New Line

#### Line is constructed between existing stations with an field-energization date of April 10th.

In this example a new line, two breakers, and two disconnect switches are scheduled to be field-energized on April 10th.

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 1st for each piece of new equipment.
* Outages should be submitted for each piece of new equipment[[16]](#footnote-16) that span the time period between the model-ready date and the field-energize date.
* On April 10th, the Approval to Energize process is followed to energize the new equipment.

The following illustration shows the sequence of outages and modeling needed to represent this change in topology in the field.

#### Switching Station

#### New Switching Station is constructed at the intersection of two existing lines. Station is to be fully energized on April 22rd. Construction requires a series of outages spanning a twenty-one day period with two intermediate configurations.

In this example, the first intermediate stage requires a new station to be cut into L1 on April 8th.

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 1st for CB-D, CB-B, L3, and L5.
* Before January 1st, a NOMCR should be submitted with a model-retirement date of April 7th for L1.
* Outage should be submitted for L1 that begins on April 2nd and ends on April 7th (the model-retirement date for L1).
* Outage should be submitted for CB-1 and CB-4 that begins on April 2nd and ends on April 8th (the field-energization date for L3 and L5).
* Outages should be submitted On April 7th, for CB-D, CB-B, L3, and L5. These outages should end on April 8th.

This completes configuration Intermediate 1.

The following needs to take place in order to transition from Intermediate 1 to Intermediate 2. For this stage, L4 is to be field-energized on April 14th (the same day as the Scheduled Model Load).

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 14st for CB-A and L4.
* Before January 1st, a NOMCR should be submitted with a model-retirement date of April 14th for L2.
* Outages should be submitted for L2 and CB-2 that begin on April 11th and end on April 14th (the model-retirement date for L2 and the field-energization date for CB-2).
* Outages should be submitted for CB-A and L4 that start and end on April 14th which is both the model-ready and field-energization date for this equipment. The outages would span the time from the database load (12:00 AM) until the field-energization.

This completes configuration Intermediate 2.

The following needs to take place in order to transition from Intermediate 2 to the final configuration for the new switching station. Line L5 is to be field-energized on April 22nd.

* Before January 1st, a NOMCR should be submitted with a model-ready date of April 22nd L6 and CB-3 (These elements could have been entered on an earlier database load and outaged).
* Outages should be submitted for L6 and CB-3 that begin on April 14th and end on April 22nd (the field-energization date for L2 and CB-B).

This completes the modeling and outage sequence for the new switching station. The overall series of modeling and outage submissions is illustrated in the below diagram.

# Contingencies

## Double Element Contingencies

ERCOT will submit NOMCRs and model double contingencies in NMMS after consulting with the owners of the equipment in the double contingencies. It is expected that equipment owners will proactively communicate to ERCOT which equipment should be included in double-circuit contingencies as identified in ERCOT Operating Guides. For example, any model change that results in the creation (or removal) of one or more new double contingencies should be submitted with the identification of which elements create each of the new double contingencies. That information will be used to update the contingency list in NMMS. An agenda item will be added to the Network Data Support Working Group (NDSWG) meetings to review the current list of double elements and verify that the list is complete. ERCOT will be identified in the model as the owner of the contingencies.

## Single Element Contingencies

Single element contingencies will be programmatically generated and appended to each CIM model. Each Network Operations Model could have a unique contingency file. It is expected that equipment owners will work with ERCOT to identify equipment that should not be included in a contingency (i.e. breakers without relaying). Conversely, it is expected that the equipment owners notify ERCOT when equipment that was previously excluded should be re-included in a contingency. ERCOT’s programmatic contingency generator has the capability to exclude contingencies on previously identified equipment. The identification flag for equipment that is to be excluded from the programmatic contingency generation will have ERCOT ownership in the model.

# Appendix A Model Request Classifications

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Description** | **Class 1** | **Class 2** | **Class 3** | **Class 4** |
| Equipment Renames | √ |  | √ |  |
| Station Renames | √ |  | √ |  |
| Equipment Rating (static) | √ | √ |  |  |
| Breaker or Switch status change | √ | √ |  |  |
| Connectivity Changes | √ | √ | √ | √ |
| Telemetry Changes | √ | √ | √ | √ |
| New Equipment Additions | √ |  | √ | √ |
| Equipment Retirements | √ | √ |  |  |
| Registration data |  | √ | √ | √ |
| Unit Characteristics | √ |  |  |  |
| Equipment Ownership | √ | √ |  |  |
| Equipment Operatorship | √ | √ |  |  |
| Zone corrections |  |  | √ | √ |
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1. ERCOT Nodal Protocols 3.10.1 (1) [↑](#footnote-ref-1)
2. ERCOT Nodal Protocols 3.10.1 [↑](#footnote-ref-2)
3. ERCOT Nodal Protocols 3.10.4 (5) [↑](#footnote-ref-3)
4. ERCOT Nodal Protocols 3.10.4 (5) [↑](#footnote-ref-4)
5. ERCOT Nodal Protocols 3.10.1 (6) [↑](#footnote-ref-5)
6. ERCOT Nodal Protocols 3.10.8.4 (c),(d) [↑](#footnote-ref-6)
7. ERCOT Nodal Protocols 3.10.4 (5) [↑](#footnote-ref-7)
8. ERCOT Nodal Protocols 3.10.1 [↑](#footnote-ref-8)
9. Related to NPRR146 [↑](#footnote-ref-9)
10. ERCOT Nodal Protocols 3.3.2.1 [↑](#footnote-ref-10)
11. ERCOT Nodal Protocols 3.3.2.1 [↑](#footnote-ref-11)
12. ERCOT Nodal Protocols 3.10.7.1.3 (1) [↑](#footnote-ref-12)
13. ERCOT Nodal Protocols 3.10.1 (5) [↑](#footnote-ref-13)
14. ERCOT Nodal Protocols 3.10.5 (2), 3.10.7.5 (5), 6.5.7.1.13 (a) (iii) [↑](#footnote-ref-14)
15. ERCOT Nodal Protocols 3.10.7.1 (1) [↑](#footnote-ref-15)
16. ERCOT Nodal Protocols 3.1.5.1 (1) [↑](#footnote-ref-16)