Brief in Support of the NextEra Appeal of the Technical Advisory Committee Recommendation Report Relating to PRR 830

PRR Number	830	PRR Title	Reactive Power Capability Requirement

Date	November 10, 2009

Decision Being Appealed	Technical Advisory Committee Recommendation Report
Date of Decision	November 5, 2009

Submitter's Information	
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Market Segment	Independent Generator

Comments

Horizon submits this, its *Brief in Support of the NextEra Appeal of the Technical Advisory Committee Recommendation Report Relating to PRR 830,* styled as comments, and incorporates by reference the earlier Horizon comments made throughout the committee process including to the Technical Advisory Committee ("TAC")[1] in opposition to PRR 830 and in support of the NextEra Energy Resources Appeal of the TAC Recommendation Report with regard to PRR 830.

Horizon incorporates NextEra's briefing in support of its appeal by reference herein and focuses its brief on demonstrating that PRR 830 is neither "clarification" of existing Protocols, nor in anyway consistent with the current Protocols and will create hardships on a single segment of the generation market that answered the call to make Texas the wind capital of the United States.

[1] Each set of comments is attached at the end of this, Horizon's Brief in Support of the NextEra Appeal of the TAC Recommendation Report relating to PRR 830, as Exhibits F, G, and H.

Brief in Support of the NextEra Appeal of the Technical Advisory Committee Recommendation Report Relating to PRR 830

PRR 830 submitted by the Electric Reliability Council of Texas ("ERCOT") purports to clarify what ERCOT has previously stated is already the clear standard set forth in the ERCOT Protocols relating to reactive power. This position has been the ERCOT position since it submitted its November 13, 2008 Interpretation of Reactive Power Protocols §§6.5.7.1(2) and 6.7.6(5), which was later withdrawn for procedural defects following an appeal to the Public Utility Commission of Texas ("PUCT" or "Commission"), and that ERCOT has stated it will still enforce. ERCOT is now attempting to modify the ERCOT Protocols to retroactively require retrofits to wind generation resources that have been operating in the ERCOT market for years, and at great expense—tens of millions of dollars for Horizon alone.

This is a sea change in the way the market has operated and is in direct conflict with the plain language of the ERCOT Protocols—it is not a clarification or consistent with the market rules that have been in place since 2004. The best way to explain the intent of the Protocols is to use ERCOT's own presentation to the market—conventional generators and wind generation resources alike, noting which generation is exempt from these requirements, and what the requirement is for generation that is not exempt. That presentation is dated August of 2008 and is the first attachment hereto (Exhibit A). The second slide of ERCOT's PowerPoint discusses the lead and lag requirement in the Protocols. Anyone listening to the discussions in the earlier ERCOT Committees would notice that this standard is referred to by ERCOT or Calpine as the "rectangle". However, as clearly discussed on slide 2, and demonstrated pictorially on slide 3, the .95 lead and lag requirement means that the MVAR or reactive power requirement starts at 0 and increases gradually under a .95 lead and lag standard as generation increases. Note also that the minimum requirement is clearly triangle or cone-shaped and noted plainly in ERCOT's presentation—intended to demonstrate what ERCOT's interpretation of these requirements was until just before the ERCOT Official Interpretation was issued in November of 2008 (see Exhibit B).

Wind-powered generation resources ("WGRs") have entered the Texas market and invested billions of dollars in this market under the existing rules. It is those WGRs that have made the investment under the rules in effect at the time, and today, that will be penalized by PRR 830. The reason is that PRR 830 is meant to require massive retrofits for WGRs that have long since financed their generation and for generation that has been operating in accordance with the Protocols for years.

WGRs have made their capabilities clear to ERCOT and ERCOT has allowed them to interconnect, sent them notices that they meet the ERCOT checklist, and ERCOT has had before it each time a Generation Asset Registration Form ("GARF") (now termed a Resource Asset Registration Form ("RARF")) that depicts the reactive power capability of WGRs—and that reflects the triangle. ERCOT has consistently accepted these GARFs and RARFs. For years and until very recently in the Resource Asset Registration Guide (Exhibit C), the minimum requirement for reactive power for WGRs has been depicted, clearly, as the triangle—increasing with the output of the wind

project. It is unclear how changes were made to the Resource Asset Registration Guide to remove the pictorial, but it was apparently removed in a July 2009 revision.

In addition to all of the above, ERCOT has permitted WGRs clearly providing the "cone" or "triangle" to interconnect using the Public Utility Commission of Texas ("PUCT" or "Commission") Standard Generation Interconnection Agreement ("SGIA") with the relevant transmission service provider ("TSP"). The SGIA requires that the TSP request ISO approval necessary to carry out its responsibilities. Further, ERCOT has the obligation not to interconnect generation in violation of the ERCOT Protocols or the Commission's Rules. In practice, ERCOT gets on the phone with the WGR and the TSP to discuss the project before allowing it to interconnect—including in its checklist the RARF or GARF demonstrating that it meets the ERCOT cone/triangle requirement and then sends a notice to the WGR that it complies with all of the requirements—which include reactive power requirements. WGRs go farther than the standards in the Protocols require though and implement any additional reactive equipment the TSP deems necessary at the time after the TSP has run its studies. All of this is the expectation of cost, value, market expectation and a clear sense of what the rules are—prior to interconnection and has resulted in all GARF and RARF forms striving to meet the cone/triangle in accordance with the Resource Asset Registration Guide. In addition, ERCOT required all WGRs to meet the New Generator Interconnection Checklist, attached as Exhibit D. Had WGRs not met the Checklist requirements, including for reactive power, and in accordance with the Operating Guides implementing these Protocols, ERCOT could not have interconnected these WGRs. See also RARF Approval attached as Exhibit E.

As further demonstration that the standards under PRR 830 seek to modify the rules and impose retrofits on WGRs without any basis or study, ERCOT takes the position that not only is the "rectangle" required to be provided, but that that response must now be dynamic, under ERCOT's current inaccurate interpretation of the Protocols and its language in PRR 830. The current Protocols make no mention of any dynamic power requirement and such a requirement multiples the retrofit investment by a factor of four. ERCOT is incorrect in stating that PRR 830 is not a change from the current Protocols. ERCOT's 2008 survey of WGR equipment confirmed that many have installed static reactive equipment. The "dynamic requirement" is not in the Protocols today. Only two manufacturers arguably can meet that requirement with their turbines, but those manufacturers are not comfortable warranting that their turbines have that capability. Similarly, there were no turbines on the market that could meet a rectangle standard at the time the Protocol language at issue was instituted.

Despite arguments largely from Calpine and PSEG in ERCOT committee meetings that WGRs are not "providing their fair share", it is important to note that PRR 830 only requires retrofits of WGRs, leaving all of the other conventional generation in service before 1999 exempt. To the extent retrofits are being required, which is what PRR 830 does only to WGRs, Calpine argues that generators in the market need to "step up" and "pay their fair share" for reliability. Horizon suggests that if the language requires

retrofits to existing generation to meet a new standard, that same standard should be applied across the board such that WGRs that complied with the Protocols as drafted and now are being asked to retrofit should be joined by conventional generators such as Calpine that should be treated in the same manner.

The singling out of one category of generation for retrofits is inappropriate, particularly when, as here, ERCOT has done no study or analysis to determine what is actually needed for reliability. As was stated by Mr. Dumas in the TAC meeting, ERCOT has modeled the transmission system as if WGRs met its "interpretation" (and the PRR 830 requirements) even though ERCOT knew from its own presentations, the language of the Protocols and the RARFs and GARFs submitted by WGRs, exactly what was on the system—WGRs providing the cone/triangle. ERCOT modeled a system different from what currently exists, and now seeks to force WGRs to make retrofits to make the system look like the model, rather than changing ERCOT's modeling and determining if the expense would provide any value or just be gold-plating that will not support reliability, as the only study done on the subject by NextEra demonstrates.

Looking at the language of the current Protocols, it can be easily demonstrated that PRR 830 is a shift intended to require retrofits from WGRs alone.

> § 6.5.7.1 Generation Resources Required to Provide VSS Installed Reactive Capability
>
> (2) Generation Resources required to provide VSS except as noted below in items (3) or (4), shall have and maintain a URL which has an over-excited (lagging) power factor capability of ninety-five hundredths (0.95) or less and an under-excited (leading) power factor capability of ninety-five hundredths (0.95) or less, both determined at the generating unit's maximum net power to be supplied to the transmission grid and at the transmission system Voltage Profile established by ERCOT, and both measured at the point of interconnection to the TDSP.
>
> § 6.7.6 Deployment of Voltage Support Service
>
> (5) At all times a Generation Resource unit required to provide VSS is On-line, the URL must be available for utilization at the generating unit's continuous rated active power output, and Reactive Power up to the unit's operating capability must be available for utilization at lower active power output levels. In no event shall the Reactive Power available be less than the required installed reactive capability multiplied by the ratio of the lower active power output to the generating unit's continuous rated active power output, and any Reactive Power available for utilization must be fully deployed to support system voltage upon request by ERCOT, or a TSP.

The operating capability is the level at which a WGR is running. The Protocols require that reactive power **up to the operating capability** and at lower levels must be available. Reactive power is not to be less that the installed reactive capability (which is the total possible reactive capability) **multiplied by the ratio of lower active power output to the continuous rated output** (the ratio of the amount the WGR is providing in output compared to the total it could provide). Thus, the reactive power will always be a percentage based on the output—increasing when output increases and decreasing when output decreases—as demonstrated in Exhibit A, ERCOT's presentation on reactive power.

Paragraphs (3) and (4) of Protocol Section 6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability explicitly state which Generation Resources are exempt from meeting the Reactive Power capability requirement and which Resources are not required to retrofit in PRR 830 as would WGRs. Since the end date of that exemption, over 40 WGRs with approximately 7,000 MW of capacity have interconnected with the ERCOT Transmission Grid. Horizon is not aware of a single WGR that meets ERCOT's interpretation of the required Reactive Power capability. This can be verified by reviewing the asset registration forms that ERCOT accepted from these WGRs, and from the results of an informal survey ERCOT undertook in the last half of 2008 of WGR capabilities and procedures. It is hard to comprehend how so many projects could be interconnected in a manner contrary to ERCOT's interpretation of the Reactive Power requirements, particularly if such interconnections would create reliability problems.

More than 40 wind resources that have interconnected with ERCOT since the Reactive Power capability requirement in the Protocols were instituted. At the time of such interconnections, WGRs interpreted the minimum Reactive Power requirement as the "triangle". This is borne out by ERCOT's survey of wind resources conducted in the summer and fall of 2008. The survey shows that WGRs have Reactive Power capability in the triangle, unless they have installed additional equipment. Thirty of the 49 WGRs surveyed have installed additional equipment. In every case where that additional equipment was specified, WGRs had installed capacitors. Horizon's projects are included in this number. Based on the studies conducted as part of the interconnection process, those projects installed sufficient capacitance to provide Reactive Power as described in the top half of the rectangle (lagging). The projects' leading Reactive Power capability as described by the triangle. While the minimum Reactive Power capability was agreed by all parties involved in the interconnection of these projects to be the triangle, Horizon, among others, installed additional equipment determined by the TSP to be necessary for system reliability. This equipment has been reported to ERCOT in several rounds of asset registration forms, which were accepted and approved by ERCOT prior to the issuance of its "compliance letters" in June of 2009 shortly after it withdrew its Official Protocol Interpretation and sought to remove the issue from Commission review in seeking dismissal of PUCT Docket 36482. The letter states that, based on the Reactive Power curves in the asset registration forms Horizon

had submitted, Horizon's projects appear unable to comply with ERCOT's interpretation of the protocol requirements.

ERCOT has never discussed or mentioned how WGRs supplying a good deal of energy to the ERCOT market will operate if this PRR passes. If WGRs do not comply with the Protocols, will they be allowed to continue to provide service and how would retrofits be accomplished with virtually all existing WGRs requiring retrofits and units having to be shut down? What would such a result do to increase market prices as conventional units are dispatched in place of WGRs that are down for retrofits? How will this benefit reliability if at all?

Horizon can answer some of the above questions—some WGRs may not be able to afford the retrofits and those that can will have to recover those investments from the market, raising the price for power in the ERCOT market, and benefiting conventional generation that would otherwise not be dispatched, such as Calpine's units. ERCOT states that the current system can be run reliably and has no studies or analyses of any kind to demonstrate that retrofits are needed. If this is true, then there is no reason not to implement this new standard on a forward-looking basis as NextEra's PRR compromise amendments to PRR 830 at the TAC would have done, and which Horizon supports.

Horizon believes that ERCOT got it right the first time, from 2004 through at least August of 2008, when it explained that the ERCOT requirement meant the cone/triangle as demonstrated on Exhibit A, rather than three months later when ERCOT changed its interpretation following its discovery that it had modeled the transmission system incorrectly. Market certainty in the requirements applicable to WGRs is extremely important. Investors depend upon stable rules to invest in the ERCOT market. In the case of PRR 830 where there is no demonstrated reliability need for retrofits and the only study that has been done shows that such changes do not provide reliability benefits, there is no reason to require a single WGR to spend tens of millions of dollars or the collective WGR market to spend what may well be hundreds of millions of dollars, without basis. PRR 830 should not be implemented such that one segment of the generation market is burdened with retrofits (WGRs), while other generation resources (exempt conventional generation) with which WGRs compete are benefited as market prices rise and are passed on to consumers. Horizon agrees with the NextEra comments provided at TAC to implement these new standards only on a forward-looking basis and not to penalize existing generation that has invested in the Texas market, resulting in overall lower market costs to consumers and cleaner power. Horizon incorporates the comments of NextEra in support of its appeal.

EXHIBIT A

Voltage Control Requirement

ERCOT Operations Planning

August 22, 2008

Voltage Control Protocols that apply to WGRs

- **Protocol 6.5.7.1-**

  Generation Resources Required to Provide VSS Installed Reactive Capability

  - (2) Generation Resources required to provide VSS except as noted below in items (3) or (4), shall have and maintain a Unit Reactive Limit (URL) which has an over-excited (lagging) power factor capability of ninety-five hundredths (0.95) or less and an under-excited (leading) power factor capability of ninety-five hundredths (0.95) or less, both determined at the generating unit's maximum net power to be supplied to the transmission grid and at the transmission system Voltage Profile established by ERCOT, and both measured at the point of interconnection to the TDSP.

  - (3) Qualified renewable Generation Resources (as described in Section 14, Renewable Energy Credit Trading Program) in operation before February 17, 2004, required to provide VSS and all other Generation Resources required to provide VSS that were in operation prior to September 1, 1999, whose current design does not allow them to meet the URL as stated above, will be required to maintain a URL that is limited to the quantity of Reactive Power that the Generation Resource can produce at its rated capability (MW) as determined using procedures and criteria as described in the Operating Guides.

0.95 PF requirement for generators

- Shown to the right are the reactive capability curves for a conventional generator and a WGR
- As seen from the figures, each generator is required to provide a + 0.95 to -0.95 pf voltage support
- Example:
  - **Wind generation output equals 100 MW; MVAR requirement = +/- 33 MVAR at Point of Interconnect**
  - **Wind generation output equals 0 MW; MVAR requirement = 0 MVAR at Point of Interconnect**

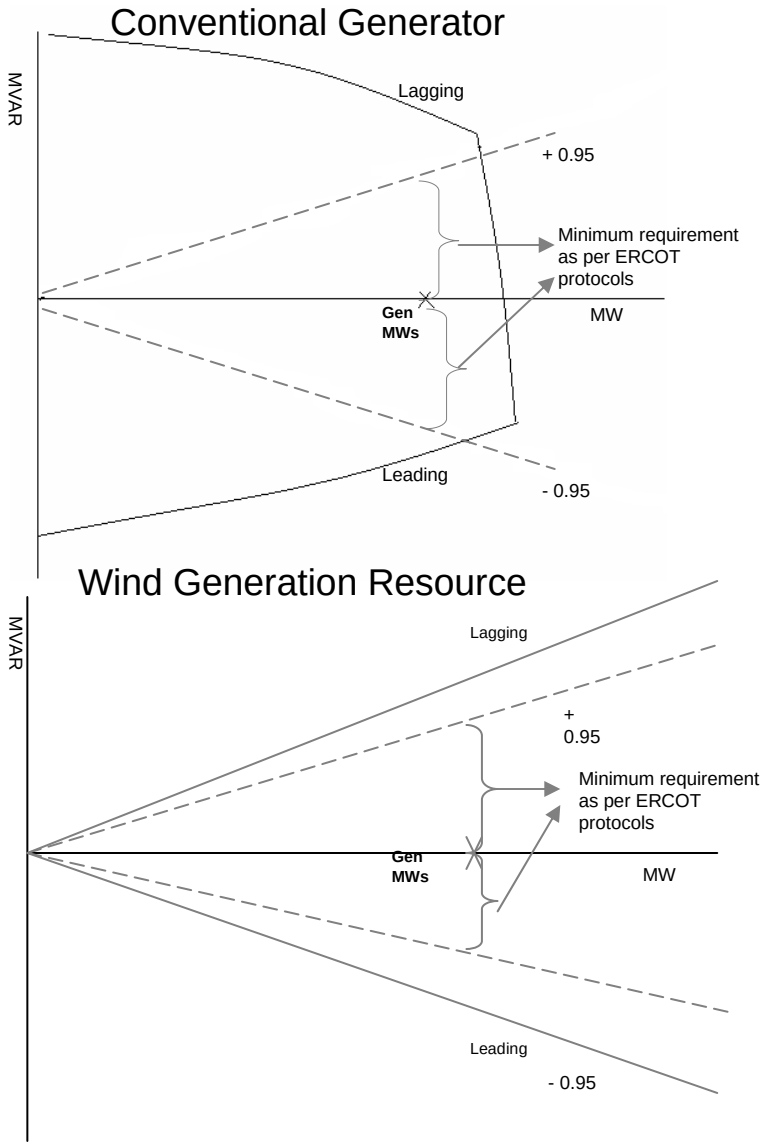


EXHIBIT B

NOTICE DATE: November 13, 2008

NOTICE TYPE: M-D111308-01 Legal

SHORT DESCRIPTION: Protocol Interpretation Request on Reactive Power Capability Requirements

INTENDED AUDIENCE: All ERCOT Market Participants

LONG DESCRIPTION: An Entity has submitted to ERCOT a Protocol Clarification/Interpretation Request (PIR) regarding subsection (2) in Protocol Section 6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability, and subsection (5) in Protocol Section 6.7.6, Deployment of Voltage Support Service. Specifically, the PIR seeks clarification on issues surrounding Reactive Power capability requirements.

ERCOT provides the following guidance to the questions submitted by the Entity.

1. **Clarify if the power factor capability of +/- 0.95 is required at all levels of generation.**

Yes. Protocol Section 6.5.7.1(2) sets the Reactive Power capability requirement for all Generation Resources that provide Voltage Support Service (VSS). The section states that a Generation Resource is required to have and maintain an Unit Reactive Limit (URL) with a power factor capability of +/- 0.95, determined at its net max output to the transmission system, and that this capability must be maintained – no exceptions are provided.

2. **Clarify the minimum reactive capability requirements at lower levels of generation and exactly how this is calculated.**

There is no minimum Reactive Power capability requirement. The Reactive Power requirement is set forth in Protocol Section 6.5.7.1, *Generation Resources Required to Provide VSS Installed Reactive Capability*. Specifically, subsection (2) states:

> Generation Resources required to provide VSS except as noted below in items (3) or (4), **shall have and maintain a URL which has an over-excited (lagging) power factor capability of ninety-five hundredths (0.95) or less and an under-excited (leading) power factor capability of ninety-five hundredths (0.95) or less**, both determined at the generating unit's maximum net power to be supplied to the transmission grid and at the transmission system Voltage Profile established by ERCOT, and both measured at the point of interconnection to the TDSP.

As described in the response to Question 1, Protocol Section 6.5.7.1(2) states that a Generation Resource must provide the MVAR requirement (+/- 0.95 power factor) calculated at the maximum net output to the ERCOT Transmission Grid, and that level must be available at all MW output levels.

ERCOT, or TSPs designated by ERCOT, have the right to instruct Generation Resources to make adjustments for voltage support within the URL capacity limits. However, dispatching a Generation Resource within a URL range is the right of the system operator, and is unrelated to, and does not affect a Generation Resource's obligation to maintain a power factor capability of +/- 0.95 when dispatched by ERCOT or TSPs.

Protocol Section 6.7.6(5) confirms the power factor capability requirement in Protocol Section 6.5.7.1(2). Specifically, the first sentence reads:

> At all times a Generation Resource unit required to provide VSS is On-Line, the URL must be available for utilization at the generating unit's continuous rated active power output, and **Reactive Power up to the unit's operating capability must be available for utilization at lower active power output levels**.

Therefore, under this Protocol as well, the power factor capability requirement does **not** decrease with decreasing generation output. A Generation Resource must be able to maintain the MVAR capability requirement as described in Protocol Section 6.5.7.1(2) even with decreasing power output.

The second sentence in Protocol Section 6.7.6(5) states:

> In no event shall the Reactive Power available be less than the required installed reactive capability multiplied by the ratio of the lower active power output to the generating unit's continuous rated active power output, and any Reactive Power available for utilization must be fully deployed to support system voltage upon request by ERCOT, or a TSP.

This sentence does not conflict with the power factor capability requirement in the first sentence or Protocol Section 6.5.7.1(2) by establishing a minimum reactive capability requirement. In fact, as described above, the requirement in 6.5.7.1(2) is confirmed in the first sentence of this section. The language in the second sentence of this section merely accounts for situations in which a Generation Resource encounters equipment-related issues or other unforeseen circumstances that may cause the Reactive Power capability to be less than the requirement in Protocol Section 6.5.7.1(2). If the Reactive Power is less than the calculation described in the second sentence, then the Generation Resource's ability to support system voltage may jeopardize the reliability of the ERCOT Transmission Grid.

3. **Clarify the definitions for "generating unit's maximum net power" as indicated in Protocol Section 6.5.7.1(2) and "the generating unit's continuous rated active power output" as indicated in Protocol Section 6.7.6(5).**

Both references above refer to the Net High Capability Limit provided by the Generation Resource to ERCOT through resource registration. Net High Capability Limit is the net high MW generation output based on the rating of plant equipment minus plant Load.

CONTACT: If you have any questions, please contact your ERCOT Account Manager. You may also call the general ERCOT Client Services phone number at (512) 248-3900 or contact ERCOT Client Services via e-mail at ClientRelations@ercot.com.

sg

EXHIBIT C

Resource Asset Registration Guide
v4.03

Revision History

Date	Version	Description	Author
10/10/2007	0.03	Draft for Internal Review	D. Showalter
10/10/2007	0.04	Second draft for Internal Review	D. Showalter
10/10/2007	0.05	Draft for Posting	D. Showalter
10/11/2007	0.06	Revised Draft for Posting	D. Showalter
10/16/2007	0.07	Revised with Market Comments	D. Showalter
12/13/2007	0.08	Revised for Planning Submittal	D. Showalter
4/01/2008	3.99	Draft -Reorganized and reformatted for RARF Ver 4	D. Showalter
4/08/2008	4.00	Released with RARF Ver 4 (Official RARF)	D. Showalter
12/16/08	4.01	Updated RARF Guide V4.01	A. Moy
2/4/2009	4.02	Updated and re-wrote transmission and load data tabs	S. Middleton
3/10/2009	4.03	Corrected / Modified business rules for transformer tab	S. Middleton

Table of Contents

1.0 Summary of Resource Registration Guide

This document is a guide to completing Resource Asset Registration with ERCOT in accordance with Section 16 of the ERCOT Nodal Protocols. Historically, the GARF, along with other documents, has been used for Resource Entities (RE) to provide information necessary to setup a Resource within ERCOT's systems, including registration, market operations, power operations, and commercial operations.

Upon obtaining the forms from Resource Entities, ERCOT will keep the RARFs in a central repository hub so the files can be tracked and easily accessed by all ERCOT systems, as well as communicated back to the Resource Entity through audits (Figure 1 below illustrates the process flow of receiving and loading RARF data).

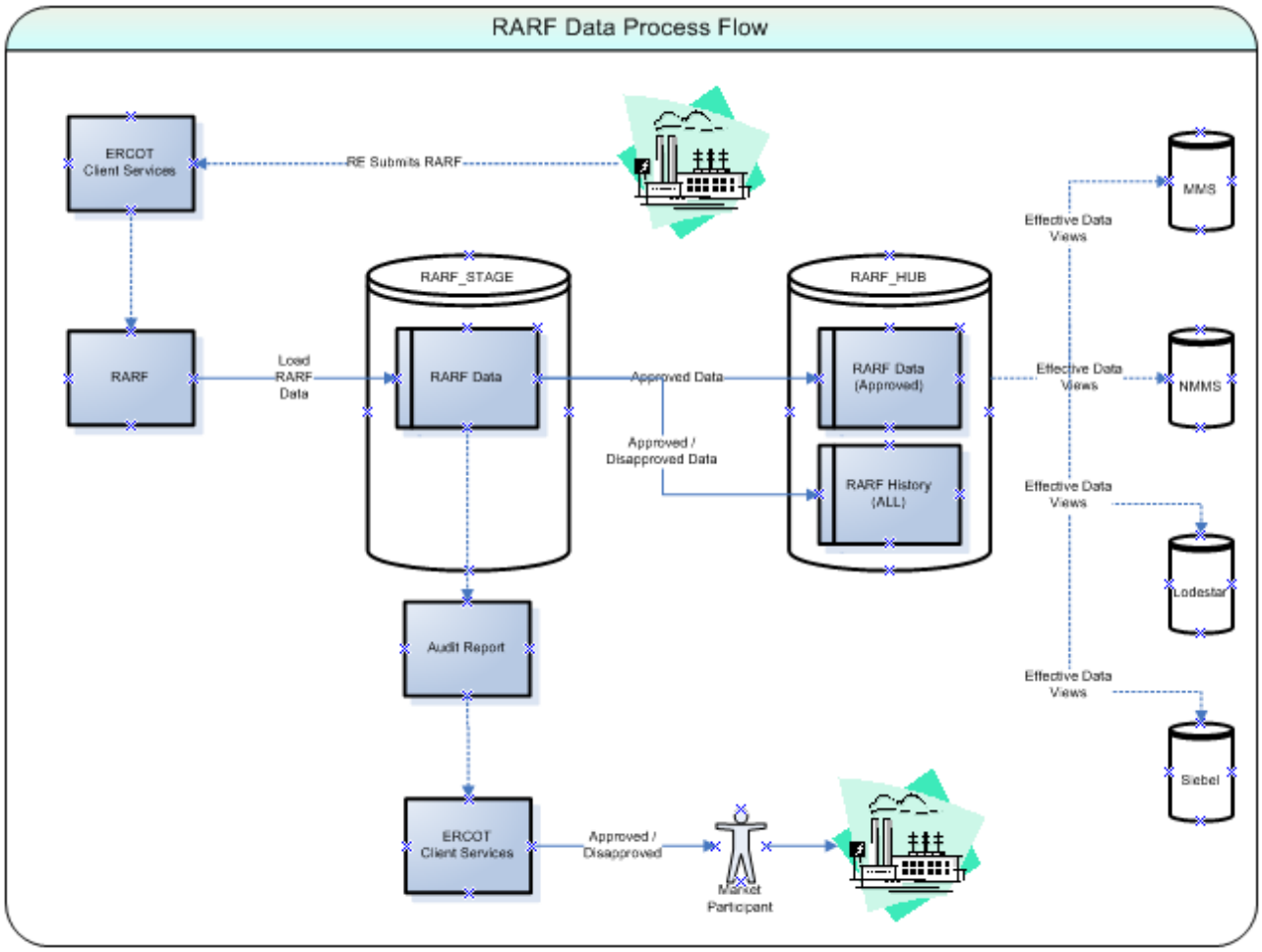


Figure 1

1.1 Tabs

The RARF uses the worksheet tabs to focus on areas. The goal is to get this as close to web-interface entry as possible. The list of tabs is as follows:

- Instructions
- Spreadsheet Map
- General Information - ALL
- Site Information - All GEN RES
- Unit Info - GEN
- Unit Info - CC
- Unit Info - WIND
- Resource Parameters - GEN
- Resource Parameters - CC
- Resource Parameters - CC CFG
- Resource Parameters - WIND
- Operational Resource Parameters - GEN
- Operational Resource Parameters - CC CFG
- Operational Resource Parameters - WIND
- Reactive Capability - GEN
- Reactive Capability - CC
- Reactive Capability - WIND
- Ownership - GEN
- Ownership - CC
- Ownership - WIND
- Configurations - CC1
- Transitions - CC1
- Configurations - CC2
- Transitions - CC2
- Configurations - CC3
- Transitions - CC3
- Planning - GEN
- Planning - CC
- Planning - WIND
- Protection - GEN
- Protection - CC
- Protection - WIND
- SubSync Resonance - GEN
- SubSync Resonance - CC
- Private Network
- GEN Owned Transmission Assets
- Line Data
- Breaker Switch Data
- Capacitor and Reactor Data

- Transformer Data

1.2 Colors

The new form for the official RARFs will primarily use colors to identify sections of the workbook. However, a pale yellow cell indicates any cell that is blank or set to zero.

ERCOT Confidential — RETURN TO MAP

Unit Information

*This worksheet tab applies only to **Wind** generation resources. This tab is UNIT specific for **all Wind**.*

Please complete this section and select RETURN TO MAP

WIND GENERATION RESOURCES

Unit Details	Labels	Unit 1	Unit 2
Unit Name		UNIT1	
Resource Name (Unit Code/Mnemonic)		TEST_UNIT1	
PUC Registration Number (Docket Number)			
ERCOT Interconnection Project Number - only new units			
NERC Number (NERC ID#)			
Unit Start Date	mm/dd/yyyy	12/12/2007	
Unit End Date	mm/dd/yyyy		
Physical Unit Type		WT	
Renewable	Y/N	Y	
Renewable/Offset		RN	
Resource Category		Renewable	
Qualifying facility	Y/N	N	
Eligible for McCamey Flowgate Rights (MCFRIs)?	Y/N	Y	
Name Plate Rating	MVA	200.00	
Real Power Rating	MW	180.00	
Reactive Power Rating	MVAR	100.00	
Unit Generating Voltage (collection voltage?)	kV	13.80	
Latitude of center of Wind Farm	decimal degrees (N)	200.00	
Longitude of center of Wind Farm	decimal degrees (W)	100.00	
Average Height above ground of Turbine Hub	meters	50.00	
Latitude of Meteorological Tower	decimal degrees (N)	200.00	
Longitude of Meteorological Tower	decimal degrees (W)	100.00	
Height of Meteorological Tower Instrumentation	meters	75.00	
Turbine Details - Turbine Information by Model			
Group 1 - Type of Turbine (Manufacturer/Model)		GE 1.5 SLE	
Group 1 - MW Rating for this model of Turbine	MW	180.00	
Group 1 - Number of this type of Turbine		10.000	

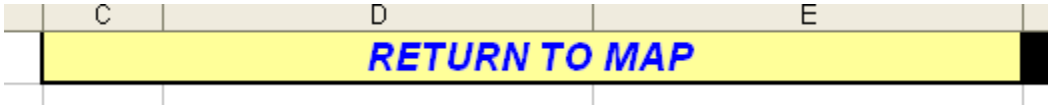
- If a cell is hatched, the cell is not ready to be filled out, and should be left blank. Upon completing the Resource Names and defining all basic site and unit information, all cells that need to be completed should be hatch-free. Do not enter data behind hatched cells.

- If a field has a Label, the data for the corresponding cell must show only the applicable data value, not the label itself,.

- N/A values or other descriptive information is not allowed in cells unless otherwise provided in the pull-down menu selection.

1.3 RARF - Hyperlinks and Mapping

In an attempt to ease accessibility to this document, hyperlinks and a mapping page have been used. Each worksheet has a “RETURN TO MAP” link at the top, in or near cell C1.



The Map page is categorized by generation type – CC, WIND and GEN where GEN is all non-wind, non-CC Generation Resources. The example below is for wind. In addition, the map shows a reference to this guide.

WIND	RARF Guide / Protocol Reference	Worksheets included in this form:
Instructions	RARF Guide: Section 3.0	Instructions
Map (this page)	RARF Guide: Section 3.0	Spreadsheet Map (this page)
General Information - ALL	RARF Guide: Section 4.0	General Information
Site Information - GEN CC WIND	RARF Guide: Section 4.0	Site Information
Unit Info - WIND	RARF Guide: Section 5.3	Unit Information
Resource Parameters - WIND	RARF Guide: Section 6.3	Resource Parameters
Operational Resource Parameters - WIND	RARF Guide: Section 7.3	Operational Resource Parameters
Reactive Capability - WIND	RARF Guide: Section 8.3	Reactive Capability
GSU Transformer - ALL	RARF Guide: Section 9.1	GSU Transformer
Ownership - WIND	RARF Guide: Section 10.3	Ownership
Planning - WIND	RARF Guide: Section 12.1	Planning
Protection - WIND	RARF Guide: Section 12.3	Planning
Private Network - PUN	RARF Guide: Section 13.0	Private Use Network
Generation Owned Transmission Assets - ALL	RARF Guide: Section 14.0	Generation Owned Transmission Assets

1.4 Glossary

A glossary has been created and is being provided as a separate document to this form. The glossary is the source for the definition of each field requested in the RARF.

162					Reactive Capability
163	Reactive Capability	GEN, CC, WIND	MW	MW1	Reactive Capability curve - point on curve of MW output for this unit, MW1
164	Reactive Capability		MVAR	Lagging MVAR limit associated with MW1 output	Unit's Lagging reactive power output capability associated with its MW1 out
165	Reactive Capability		MVAR	Leading MVAR limit associated with MW1 output	Unit's Leading reactive power output capability associated with its MW1 out negative number
166	Reactive Capability		MW	MW2	Reactive Capability curve - point on curve of MW output for this unit, MW2
167	Reactive Capability		MVAR	Lagging MVAR limit associated with MW2 output	Unit's Lagging reactive power output capability associated with its MW2 out
168	Reactive Capability		MVAR	Leading MVAR limit associated with MW2 output	Unit's Leading reactive power output capability associated with its MW2 out negative number
169	Reactive Capability		MW	MW3	Reactive Capability curve - point on curve of MW output for this unit, MW3
170	Reactive Capability		MVAR	Lagging MVAR limit associated with MW3 output	Unit's Lagging reactive power output capability associated with its MW3 out
171	Reactive Capability		MVAR	Leading MVAR limit associated with MW3 output	Unit's Leading reactive power output capability associated with its MW3 out negative number
172	Reactive Capability		MW	MW4	Reactive Capability curve - point on curve of MW output for this unit, MW4
173	Reactive Capability		MVAR	Lagging MVAR limit associated with MW4 output	Unit's Lagging reactive power output capability associated with its MW4 out
174	Reactive Capability		MVAR	Leading MVAR limit associated with MW4 output	Unit's Leading reactive power output capability associated with its MW4 out negative number
175	Reactive Capability		MW	MW5 - Unity Power Factor	From the Reactive Capability curve - the MW output at Unity Power Factor (ze
176	Reactive Capability	GEN, CC	PSI	If hydrogen cooled, indicate hydrogen pressure (psi) associated with your Reactive Curve submitted for ERCOT studies	From manufacturer Reactive Capability Curve or data sheet.
177	Reactive Capability	GEN, CC, WIND	MVAR	Net Maximum Leading Operating Capability (MVAR)	Enter the maximum lagging MVARs that can be produced. Obtained from m Capability Curve or data sheet; input as negative number
178	Reactive Capability		MVAR	Net Maximum Lagging Operating Capability (MVAR)	From manufacturer Reactive Capability Curve or data sheet.
179	Reactive Capability		Y/N	Manufacturer's Capability Curve submitted?	Has a recent curve been submitted to ERCOT? If not, please submit.
180	Reactive Capability	WIND	Y/N	Reactive Standard?	Does the Wind unit meet the reactive standard?

2.0 Instructions and Map

A RARF should be submitted for each generation resource site that contains data for all generation at the site. A separate RARF should also be submitted for each Resource Entity covering all load resources represented by that entity. A RARF is to be completed for all active and mothballed generation resources inside ERCOT. Organizations must submit a market participant application as a Resource Entity prior to submission of this form, if not eligible for Federal Hydro waiver (Section 16.5). If questions arise related to the completion of this form, please contact your designated ERCOT Account Manager or email Wholesale Client Services at NodalMarketTransition@ercot.com with the subject "Resource/Asset Registration Form".

Please bear in mind the following for the completion of this form:

- A single RARF must be submitted for each generation resource site. This form will accommodate generation Resources located at a common site as well as generation load splitting.

- A single RARF must be submitted for load resources represented by a common Resource Entity.

2.1 Process for Official Submittal

There are two methods of submitting the RARF, as follows:

PRIMARY: RARFs are to be submitted through the Texas Market Link (TML) located at https://tml.ercot.com. Submission through the TML link requires a valid Authorized Representative's digital certificate.

ALTERNATIVE: An alternate email signature document is available upon request from your ERCOT Account Manager for those who have technical problems submitting via the TML portal. The RARF must be emailed in both portable document format (pdf) and Microsoft Excel spreadsheet (xls) format, along with the signature document to: MPAPPL@ERCOT.COM and NodalMarketTransition@ercot.com.

The following are instructions for submitting the RARF through TML:

- Access to ERCOT TML requires a user digital certificate with a minimal role that allows access to "Create Service Request" on the "Market Activities" page. The "user digital certificate" is authorized by the Market Participant's User Security Administrator.

- Upon accessing TML, go to the "*Market Activities*" page and select "*Create Service Request*". Be advised that the Service Request will display in a new window as a pop-up, which may be restricted by browser settings.

- Complete the required fields on the "*Service Request*" screen annotated by red asterisks.

- The following Request Type and Sub-Type are essential to a proper submittal:
    - *Request Type:* Select "**MP Registration**" from the drop-down list
    - *Request Sub-Type:* Select "**Resource/Asset Registration**" from the drop-down list

Please note that if the Type and Sub-Type values above are not used, the RARF will not be received or processed by ERCOT Client Services.

- Click "*Submit*" (you will add the RARF file on the next screen)
- From the "*Activities and Attachments*" screen, under the Attachments heading of the Service Request click the 'Add' button.
- Select "*Browse*" icon and find the completed RARF file on your computer
- Click "*Submit*" (comments are optional)

ERCOT will verify the RARF is sent from the Authorized Representative of the registered Resource Entity via digital certificate. ERCOT may request additional authentication as deemed necessary.

2.2 Map

ERCOT Confidential		
Map of the ERCOT Resource Asset Registration Form		
This worksheet tab identifies the necessary worksheets and provides links to the pages.		
WIND	**RARF Guide / Protocol Referenc**	**Worksheets included in this form:**
Instructions	RARF Guide: Section 3.0	Instructions
Map (this page)	RARF Guide: Section 3.0	Spreadsheet Map (this page)
General Information - ALL	RARF Guide: Section 4.0	General Information
Site Information - GEN CC WIND	RARF Guide: Section 4.0	Site Information
Unit Info - WIND	RARF Guide: Section 5.3	Unit Information
Resource Parameters - WIND	RARF Guide: Section 6.3	Resource Parameters
Operational Resource Parameters - WIND	RARF Guide: Section 7.3	Operational Resource Parameters
Reactive Capability - WIND	RARF Guide: Section 8.3	Reactive Capability
GSU Transformer - ALL	RARF Guide: Section 9.1	GSU Transformer
Ownership - WIND	RARF Guide: Section 10.3	Ownership
Planning - WIND	RARF Guide: Section 12.1	Planning
Protection - WIND	RARF Guide: Section 12.3	Planning
Private Network - PUN	RARF Guide: Section 13.0	Private Use Network
Generation Owned Transmission Assets - ALL	RARF Guide: Section 14.0	Generation Owned Transmission Assets
GEN		
Instructions	RARF Guide: Section 3.0	Instructions
Map (this page)	RARF Guide: Section 3.0	Spreadsheet Map (this page)
General Information - ALL	RARF Guide: Section 4.0	General Information
Site Information - GEN CC WIND	RARF Guide: Section 4.0	Site Information
Unit Info - GEN	RARF Guide: Section 5.1	Unit Information
Resource Parameters - GEN	RARF Guide: Section 6.1	Resource Parameters
Operational Resource Parameters - GEN	RARF Guide: Section 7.3	Operational Resource Parameters
Reactive Capability - GEN	RARF Guide: Section 8.1	Reactive Capability
GSU Transformer - ALL	RARF Guide: Section 9.1	GSU Transformer
Ownership - GEN	RARF Guide: Section 10.1	Ownership
Planning - GEN	RARF Guide: Section 12.1	Planning
Protection - GEN	RARF Guide: Section 12.2	Planning
Subsynchronous Resonance - GEN	RARF Guide: Section 12.3	Planning
Private Network - PUN	RARF Guide: Section 13.0	Private Use Network
Generation Owned Transmission Assets - ALL	RARF Guide: Section 14.0	Generation Owned Transmission Assets
COMBINED CYCLE		
Instructions	RARF Guide: Section 3.0	Instructions
Map (this page)	RARF Guide: Section 3.0	Spreadsheet Map (this page)
General Information - ALL	RARF Guide: Section 4.0	General Information
Site Information - GEN CC WIND	RARF Guide: Section 4.0	Site Information
Unit Info - CC	RARF Guide: Section 5.2	Unit Information
Resource Parameters - CC	RARF Guide: Section 6.2	Resource Parameters
Resource Parameters - CC CFG (ensure configurations are entered first)	RARF Guide: Section 6.2	Resource Parameters
Operational Resource Parameters - CC CFG (ensure configurations are entered first)	RARF Guide: Section 7.3	Operational Resource Parameters
Reactive Capability - CC	RARF Guide: Section 8.2	Reactive Capability
GSU Transformer - ALL	RARF Guide: Section 9.1	GSU Transformer
Ownership - CC	RARF Guide: Section 10.2	Ownership
Configurations - CC1	RARF Guide: Section 11.2	Combined Cycle Configuration Details
Configurations - CC2	RARF Guide: Section 11.2	Combined Cycle Configuration Details
Configurations - CC3	RARF Guide: Section 11.2	Combined Cycle Configuration Details
Transitions - CC1	RARF Guide: Section 11.3	Combined Cycle Configuration Details
Transitions - CC2	RARF Guide: Section 11.3	Combined Cycle Configuration Details
Transitions - CC3	RARF Guide: Section 11.3	Combined Cycle Configuration Details
Planning - CC	RARF Guide: Section 12.1	Planning

3.0 General Information and Site Information

These sections contain information that applies to the RARF submittal and/or the site.

3.1 General Information

The General Information tab should be updated with every submittal for load and generation resources. The submittal information, such as date completed, should be updated with every submission, while the remainder of the fields should be verified. Primary contact information is essential, as it provides ERCOT with an additional contact in case of questions regarding the RARF.

ERCOT Confidential	***RETURN TO MAP***
General Information - All Resource Entities	
This worksheet tab contains information on the Resource Entity responsible for submitting this form.	
Please complete this section and select RETURN TO MAP	
This submittal is for:	
** Deletions are accepted as intentions. This form does not supersede the Notice of Suspension of Operations requirements.*	
Submittal Information	
Date Form Completed:	
Resource Entity Submitting Form:	
Resource Entity DUNS #:	
Primary Contact (name of person ERCOT can contact with questions regarding this form)	
Printed Name:	
Title:	
Phone Number:	
E-mail Address:	
Fax Number:	
Secondary Contact (if available)	
Printed Name:	
Title:	
Phone Number:	
E-mail Address:	
Fax Number:	
Instructions for Revisions	
Tab name (Use Drop-Down List):	**Describe revision and whether revision is to be applied in Zonal Market. All revisions will be applied to Nodal as default.**

3.2 Site Information

The Site Information tab identifies information for the generation resource site, such as address and ERCOT Polled Settlement metering information. The Resource Site Code is determined jointly with ERCOT, and typically aligns with the substation name at the point of interconnection.

All fields in this section must be completed with the exception of Site Stop Service Date. For assistance in identifying the 2003 Congestion Management Zone or the Resource ID (RID), please contact NodalMarketTransition@ercot.com.

Please verify the transmission provider, as some names may have changed over time.

This section does not apply to load resources.

ERCOT Confidential	RETURN TO MAP
Site Information	
This worksheet tab contains site-specific information.	
Please complete this section and select RETURN TO MAP	
All Generation Resources	
Site Info for Generation Resources (Load Resources and Block Load Transfers should skip this section)	
Resource Site Name:	
Resource Site Code:	
Street Address:	
City:	
State & Zip:	
County:	
Site In-Service Date:	
Site Stop Service Date:	
Congestion Management Zone for 2003:	
Resource owned by NOIE?	
Is Resource behind a NOIE Settlement Meter Point?	
Number of EPS Primary meters:	
Generation Load Split?	
ESI ID:	
ERCOT Read Meter?	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	

If the facility has the Gen Site Load split among multiple competitive retailers or among multiple TDSPs, the second part of the Site Information tab should be filled out as applicable (not the top ESI ID & TDSP fields). Otherwise this section should be left blank.

ERCOT Confidential	RETURN TO MAP
Site Information	
This worksheet tab contains site-specific information.	
Please complete this section and select RETURN TO MAP	
Site Load Split	
Complete this section if the Gen Site Load is split among multiple ESI IDs.	
ESI ID 1:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	
ESI ID 2:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	
ESI ID 3:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	
ESI ID 4:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	
ESI ID 5:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	
TDSP Providing Service To Resource:	
TDSP DUNS Number:	
ESI ID 6:	
Fixed Load Splitting %	
Competitive Retailer	
Competitive Retailer DUNS #	

4.0 Unit Information

The Unit Information section is required for all generation resources. This tab is split into the different sections based on generation resource type: Wind, CC, or other non-Wind, non-CC Generation.

Please enter the PUC Registration number and the NERC Registration number for tracking purposes. The ERCOT Interconnection Project number is only needed for NEW units to aid with tying the interconnection process and the commercial operation process together.

All fields in this section should be completed. Also, the ERCOT Interconnection Project Number is not needed for units already in commercial operation.

4.1 Unit Info – non-Wind, non-CC Generation Units

The Resource Name (also known as the Unit Code/Mnemonic) is the unique identifier that propagates through ERCOT systems. This is determined jointly between ERCOT and the resource, but is already established for existing units. The Resource Name consists of "SITECODE_UNITNAME". This field will populate the remainder of the spreadsheet, identifying additional fields that must be completed.

ERCOT Confidential — RETURN TO MAP

Unit Information

*This worksheet tab provides generator unit information for generation resources. This tab is UNIT specific for **all non-Wind and non-CC**.*

Please complete this section and select RETURN TO MAP

GENERATION RESOURCES (non-WIND, non-CC)

Unit Details	Labels	Unit 1	Unit 2	Unit 3
Unit Name				
Resource Name (Unit Code/Mnemonic)		TEST_A	TEST_B	
PUC Registration Number				
ERCOT Interconnection Project Number - only new units				
NERC Number				
Unit Start Date	mm/dd/yyyy			
Unit End Date	mm/dd/yyyy			
Physical Unit Type				
Primary Fuel Type				
Secondary Fuel Type				
Fuel Transportation Type				
Renewable	Y/N			
Renewable/Offset				
Resource Category				
Qualifying facility	Y/N			
Name Plate Rating	MVA			
Real Power Rating	MW			
Reactive Power Rating	MVAR			
Turbine Rating	MW			
Unit Generating Voltage	kV			

4.2 Unit Info – Combined-Cycle Units

This tab contains three parts – for registering up to three trains at one site.

The Mnemonic of Combined Cycle Train is the unique identifier that will propagate through ERCOT systems to identify the Train. This is determined by ERCOT by simply using "SITECODE_CCx" where x is 1, 2, or 3.

The Resource Name (also known as the Unit Code/Mnemonic) is the unique identifier that propagates through ERCOT systems. This is determined jointly between ERCOT and the resource, but is already established for existing units. The Resource Name consists of "SITECODE_UNITNAME". This field will populate the remainder of the spreadsheet, identifying additional fields that must be completed.

ERCOT Confidential — RETURN TO MAP

Unit Information

*This worksheet tab applies to **all combined cycle** generation resources. This information is UNIT and TRAIN specific.*
Please complete this sections (one for each train at the facility) and select RETURN TO MAP

COMBINED-CYCLE GENERATION RESOURCES CC1

Train Details	Labels	Train 1
Name of Combined Cycle Train		
Mnemonic for Combined Cycle Train		TEST_CC1
PUC Registration Number		
NERC Number		
Unit Start Date	mm/dd/yyyy	
Unit End Date	mm/dd/yyyy	
Fuel Transportation Type		
Resource Category		
Qualifying Facility (Y/N)?	Y/N	
Is train augmented with Duct Burner(s)?	Y/N	
Is train augmented with Evap Cooler(s)?	Y/N	
Is train augmented with Chiller(s)?	Y/N	
Other augmentation?	Y/N	

Unit Details	Labels	Unit 1	Unit 2	Unit 3
Unit Name				
Resource Name (Unit Code/Mnemonic)		TEST_A	TEST_B	TEST_C
ERCOT Interconnection Project Number - only new units				
Unit Start Date	mm/dd/yyyy			
Unit End Date	mm/dd/yyyy			
Physical Unit Type				
Primary Fuel Type				
Secondary Fuel Type				
Name Plate Rating	MVA			
Real Power Rating	MW			
Reactive Power Rating	MVAR			
Turbine Rating	MW			
Unit Generating Voltage	KV			

4.3 Unit Info – Wind Units

The Resource Name (also known as the Unit Code/Mnemonic) is the unique identifier that propagates through ERCOT systems. This is determined jointly between ERCOT and the resource, but is already established for existing units. The Resource Name consists of "SITECODE_UNITNAME". This field will populate the remainder of the spreadsheet, identifying additional fields that must be completed.

The Wind Unit Information tab contains information on the turbine groups. Each Wind Unit may identify up to 5 groups of turbine types, or 5 different models, within a particular unit. This section asks for the model, quantity, and rating of each.

ERCOT Confidential — RETURN TO MAP

Unit Information

*This worksheet tab applies only to **Wind** generation resources. This tab is UNIT specific for **all Wind**.*

Please complete this section and select RETURN TO MAP

WIND GENERATION RESOURCES

Unit Details	Labels	Unit 1	Unit 2	Unit 3
Unit Name				
Resource Name (Unit Code/Mnemonic)		TEST_A		
PUC Registration Number (Docket Number)				
ERCOT Interconnection Project Number - only new units				
NERC Number (NERC ID#)				
Unit Start Date	mm/dd/yyyy			
Unit End Date	mm/dd/yyyy			
Physical Unit Type				
Renewable	Y/N			
Renewable/Offset				
Resource Category				
Qualifying facility	Y/N			
Eligible for McCamey Flowgate Rights (MCFRIs)?	Y/N			
Name Plate Rating	MVA			
Real Power Rating	MW			
Reactive Power Rating	MVAR			
Unit Generating Voltage	kV			
Latitude of center of Wind Farm	decimal degrees (N)			
Longitude of center of Wind Farm	decimal degrees (W)			
Average Height above ground of Turbine Hub	meters			
Latitude of Meteorological Tower	decimal degrees (N)			
Longitude of Meteorological Tower	decimal degrees (W)			
Height of Meteorological Tower Instrumentation	meters			
Turbine Details - Turbine Information by Model				
Group 1 - Type of Turbine (Manufacturer/Model)		GROUP1		
Group 1 - MW Rating for this model of Turbine	MW			
Group 1 - Number of this type of Turbine				
Group 2 - Type of Turbine (Manufacturer/Model)				
Group 2 - MW Rating for this model of Turbine	MW			
Group 2 - Number of this type of Turbine				
Group 3 - Type of Turbine (Manufacturer/Model)				
Group 3 - MW Rating for this model of Turbine	MW			
Group 3 - Number of this type of Turbine				
Group 4 - Type of Turbine (Manufacturer/Model)				
Group 4 - MW Rating for this model of Turbine	MW			
Group 4 - Number of this type of Turbine				
Group 5 - Type of Turbine (Manufacturer/Model)				
Group 5 - MW Rating for this model of Turbine	MW			
Group 5 - Number of this type of Turbine				
Total number of turbines		*0*	*0*	*0*

5.0 Resource Parameters

The Resource Parameters tab allows generation resources to establish operational limits and long term planning information. The Seasonal Net Max Sustainable ratings for each season will also be used for the Mitigated Offer Cap.

All fields on this tab should be completed.

5.1 Generation Resources – non-Wind, non-CC Generation Units

	ERCOT Confidential		*RETURN TO MAP*		
	Resource Parameters				
	*This worksheet tab provides resource parameters for **generation** resources. This tab is UNIT specific for **all non-Wind and non-CC**.*				
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and select RETURN TO				
GENERATION RESOURCES (non-WIND, non-CC)	**Reasonability Limits**	**Labels**	**TEST_A**	**TEST_B**	
	High Reasonability Limit	MW			
	Low Reasonability Limit	MW			
	High Reasonability Ramp Rate Limit	MW/min			
	Low Reasonability Ramp Rate Limit	MW/min			
	Seasonal Ratings	**Labels**	**TEST_A**	**TEST_B**	
	Seasonal Net Max Sustainable Rating - Spring	MW			
	Seasonal Net Min Sustainable Rating - Spring	MW			
	Seasonal Net Max Emergency Rating - Spring	MW			
	Seasonal Net Min Emergency Rating - Spring	MW			
	Seasonal Net Max Sustainable Rating - Summer	MW			
	Seasonal Net Min Sustainable Rating - Summer	MW			
	Seasonal Net Max Emergency Rating - Summer	MW			
	Seasonal Net Min Emergency Rating - Summer	MW			
	Seasonal Net Max Sustainable Rating - Fall	MW			
	Seasonal Net Min Sustainable Rating - Fall	MW			
	Seasonal Net Max Emergency Rating - Fall	MW			
	Seasonal Net Min Emergency Rating - Fall	MW			
	Seasonal Net Max Sustainable Rating - Winter	MW			
	Seasonal Net Min Sustainable Rating - Winter	MW			
	Seasonal Net Max Emergency Rating - Winter	MW			
	Seasonal Net Min Emergency Rating - Winter	MW			

5.2 Generation Resources – Combined-Cycle Units and Configurations

This tab contains three parts – for registering up to three trains at one site. This information is required for Units and Configurations.

Units:

	ERCOT Confidential		*RETURN TO MAP*		
	Resource Parameters				
	*This worksheet tab provides resource parameters for **Combined Cycle** generation resources. This tab is UNIT specific for **all CC**.*				
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and select RETURN TO				
CC GENERATION RESOURCES CC1	**Reasonability Limits**	**Labels**	**TEST_A**	**TEST_B**	**TEST_C**
	High Reasonability Limit	MW			
	Low Reasonability Limit	MW			
	High Reasonability Ramp Rate Limit	MW/min			
	Low Reasonability Ramp Rate Limit	MW/min			
	Seasonal Ratings	**Labels**	**TEST_A**	**TEST_B**	**TEST_C**
	Seasonal Net Max Sustainable Rating - Spring	MW			
	Seasonal Net Min Sustainable Rating - Spring	MW			
	Seasonal Net Max Emergency Rating - Spring	MW			
	Seasonal Net Min Emergency Rating - Spring	MW			
	Seasonal Net Max Sustainable Rating - Summer	MW			
	Seasonal Net Min Sustainable Rating - Summer	MW			
	Seasonal Net Max Emergency Rating - Summer	MW			
	Seasonal Net Min Emergency Rating - Summer	MW			
	Seasonal Net Max Sustainable Rating - Fall	MW			
	Seasonal Net Min Sustainable Rating - Fall	MW			
	Seasonal Net Max Emergency Rating - Fall	MW			
	Seasonal Net Min Emergency Rating - Fall	MW			
	Seasonal Net Max Sustainable Rating - Winter	MW			
	Seasonal Net Min Sustainable Rating - Winter	MW			
	Seasonal Net Max Emergency Rating - Winter	MW			
	Seasonal Net Min Emergency Rating - Winter	MW			

Configurations:

	ERCOT Confidential		*RETURN TO MAP*		
	Resource Parameters				
	*This worksheet tab provides resource parameters for **Combined Cycle** generation resources. This tab is specific to all **CC configurations**.*				
	The cells for the resource parameters will become un-hatched for data entry, after a configuration is entered on the corresponding Configurations Tab.				
CC GENERATION RESOURCES CC1 CONFIGURATIONS	**Reasonability Limits**	**Labels**	**TEST_CC1_1**	**TEST_CC1_2**	**TEST_CC1_3**
	High Reasonability Limit	MW			
	Low Reasonability Limit	MW			
	High Reasonability Ramp Rate Limit	MW/min			
	Low Reasonability Ramp Rate Limit	MW/min			
	Seasonal Ratings	**Labels**	**TEST_CC1_1**	**TEST_CC1_2**	**TEST_CC1_3**
	Seasonal Net Max Sustainable Rating - Spring	MW			
	Seasonal Net Min Sustainable Rating - Spring	MW			
	Seasonal Net Max Emergency Rating - Spring	MW			
	Seasonal Net Min Emergency Rating - Spring	MW			
	Seasonal Net Max Sustainable Rating - Summer	MW			
	Seasonal Net Min Sustainable Rating - Summer	MW			
	Seasonal Net Max Emergency Rating - Summer	MW			
	Seasonal Net Min Emergency Rating - Summer	MW			
	Seasonal Net Max Sustainable Rating - Fall	MW			
	Seasonal Net Min Sustainable Rating - Fall	MW			
	Seasonal Net Max Emergency Rating - Fall	MW			
	Seasonal Net Min Emergency Rating - Fall	MW			
	Seasonal Net Max Sustainable Rating - Winter	MW			
	Seasonal Net Min Sustainable Rating - Winter	MW			
	Seasonal Net Max Emergency Rating - Winter	MW			
	Seasonal Net Min Emergency Rating - Winter	MW			

5.3 Generation Resource – Wind Units

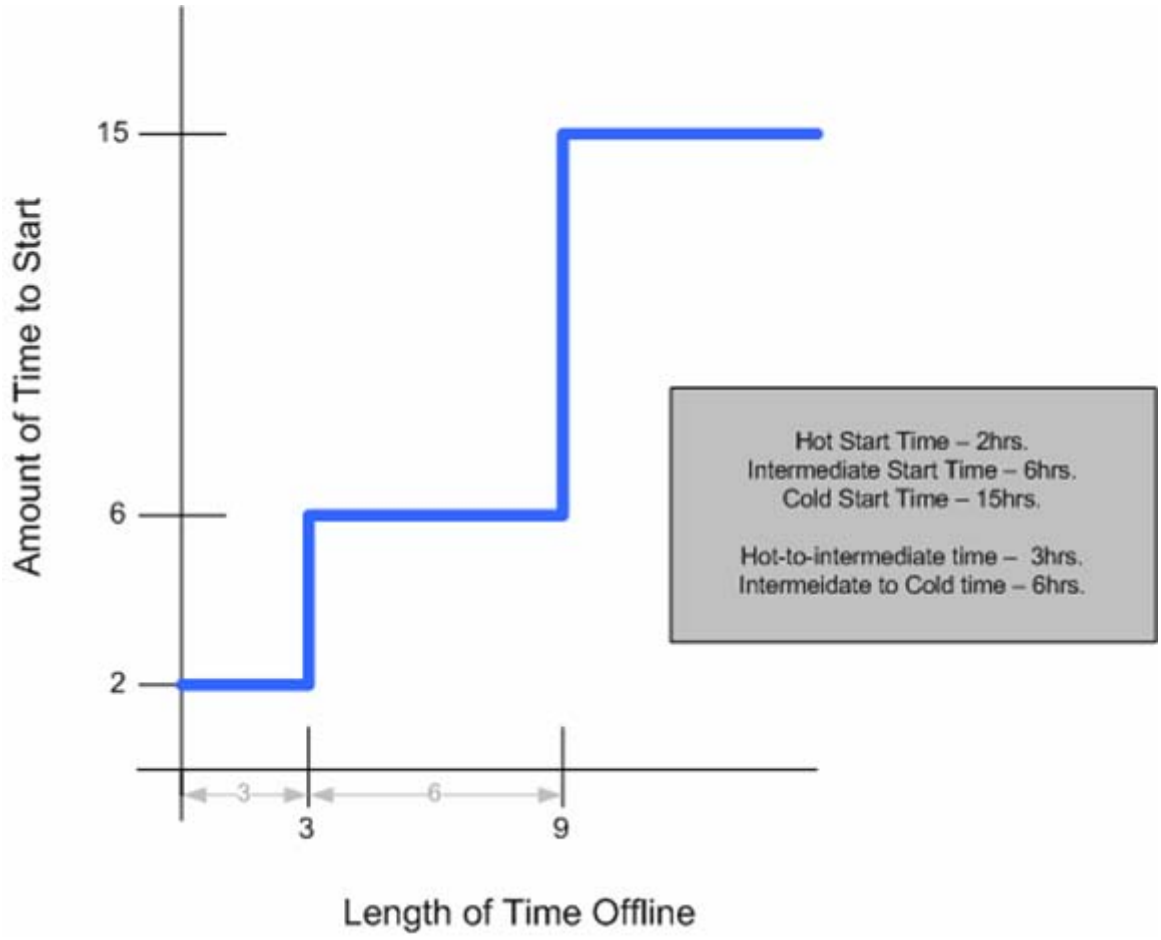
	ERCOT Confidential		*RETURN TO MAP*	
	Resource Parameters			
	*This worksheet tab provides resource parameters for **Wind** generation resources. This tab is UNIT specific for **all Wind**.*			
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this se			
WIND GENERATION RESOURCES	**Reasonability Limits**	**Labels**	**TEST_A**	
	High Reasonability Limit	MW		
	Low Reasonability Limit	MW		
	High Reasonability Ramp Rate Limit	MW/min		
	Low Reasonability Ramp Rate Limit	MW/min		
	Seasonal Ratings	**Labels**	**TEST_A**	
	Seasonal Net Max Sustainable Rating - Spring	MW		
	Seasonal Net Min Sustainable Rating - Spring	MW		
	Seasonal Net Max Emergency Rating - Spring	MW		
	Seasonal Net Min Emergency Rating - Spring	MW		
	Seasonal Net Max Sustainable Rating - Summer	MW		
	Seasonal Net Min Sustainable Rating - Summer	MW		
	Seasonal Net Max Emergency Rating - Summer	MW		
	Seasonal Net Min Emergency Rating - Summer	MW		
	Seasonal Net Max Sustainable Rating - Fall	MW		
	Seasonal Net Min Sustainable Rating - Fall	MW		
	Seasonal Net Max Emergency Rating - Fall	MW		
	Seasonal Net Min Emergency Rating - Fall	MW		
	Seasonal Net Max Sustainable Rating - Winter	MW		
	Seasonal Net Min Sustainable Rating - Winter	MW		
	Seasonal Net Max Emergency Rating - Winter	MW		
	Seasonal Net Min Emergency Rating - Winter	MW		

6.0 Operational Resource Parameters

The Operational Resource Parameters section of the RARF provides base values for start-up. The QSE will be able to update these values through the MMS.

These values are required. The only permissible blanks will be the unused portion of the ramp rate curves. (e.g. A minimum of one megawatt value is required, so the MW1 Value and the Upward & Downward Ramps for that MW value.)

The start times for hot, intermediate, and cold apply only to units and trains that are off-line. The Hot-Intermediate and Intermediate-Cold times define which start time to use by seeing how long the unit/train has been off-line. An example is shown below:



6.1 Operational Resource Parameters – non-Wind, non-CC Generation Units

ERCOT Confidential | RETURN TO MAP

Operational Resource Parameters

Resource Entity authorized QSE representing this Generation Resource to submit Resource Parameters on this page for operational purposes in accordance with Section 3.7.1 on behalf of Resource Entity.

This worksheet tab provides resource parameters for ***generation*** *resources. This tab is UNIT specific for* ***all non-Wind and non-CC***

Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and selec

GENERATION RESOURCES (non-WIND, non-CC)

Resource Parameters	Labels	TEST_A	TEST_B	
Minimum On Line Time	hours			
Minimum Off Line Time	hours			
Hot Start Time	hours			
Intermediate Start Time	hours			
Cold Start Time	hours			
Max Weekly Starts				
Max On Line Time	hours			
Max Daily Starts				
Max Weekly Energy	MWh			
Hot-to-Intermediate Time	hours			
Intermediate-to-Cold Time	hours			
Normal Ramp Rate Curve	**Labels**	**TEST_A**	**TEST_B**	
MW1	MW			
Upward RampRate1	MW/min			
Downward RampRate1	MW/min			
MW2	MW			
Upward RampRate2	MW/min			
Downward RampRate2	MW/min			
MW3	MW			
Upward RampRate3	MW/min			
Downward RampRate3	MW/min			
MW4	MW			
Upward RampRate4	MW/min			
Downward RampRate4	MW/min			
MW5	MW			
Upward RampRate5	MW/min			
Downward RampRate5	MW/min			
MW6	MW			
Upward RampRate6	MW/min			
Downward RampRate6	MW/min			
MW7	MW			
Upward RampRate7	MW/min			
Downward RampRate7	MW/min			
MW8	MW			
Upward RampRate8	MW/min			
Downward RampRate8	MW/min			
MW9	MW			
Upward RampRate9	MW/min			
Downward RampRate9	MW/min			
MW10	MW			
Upward RampRate10	MW/min			
Downward RampRate10	MW/min			
Emergency Ramp Rate Curve	**Labels**	**TEST_A**	**TEST_B**	
MW1	MW			
Upward RampRate1	MW/min			
Downward RampRate1	MW/min			
MW2	MW			
Upward RampRate2	MW/min			
Downward RampRate2	MW/min			
MW3	MW			
Upward RampRate3	MW/min			
Downward RampRate3	MW/min			
MW4	MW			
Upward RampRate4	MW/min			
Downward RampRate4	MW/min			
MW5	MW			
Upward RampRate5	MW/min			
Downward RampRate5	MW/min			
MW6	MW			
Upward RampRate6	MW/min			
Downward RampRate6	MW/min			

6.2 Operational Resource Parameters – Combined-Cycle Configurations

This tab contains three parts – for registering up to three trains at one site. This information is required for Configurations.

ERCOT Confidential | RETURN TO MAP

Operational Resource Parameters

Resource Entity authorizer QSE representing this Generation Resource to submit Resource Parameters on this page for operational purposes in accordance with Section 3.7.1 on behalf of Resource Entity.

This worksheet tab provides resource parameters for ***Combined Cycle*** *generation resources. This tab is* ***Configuration*** *specific.*

The cells for the operational resource parameters will become un-hatched for data entry, after a configuration is entered on the corresponding

CC GENERATION RESOURCES CC1 CONFIGURATIONS

Resource Parameters	s	TEST_CC1_1	TEST_CC1_2	TEST_CC1_3
Minimum On Line Time	hours			
Minimum Off Line Time	hours			
Hot Start Time	hours			
Intermediate Start Time	hours			
Cold Start Time	hours			
Max Weekly Starts				
Max On Line Time	hours			
Max Daily Starts				
Max Weekly Energy	MWh			
Hot-to-Intermediate Time	hours			
Intermediate-to-Cold Time	hours			
Normal Ramp Rate Curve	**s**	**TEST_CC1_1**	**TEST_CC1_2**	**TEST_CC1_3**
MW1	MW			
Upward RampRate1	MW/min			
Downward RampRate1	MW/min			
MW2	MW			
Upward RampRate2	MW/min			
Downward RampRate2	MW/min			
MW3	MW			
Upward RampRate3	MW/min			
Downward RampRate3	MW/min			
MW4	MW			
Upward RampRate4	MW/min			
Downward RampRate4	MW/min			
MW5	MW			
Upward RampRate5	MW/min			
Downward RampRate5	MW/min			
MW6	MW			
Upward RampRate6	MW/min			
Downward RampRate6	MW/min			
MW7	MW			
Upward RampRate7	MW/min			
Downward RampRate7	MW/min			
MW8	MW			
Upward RampRate8	MW/min			
Downward RampRate8	MW/min			
MW9	MW			
Upward RampRate9	MW/min			
Downward RampRate9	MW/min			
MW10	MW			
Upward RampRate10	MW/min			
Downward RampRate10	MW/min			
Emergency Ramp Rate Curve	**s**	**TEST_CC1_1**	**TEST_CC1_2**	**TEST_CC1_3**
MW1	MW			
Upward RampRate1	MW/min			
Downward RampRate1	MW/min			
MW2	MW			
Upward RampRate2	MW/min			
Downward RampRate2	MW/min			
MW3	MW			
Upward RampRate3	MW/min			
Downward RampRate3	MW/min			
MW4	MW			
Upward RampRate4	MW/min			
Downward RampRate4	MW/min			
MW5	MW			
Upward RampRate5	MW/min			
Downward RampRate5	MW/min			
MW6	MW			
Upward RampRate6	MW/min			
Downward RampRate6	MW/min			
MW7	MW			

6.3 Operational Resource Parameters – Wind Units

ERCOT Confidential | RETURN TO MAP

Operational Resource Parameters

Resource Entity authorizes QSE representing this Generation Resource to submit Resource Parameters on this page for operational purposes in accordance with Section 3.7.1 on behalf of Resource Entity.

*This worksheet tab provides resource parameters for **Wind** generation resources. This tab is UNIT specific for **all W***

Complete the Unit Information Tab first, then the corresponding cells will become un-hatched on this tab. Then complet

WIND GENERATION RESOURCES

Resource Parameters	Labels	TEST_A	
Minimum On Line Time	hours		
Minimum Off Line Time	hours		
Hot Start Time	hours		
Intermediate Start Time	hours		
Cold Start Time	hours		
Max Weekly Starts			
Max On Line Time	hours		
Max Daily Starts			
Max Weekly Energy	MWh		
Hot-to-Intermediate Time	hours		
Intermediate-to-Cold Time	hours		
Normal Ramp Rate Curve	**Labels**	**TEST_A**	
MW1	MW		
Upward RampRate1	MW/min		
Downward RampRate1	MW/min		
MW2	MW		
Upward RampRate2	MW/min		
Downward RampRate2	MW/min		
MW3	MW		
Upward RampRate3	MW/min		
Downward RampRate3	MW/min		
MW4	MW		
Upward RampRate4	MW/min		
Downward RampRate4	MW/min		
MW5	MW		
Upward RampRate5	MW/min		
Downward RampRate5	MW/min		
MW6	MW		
Upward RampRate6	MW/min		
Downward RampRate6	MW/min		
MW7	MW		
Upward RampRate7	MW/min		
Downward RampRate7	MW/min		
MW8	MW		
Upward RampRate8	MW/min		
Downward RampRate8	MW/min		
MW9	MW		
Upward RampRate9	MW/min		
Downward RampRate9	MW/min		
MW10	MW		
Upward RampRate10	MW/min		
Downward RampRate10	MW/min		
Emergency Ramp Rate Curve	**Labels**	**TEST_A**	
MW1	MW		
Upward RampRate1	MW/min		
Downward RampRate1	MW/min		
MW2	MW		
Upward RampRate2	MW/min		

6.4 Ramp Rates

The Ramp Rate Curve data must be entered for both Normal and Emergency Operations. The ramp rates are initially submitted in the RARF, however the QSE will be able to update the ramp rates in Market Management System (MMS).

Ramp rate curves are step functions in the up and down directions at ten MW break points. All ramp rate values, including downward rates, should be entered in the RARF as non-zero positive values. The ramp rates and curves are critical and must be provided for every unit or, in the case of Combined Cycle facilities, ramp rates curves are needed for every configuration

The values submitted in the RARF are used to build the ramp rate step curves, and should not be used as tools to restrain the operating range of the unit or configuration. The curves are limited to LRL and HRL. Further operating restrictions exist as part of the COP and telemetry.

For ranges where the resource must be manually ramped, the up and down ramp rate should be a MW rate at which, if requested, the resource can be manually ramped to within a 5 minute period.

Only one ramp rate is required for the Normal curve and the Emergency curve.

The following picture is an example of a Ramp Rate curve using only five MW break points.

Normal Ramp Rate Curve	Labels	TEST_UNIT1
MW1	MW	50.00
Upward RampRate1	MW/min	5.00
Downward RampRate1	MW/min	8.00
MW2	MW	100.00
Upward RampRate2	MW/min	7.00
Downward RampRate2	MW/min	9.00
MW3	MW	150.00
Upward RampRate3	MW/min	12.00
Downward RampRate3	MW/min	10.00
MW4	MW	200.00
Upward RampRate4	MW/min	8.00
Downward RampRate4	MW/min	8.00
MW5	MW	250.00
Upward RampRate5	MW/min	6.00
Downward RampRate5	MW/min	7.00
MW6	MW	
Upward RampRate6	MW/min	
Downward RampRate6	MW/min	
MW7	MW	
Upward RampRate7	MW/min	
Downward RampRate7	MW/min	
MW8	MW	
Upward RampRate8	MW/min	
Downward RampRate8	MW/min	
MW9	MW	
Upward RampRate9	MW/min	
Downward RampRate9	MW/min	
MW10	MW	
Upward RampRate10	MW/min	
Downward RampRate10	MW/min	

The curve below is shown to help visualize how the reasonability and sustainable limits act as operational limiters as entered on the COP:

7.0 Reactive Capability

The Reactive Capability section requires the submittal of the manufacturer's capability curve as well as the 9-point curve values in the RARF. This information will be used to validate test data and should be the best design information available – including all reactive limitations. ERCOT will continue to require bi-annual testing, and this data will be used operationally.

With the exception of Wind, all values on this tab should be filled in.

7.1 Reactive Capability – non-Wind, non-CC Generation Units

ERCOT Confidential — *RETURN TO MAP*

Reactive Capability

*This worksheet tab provides reactive capability for **generation** resources. This tab is UNIT specific for **all non-Wind and non-CC**.*
Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section

GENERATION RESOURCES (non-WIND, non-CC)	Reactive Capability Curve	Labels	TEST_A	TEST_B
	MW1	MW		
	Lagging MVAR limit associated with MW1 output	MVAR		
	Leading MVAR limit associated with MW1 output	MVAR		
	MW2	MW		
	Lagging MVAR limit associated with MW2 output	MVAR		
	Leading MVAR limit associated with MW2 output	MVAR		
	MW3	MW		
	Lagging MVAR limit associated with MW3 output	MVAR		
	Leading MVAR limit associated with MW3 output	MVAR		
	MW4	MW		
	Lagging MVAR limit associated with MW4 output	MVAR		
	Leading MVAR limit associated with MW4 output	MVAR		
	MW5 - Unity Power Factor	MW		
	If hydrogen cooled, indicate hydrogen pressure (psi) associated with your Reactive Curve submitted for ERCOT	PSI		
	Maximum Leading Operating Capability (MVAR)	MVAR		
	Maximum Lagging Operating Capability (MVAR)	MVAR		
	Manufacturer's Capability Curve submitted?	Y/N		

7.2 Reactive Capability – Combined-Cycle Units

This tab contains three parts – for registering up to three trains at one site. This information is required for Units.

ERCOT Confidential | RETURN TO MAP

Reactive Capability

*This worksheet tab provides reactive capability for **Combined Cycle** generation resources. This tab is UNIT specific for **all CC**.*

Please complete this section and select RETURN TO MAP

CC GENERATION RESOURCES CC1

Reactive Capability Curve	Labels	TEST_A	TEST_B	TEST_C
MW1	MW			
Lagging MVAR limit associated with MW1 output	MVAR			
Leading MVAR limit associated with MW1 output	MVAR			
MW2	MW			
Lagging MVAR limit associated with MW2 output	MVAR			
Leading MVAR limit associated with MW2 output	MVAR			
MW3	MW			
Lagging MVAR limit associated with MW3 output	MVAR			
Leading MVAR limit associated with MW3 output	MVAR			
MW4	MW			
Lagging MVAR limit associated with MW4 output	MVAR			
Leading MVAR limit associated with MW4 output	MVAR			
MW5 - Unity Power Factor	MW			
If hydrogen cooled, indicate hydrogen pressure (psi) associated with your Reactive Curve submitted for ERCOT	PSI			
Maximum Leading Operating Capability (MVAR)	MVAR			
Maximum Lagging Operating Capability (MVAR)	MVAR			
Manufacturer's Capability Curve submitted?	Y/N			

SOURCES CC2

Reactive Capability Curve	Labels			
MW1	MW			
Lagging MVAR limit associated with MW1 output	MVAR			
Leading MVAR limit associated with MW1 output	MVAR			
MW2	MW			
Lagging MVAR limit associated with MW2 output	MVAR			
Leading MVAR limit associated with MW2 output	MVAR			
MW3	MW			

7.3 Reactive Capability – Wind Units

The 9 point reactive curve data points must be submitted for each unit, as well as the manufacturer's capability curve. The units are listed in the vertical columns – the RARF allows up to five. The groups are horizontal.

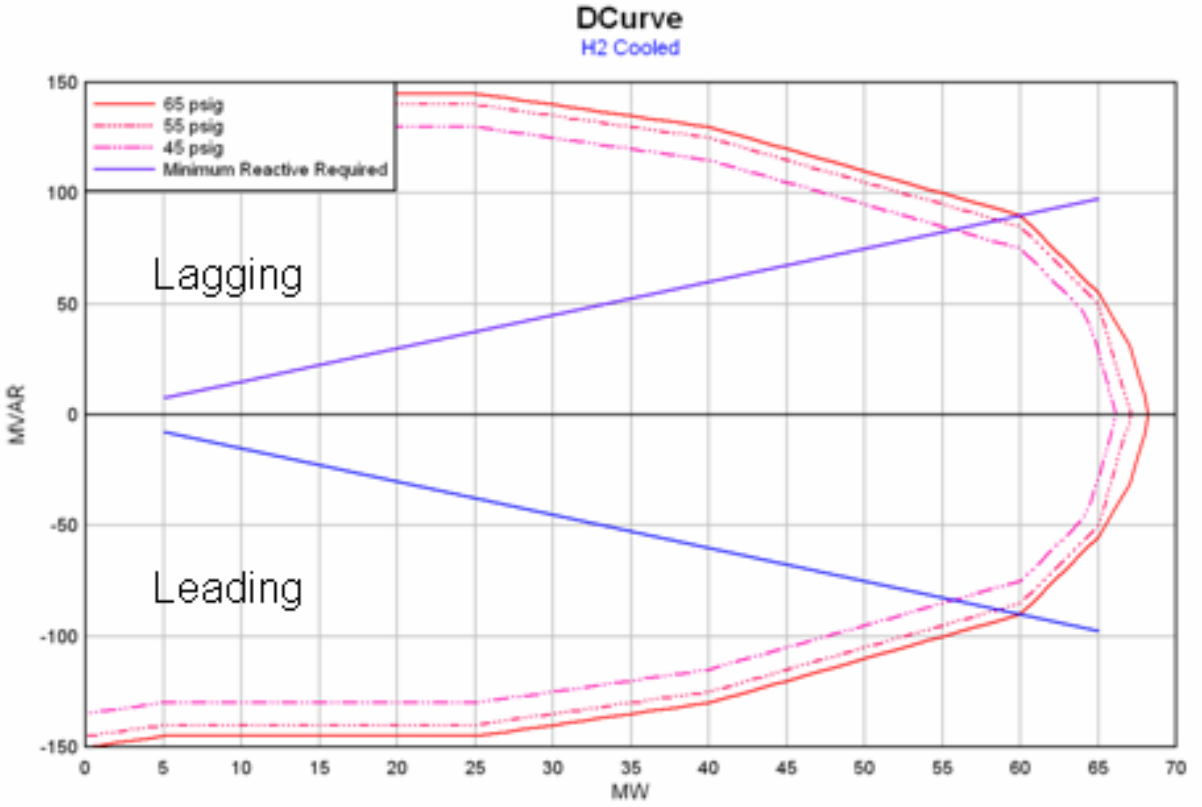
Reactive capability must be completed for each group of each unit.

ERCOT Confidential		*RETURN TO MAP*				
Reactive Capability						
	*This worksheet tab provides reactive capability for **Wind** generation resources. This tab is UNIT specific for **all WIND**.*					
	Complete the Unit Information Tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and select RETURN TO					
WIND GENERATION RESOURCES UNIT 1	**Reactive Capability Curves - TEST_A**	**Labels**	**Group 1**	**Group 2**	**Group 3**	**Group 4**
	Does this unit meet the ERCOT Reactive Standard?					
	MW1	MW				
	Lagging MVAR limit associated with MW1 output	MVAR				
	Leading MVAR limit associated with MW1 output	MVAR				
	MW2	MW				
	Lagging MVAR limit associated with MW2 output	MVAR				
	Leading MVAR limit associated with MW2 output	MVAR				
	MW3	MW				
	Lagging MVAR limit associated with MW3 output	MVAR				
	Leading MVAR limit associated with MW3 output	MVAR				
	MW4	MW				
	Lagging MVAR limit associated with MW4 output	MVAR				
	Leading MVAR limit associated with MW4 output	MVAR				
	MW5 - Unity Power Factor	MW				
	Maximum Leading Operating Capability	MVAR				
	Maximum Lagging Operating Capability	MVAR				
	Has the Manufacturer's Capability Curve submitted?	Y/N				

7.4 D-Curve / REACTIVE CAPABILITY CURVES

Reactive capability is the ability of a generator unit to supply/absorb reactive power (MVAR) to the grid continuously for a given MW operating value without damaging the unit. Reactive power is required to control voltage under normal and emergency situations in order to prevent voltage collapse of the grid. Reactive capability qualification testing is required by ERCOT for verification of maximum leading and lagging capability of all generation resources required to provide voltage support service.

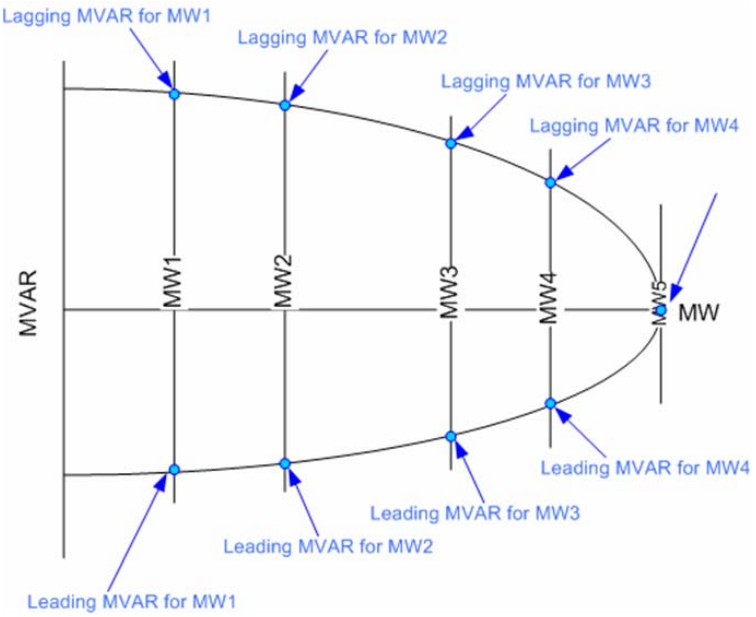
The Reactive Capability Curve, also known as the D-curve, represents the operating limits of the generator. The example Reactive Capability Curve pictured below shows the Reactive Capability Curve or D-Curve of a generator unit where the X-axis is MW and the Y-axis is MVAR, and is intended for illustrative purposes only. Values above the x-axis (positive VARs) are "LAGGING" MVARs and values below the x-axis (negative VARs) are "LEADING" MVARs.


DCurve
H2 Cooled
65 psig
55 psig
45 psig
Minimum Reactive Required
Lagging
Leading
MVAR
MW
150
100
50
0
-50
-100
-150
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70

To establish the curve in the RARF, ERCOT requests nine points of data. When entering data on the RARF, use POSITIVE values to represent the lagging MVARs and NEGATIVE values to represent leading MVARs. If the unit is hydrogen cooled, indicate pressure of hydrogen in psi; otherwise leave the cell blank. Supply 5 increasing MW values of operating real power - MW1 at the lowest operation MW through MW 5 at unity power factor. An example of this entry is shown below.

Reactive Capability Curve	Labels	TEST_UNIT1
MW1	MW	50.00
Lagging MVAR limit associated with MW1 output	MVAR	10.00
Leading MVAR limit associated with MW1 output	MVAR	-12.00
MW2	MW	100.00
Lagging MVAR limit associated with MW2 output	MVAR	15.00
Leading MVAR limit associated with MW2 output	MVAR	-25.00
MW3	MW	150.00
Lagging MVAR limit associated with MW3 output	MVAR	20.00
Leading MVAR limit associated with MW3 output	MVAR	-35.00
MW4	MW	200.00
Lagging MVAR limit associated with MW4 output	MVAR	30.00
Leading MVAR limit associated with MW4 output	MVAR	-50.00
MW5 - Unity Power Factor	MW	250.00
If hydrogen cooled, indicate hydrogen pressure (psi) associated with your Reactive Curve submitted for ERCOT studies	PSI	65.0
Maximum Lagging Operating Capability (MVAR)	MVAR	40.00
Maximum Leading Operating Capability (MVAR)	MVAR	-55.00
Manufacturer's Capability Curve submitted?	Y/N	Y

The following is an example of a D-curve and the selection of points. The graph below shows five MW points and corresponding MVARs. After entering these values in the form, the end curve is shown. This implies that the MW selection points should move closer to the unity end to more accurately depict the curve and reactive capability of the resource.



8.0 Split Generation Resources

The responsibility for ensuring proper resource registration belongs to the Resource Entity that represents or controls the output of the unit(s). Joint-ownership is not formally defined in ERCOT. These resources are referred to as Split Generation.

If the entire output of all units at a facility/site is controlled by one Resource Entity only, then the top section should be completed. However, if multiple Resource Entities share ownership, even if the split is by entire units, then the Split Generation Resource section must be completed. This will allow the unit to be properly aligned with the Resource Entity in the ERCOT registration system.

8.1 Ownership – non-Wind, non-CC Generation Units

Complete this section ONLY if a single Resource Entity (RE) represents 100% of all units.		
Resource Owner Data	**Owner 1**	
Resource Entity Name		
Resource Duns Number		
Complete the following sections if units at the same site are represented by different Resource Entites (RE) or represented a		
TEST_A	**Owner 1**	**Owner 2**
Market Participant (Resource) Name	RESOURCEOWNER1	RESOURCEOWNER2
Market Participant (Resource) Duns Numb	123456789	3216549872000
Fixed Ownership % (must equal 100%)	60.00%	40.00%
Master Owner (Y or N)	Y	N
	Owner 1	**Owner 2**
Market Participant (Resource) Name		
Market Participant (Resource) Duns Number		
Fixed Ownership % (must equal 100%)		
Master Owner (Y or N)		

8.2 Split Resource Generation – Combined-Cycle Units

This tab contains three parts, for registering up to three trains at one site. The information is required for each train. ERCOT does not allow Combined-Cycle Resources to register as Split Generation.

CC1	Complete this section if a single Resource Entity (RE) represents 100% of all units	
	Resource Owner Data - TEST_CC1	Owner
	Resource Entity Name	RESOURCEOWNER1
	Resource Duns Number	123456789
CC2	Complete this section if a single Resource Entity (RE) represents 100% of all units	
	Resource Owner Data -	Owner
	Resource Entity Name	RESOURCEOWNER1
	Resource Duns Number	3216549872000
CC3	Complete this section if a single Resource Entity (RE) represents 100% of all units	
	Resource Owner Data -	Owner
	Resource Entity Name	
	Resource Duns Number	

8.3 Split Resource Generation – Wind Units

ERCOT Confidential		***RETURN TO MAP***
Representation of Facility Output		
	This worksheet tab applies to ***all WIND*** *Generation Resources. This tab identifies the Resource*	
	Please complete either the single Resource Owner section or the Split-Generation Owners secti	
WIND GENERATION RESOURCES	**Complete this section ONLY if a single Resource Entity (RE) represents 100% of all units.**	
	Resource Owner Data	**Owner 1**
	Resource Entity Name	
	Resource Duns Number	
	Complete the following sections if units at the same site are represented by different Reso	
	TEST_A	**Owner 1**
	Market Participant (Resource) Name	RESOURCEOWNER1
	Market Participant (Resource) Duns Number	123456789
	Fixed Ownership % (must equal 100%)	100.00%
	Master Owner (Y or N)	Y
	TEST_B	**Owner 1**
	Market Participant (Resource) Name	RESOURCEOWNER2
	Market Participant (Resource) Duns Number	3216549872000
	Fixed Ownership % (must equal 100%)	100.00%
	Master Owner (Y or N)	Y
		Owner 1
	Market Participant (Resource) Name	
	Market Participant (Resource) Duns Number	
	Fixed Ownership % (must equal 100%)	
	Master Owner (Y or N)	

9.0 Combined-Cycle Configurations and Transitions

Before the details such as ramp rates can be entered for a configuration, the configurations must be established.

9.1 Configurations

This section is pre-populated with the unit mnemonic, the unit type, and the nameplate MVA rating for reference. CCx refers to a combined cycle train, e.g. CC1 or CC2 or CC3.

Previously, ERCOT limited registration of configurations to no more than the number of units in the train. In this registration, resources are allowed to register all operationally unique configurations. When registering additional configurations, bear in mind the configurations should represent logical configurations (1-0, 2-0, 1-1, etc.), and should NOT represent uniqueness for individual units. In the example below, whether running Unit1&Steamer or Unit2&Steamer, the resource would represent only one unique configuration of 1-on-1.

Enter the unique configurations for each train. Assistance with developing all unique configurations can be found later in this document. The keys to properly identifying the configurations include defining the configurations to increase in MW and in units from left to right (configuration 1 through xx).

As a configuration is entered, the cells for all the resource parameters for that configuration will become available for data entry. The resource parameters must be filled, as this will overwrite any RARF submittals for all configurations.

ERCOT CONFIDENTIAL — *RETURN TO MAP*

Combined Cycle Configurations

*This worksheet tab applies to **all Combined Cycle** Generation Resources. Please complete this section and select RETURN TO MAP*

As a configuration is entered into the CCx Config tab, the hatched cells will open up in the corresponding CCx Transition tab.

	Resource Name (Unit Code)	Unit Type	TEST_CC1_1	TEST_CC1_2	TEST_CC1_3
CC1	TEST_A	0	x	x	x
	TEST_B	0	a	x	x
	TEST_C	0			x
	Number of units and MW increase from left to right.				

9.2 Transitions

As a configuration is entered into the CCx Config tab, the hatched cells will open up in the corresponding CCx Transition tab. This table is a map that, for each operating state/configuration, identifies what states/configurations are next available – e.g. adding a unit or removing a unit. This map is critical to properly transition the ERCOT systems.

ERCOT CONFIDENTIAL — RETURN TO MAP

Combined Cycle Transitions

*This worksheet tab applies to **all Combined Cycle** Generation Resources. This tab defines the operating transitions.*

Transition cells will open as a configuration is entered into the corresponding CCx Config tab. After completing this section, select RETURN TO MAP

From \ To	Offline	TEST_CC1_1	TEST_CC1_2	TEST_CC1_3	TEST_CC1_4	TEST_CC1_5
Offline		X				
TEST_CC1_1	X		X			
TEST_CC1_2	X	X		X		
TEST_CC1_3	X	X	X			
TEST_CC1_4						

9.3 Establishing Configurations and Transitions

The following are steps intended to aid in developing configurations and transitions. These steps are not required.

An example is included for illustrative purposes only. For the example, assume a three unit train named ABC_CC1, consisting of two 100MW combustion turbines (CT) and one 100MW steam turbine (CA). When one CT is on, assume the CA can operate at 50% output.

Step 1:

Establish and register all operationally unique configurations with ERCOT. When registering additional configurations, bear in mind the configurations represent logical configurations (1-0, 2-0, 1-1, etc), and should NOT represent uniqueness for individual units. In the example below, whether running Unit1&Steamer or Unit2&Steamer, the resource would only represent one unique configuration of 1-on-1. Additional background to assist with this step can be obtained from the combined cycle whitepaper found at http://www.ercot.com/calendar/2008/01/20080121-TPTF.html, item 31.

This step should also establish a configuration order, 1 through xx (where xx represents, at a maximum, the number of unique configurations for the train). The sort order for the configurations should be from lowest to highest MW. A secondary sort order, if needed, would be to assign the lower configuration number to the configuration with fewer units operating.

Step 1 Example:

CC1 can operate in four unique configurations – 1x0, 2x0, 1x1, and 2x1. Each configuration has a different MW output. These configurations and the output have been identified in the table to the right. Applying the configuration order requirement, the yellow cells identify the order that they should be entered into the CCx Config table.

CC1		MW	1x0	2x0	1x1	2x1
Unit 1	CT	100	x	x	x	x
Unit 2	CT	100	a	x	a	x
Unit 3	CA	100			x	x
		300	100	200	150	300
			1	*3*	*2*	*4*

Step 2:

Enter the configurations into the CCx Config tab of Addendum 2.

Step 2 Example:

Unit Code / Mnemonic	Unit Type, MVA	ABC_CC1_1	ABC_CC1_2	ABC_CC1_3	ABC_CC1_4
ABC_Unit1	CT, 120MVA	X	X	X	X
ABC_Unit2	CT, 120MVA	A	A	X	X
ABC_Unit3	CA, 120MVA		X		X

Step 3:

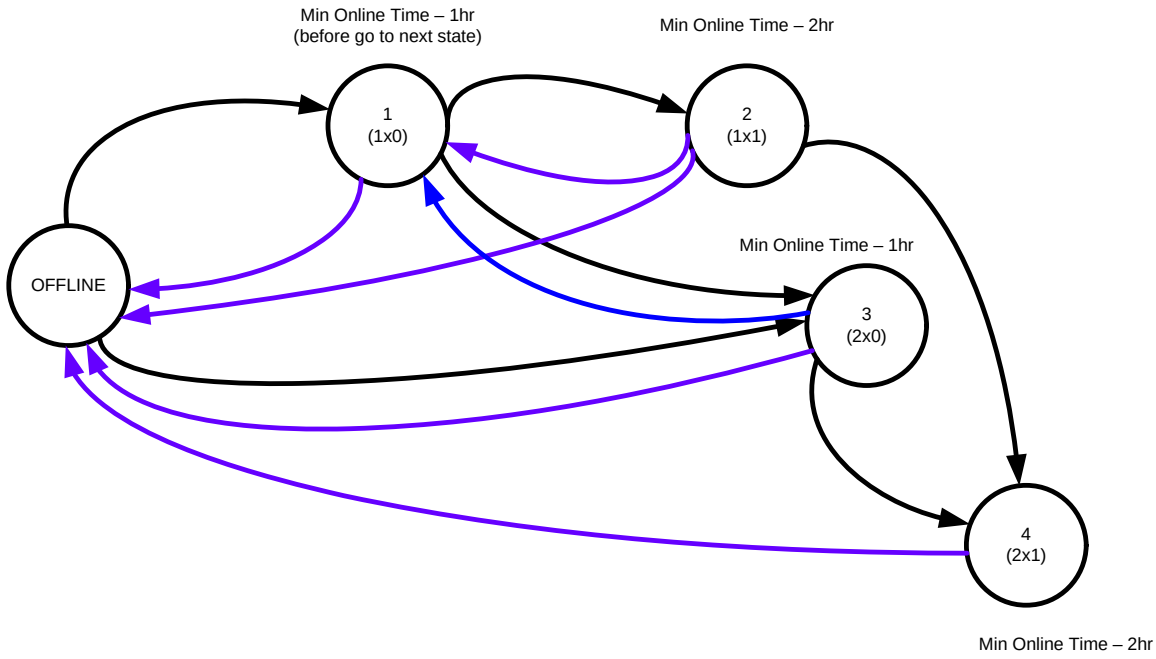
Enter resource parameter information for the configurations. Use the hyperlinks and the map to return to these sections.

Step 4:

Construct a state diagram, where each configuration is a “state” represented by a circle. Then arrows are drawn from each configuration to any other that can be reached **within the minimum online time.**

The state diagram should be laid out from left to right, where OFFLINE is furthest to the left, and the highest configuration number is furthest to the right. Draw arrows between states/configurations to indicate where the train could operate next. If the configurations were assigned correctly, arrows to the right should add a unit and increase MW. Arrows to the left should indicate decreasing MW and units. This diagram will help you build an accurate matrix for the Nodal systems.

Step 4 Example:



Step 5:

Go to the transition tab to complete the transition matrix.

Referring to the state diagram constructed in Step 4, each arrow should be an X in the matrix. With this layout, an arrow from left to right will be entered as an X in the transition matrix *above* the black diagonal, and any arrow from right to left will be entered as an X in the transition matrix *below* the black diagonal.

Please keep in mind that the unit will stay in any one state/configuration for the duration of the minimum online time.

Step 5 Example:

From Offline, this train can go to ABC_CC1_1 or ABC_CC1_2. This could be any state that could be reached in one hour from offline. The unit will stay in the initial state for the duration of the minimum online time.

To / From	Offline	ABC_CC1_1	ABC_CC1_2	ABC_CC1_3	ABC_CC1_4
Offline		X		X	
ABC_CC1_1	X		X	X	
ABC_CC1_2	X	X			X
ABC_CC1_3	X	X			X
ABC_CC1_4	X				

In this example, the train could reach Configuration 4 after 1 hour by going from Offline to Configuration 3 (ABC_CC1_3), wait the minimum online time of 1 hour, then transition to Configuration 4 (ABC_CC1_4). If the steamer cannot be ready in 1 hour, then the minimum online time should be increased for Configuration 3.

Alternatively, the train could reach Configuration 4 in 3 hours by going from ABC_CC1_1, wait 1 hour, go to ABC_CC1_2, wait 2 hours, then go to ABC_CC1_4. Again, if the steamer cannot be ready in 1 hour, then the minimum online time for Configuration 1 should be increased.

Complete these steps for each CC train.

10.0 Planning

The Planning Information section of the RARF, along with the PSSE Model datasheets, provides ERCOT with the information needed to properly complete studies. The planning section of the RARF has been separated into three sections.

10.1 Planning Information

This section provides details to ERCOT regarding generator details, auxiliary load information, acknowledgement of PSSE model submittals, as well as transient and subtransient reactances.

Machine Impedance is equivalent to Zeq, which consists of the armature, rotor, and mutual coupling impedances. In addition, the System Protection Working Group needs the Positive, Negative, and Zero sequence impedances.

The Auxiliary Load should be defined by identifying the amount of load in MW and MVAR for each unit. The Load Characteristics should be completed to allocate 100% of the MW and MVAR (separately) across the types of load the facility may have. Please include any motor connected to 2400V/4160V and above with the large motor percentage and lower voltage motors as small.

New Resources should request the PSSE model direct from the manufacturer, especially if the standard models do not exist.

If there are questions related to the PSSE models, please contact your designated ERCOT Account Manager or email Wholesale Client Services at NodalMarketTransition@ercot.com.

All fields in this section should be completed.

10.1.1 Planning – non-Wind, non-CC Generation Units

ERCOT Confidential			*RETURN TO MAP*	
Planning Information				
	*This worksheet tab provides planning information for **generation** resources. This tab is UNIT specific for **all non-Wind and non-CC**.*			
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and select RE			
GEII (non-wind, non-CC)	**Generator Details**	**Labels**	**TEST_A**	**TEST_B**
	What is the MVA base that the following data is based on?	MVA		
	What is the kV base that the following data is based on?	kV		
	Machine Impedance Zeq (R+jX)	R in p.u.		
		X in p.u.		
	Armature Z	R in p.u.		
		X in p.u.		
	Rotor Z	R in p.u.		
		X in p.u.		
	Mutual coupling Armature-Rotor Z	R in p.u.		
		X in p.u.		
	Positive Sequence Z	R in p.u.		
		X in p.u.		
	Negative Sequence Z	R in p.u.		
		X in p.u.		
	Zero Sequence Z	R in p.u.		
		X in p.u.		
	Generator Auxiliary Load	**Labels**	**TEST_A**	**TEST_B**
	Average Amount of Auxiliary Real Power	MW		
	Average Amount of Auxiliary Reactive Power	MVAR		
	Generation Auxiliary Load Characteristics for MW Load			
	Large Motor, percent of total MW load	%		
	Small Motor, percent of total MW load	%		
	Resistive (Heating) Load, percent of total MW load	%		
	Discharge Lighting, percent of total MW load	%		
	Other, percent of total MW load	%		
	Generation Auxiliary Load Characteristics for MVAR Load			
	Large Motor, percent of total MVAR load	%		
	Small Motor, percent of total MVAR load	%		
	Discharge Lighting, percent of total MVAR load	%		
	Other, percent of total MVAR load	%		
	PSSE Model		**TEST_A**	**TEST_B**
	Generator Form on file with ERCOT?	Y/N		
	Turbine-Governor Form on file with ERCOT?	Y/N		
	Excitation Form on file with ERCOT?	Y/N		
	Do you have a Power System Stabilizer?	Y/N		
	If so, is Stabilizer Form on file with ERCOT?	Y/N		
	Do you have a Compensator?	Y/N		
	If so, is Compensator Form on file with ERCOT?	Y/N		
	Do you have a Over Excitation Limiter?	Y/N		
	If so, is Over Excitation Limiter Form on file with ERCOT?	Y/N		
	Do you have a Under Excitation Limiter?	Y/N		
	If so, is Under Excitation Limiter Form on file with ERCOT?	Y/N		

10.1.2 Planning – Combined Cycle

This tab contains three parts, for registering up to three trains at one site. This information should be completed for each unit of the trains.

ERCOT Confidential		*RETURN TO MAP*			
Planning Information					
*This worksheet tab provides planning information for **Combined Cycle** generation resources. This tab is UNIT specific for **all CC** units.*					
Please complete this section and select RETURN TO MAP					
CC1	**Generator Details**		**TEST_A**	**TEST_B**	**TEST_C**
	What is the MVA base that the following data is based on?	MVA			
	What is the kV base that the following data is based on?	kV			
	Machine Impedance Zeq (R+jX)	R in p.u.			
		X in p.u.			
	Armature Z	R in p.u.			
		X in p.u.			
	Rotor Z	R in p.u.			
		X in p.u.			
	Mutual coupling Armature-Rotor Z	R in p.u.			
		X in p.u.			
	Positive Sequence Z	R in p.u.			
		X in p.u.			
	Negative Sequence Z	R in p.u.			
		X in p.u.			
	Zero Sequence Z	R in p.u.			
		X in p.u.			
	Generator Auxiliary Load		**TEST_A**	**TEST_B**	**TEST_C**
	Average Amount of Auxiliary Real Power	MW			
	Average Amount of Auxiliary Reactive Power	MVAR			
	Generation Auxiliary Load Characteristics for MW Load				
	Large Motor, percent of total MW load	%			
	Small Motor, percent of total MW load	%			
	Resistive (Heating) Load, percent of total MW load	%			
	Discharge Lighting, percent of total MW load	%			
	Other, percent of total MW load	%			
	Generation Auxiliary Load Characteristics for MVAR Load				
	Large Motor, percent of total MVAR load	%			
	Small Motor, percent of total MVAR load	%			
	Discharge Lighting, percent of total MVAR load	%			
	Other, percent of total MVAR load	%			
	PSSE Model		**TEST_A**	**TEST_B**	**TEST_C**
	Generator Form on file with ERCOT?	Y/N			
	Turbine-Governor Form on file with ERCOT?	Y/N			
	Excitation Form on file with ERCOT?	Y/N			
	Do you have a Power System Stabilizer?	Y/N			
	If so, is Stabilizer Form on file with ERCOT?	Y/N			
	Do you have a Compensator?	Y/N			
	If so, is Compensator Form on file with ERCOT?	Y/N			
	Do you have a Over Excitation Limiter?	Y/N			
	If so, is Over Excitation Limiter Form on file with ERCOT?	Y/N			
	Do you have a Under Excitation Limiter?	Y/N			
	If so, is Under Excitation Limiter Form on file with ERCOT?	Y/N			
	Reactances		**TEST_A**	**TEST_B**	**TEST_C**
	Direct Axis Subtransient reactance, X"di				
	Direct Axis Transient reactance, X'di				

10.1.3 Planning – Wind Units

For non-Wind Generation Resources, the Over/Under Excitation Limiter form is new and must be submitted to ERCOT as soon as possible.

All fields in this section should be completed.

ERCOT Confidential			***RETURN TO MAP***	
Planning Information				
	*This worksheet tab provides planning information for **WIND** generation resources. This tab is UNIT specific for **all Wind** units.*			
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete this section and select RETURN			
Wind	**Field Description**	**Labels**	**TEST_A**	**TEST_B**
	What is the MVA base that the following data is based on?	MVA		
	What is the kV base that the following data is based on?	kV		
	Machine Impedance Zeq (R+jX)	R in p.u.		
		X in p.u.		
	Armature Z	R in p.u.		
		X in p.u.		
	Rotor Z	R in p.u.		
		X in p.u.		
	Mutual coupling Armature-Rotor Z	R in p.u.		
		X in p.u.		
	Positive Sequence Z	R in p.u.		
		X in p.u.		
	Negative Sequence Z	R in p.u.		
		X in p.u.		
	Zero Sequence Z	R in p.u.		
		X in p.u.		
	PSSE MODEL		**TEST_A**	**TEST_B**
	PSSE Compatible Wind Generator Models submitted to ERCOT?	Y/N		
	Do you have a Dynamic Reactive Device?	Y/N		
	If so, is corresponding Dynamic Reactive Device Form on file with ERCOT?	Y/N		
	Transient and Subtransient Reactances		**TEST_A**	**TEST_B**
	Direct Axis Subtransient reactance, X"di			
	Direct Axis Transient reactance, X'di			

10.2 Protection

The protection section of the Planning tabs covers the breaker interruption time as well as the voltage and frequency protection of the unit.

Protection information must be provided as applicable. Please ensure that the generator protection is defined.

10.2.1 Protection – non-Wind, non-CC Generation Units

ERCOT Confidential		RETURN TO MAP	
Planning Information			
*This worksheet tab provides protection information for **generation** resources. This tab is UNIT specific for*			
Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. The			
GEN (non-wind, non-CC)			
Plant Voltage Protection	**Label**	**TEST_A**	**TEST_B**
Instantaneous Undervoltage Trip	kV		
Time 1	sec		
Undervoltage 1	kV		
Time 2	sec		
Undervoltage 2	kV		
Time 3	sec		
Undervoltage 3	kV		
Instantaneous Overvoltage Trip	kV		
Time 1	sec		
Overvoltage 1	kV		
Time 2	sec		
Overvoltage 2	kV		
Time 3	sec		
Overvoltage 3	kV		
Plant Frequency Protection	**Label**	**TEST_A**	**TEST_B**
Instantaneous Underfrequency Trip	Hz		
Time 1	sec		
Underfrequency 1	Hz		
Time 2	sec		
Underfrequency 2	Hz		
Time 3	sec		
Underfrequency 3	Hz		
Instantaneous Overfrequency Trip	Hz		
Time 1	sec		
Overfrequency 1	Hz		
Time 2	sec		
Overfrequency 2	Hz		
Time 3	sec		
Overfrequency 3	Hz		
Breaker Interruption Time	**Label**	**TEST_A**	**TEST_B**
Breaker Interruption Time	cycles		

10.2.2 Protection – Combined Cycle

This tab contains three parts – for registering up to three trains at one site. This information is required for each unit of the train.

ERCOT Confidential | *RETURN TO MAP*

Planning Information

*This worksheet tab provides protection information for **Combined Cycle** generation resources. This tab is UNIT specific for **all CC**.*

Please complete this section and select RETURN TO MAP

CC1

Plant Voltage Protection	Label	TEST_A	TEST_B	TEST_C
Instantaneous Undervoltage Trip	kV			
Time 1	sec			
Undervoltage 1	kV			
Time 2	sec			
Undervoltage 2	kV			
Time 3	sec			
Undervoltage 3	kV			
Instantaneous Overvoltage Trip	kV			
Time 1	sec			
Overvoltage 1	kV			
Time 2	sec			
Overvoltage 2	kV			
Time 3	sec			
Overvoltage 3	kV			

Plant Frequency Protection	Label	TEST_A	TEST_B	TEST_C
Instantaneous Underfrequency Trip	Hz			
Time 1	sec			
Underfrequency 1	Hz			
Time 2	sec			
Underfrequency 2	Hz			
Time 3	sec			
Underfrequency 3	Hz			
Instaneous Overfrequency Trip	Hz			
Time 1	sec			
Overfrequency 1	Hz			
Time 2	sec			
Overfrequency 2	Hz			
Time 3	sec			
Overfrequency 3	Hz			

Breaker Interruption Time	Label	TEST_A	TEST_B	TEST_C
Breaker Interruption Time	cycles			

10.2.3 Protection – Wind Units

	ERCOT Confidential		*RETURN TO MAP*		
	Planning Information				
	*This worksheet tab provides protection information for **WIND** generation resources. This tab is UNIT specific for **all Wind***				
	Complete the Unit Information tab first, then the corresponding cells will become un-hatched on this tab. Then complete th				
WIND	**Plant Voltage Protection**	**Label**	**TEST_A**	**TEST_B**	
	Instantaneous Undervoltage Trip	kV			
	Time 1	sec			
	Undervoltage 1	kV			
	Time 2	sec			
	Undervoltage 2	kV			
	Time 3	sec			
	Undervoltage 3	kV			
	Instantaneous Overvoltage Trip	kV			
	Time 1	sec			
	Overvoltage 1	kV			
	Time 2	sec			
	Overvoltage 2	kV			
	Time 3	sec			
	Overvoltage 3	kV			
	Plant Frequency Protection	**Label**	**TEST_A**	**TEST_B**	
	Instantaneous Underfrequency Trip	Hz			
	Time 1	sec			
	Underfrequency 1	Hz			
	Time 2	sec			
	Underfrequency 2	Hz			
	Time 3	sec			
	Underfrequency 3	Hz			
	Instantaneous Overfrequency Trip	Hz			
	Time 1	sec			
	Overfrequency 1	Hz			
	Time 2	sec			
	Overfrequency 2	Hz			
	Time 3	sec			
	Overfrequency 3	Hz			
	Breaker Interruption Time	**Label**	**TEST_A**	**TEST_B**	
	Breaker Interruption Time	cycles			

10.3 Sub-synchronous Resonance

Sub-synchronous Resonance information has been difficult for many Resources to provide. At this time, the studies that need this information are not completed often, but will become more common as capacitor compensation is used in series on long transmission lines.

The studies focus on the units at either end of the lines compensated with the series capacitors to ensure the resonance from these lines will not excite critical frequencies in the machines in the areas at the ends of these lines.

In the future, these studies will be useful to Resource owners interested in equipment damage prevention.

Due to the infrequent nature of these studies, ERCOT accepts minimal information in these fields at this time. However, as series compensation is installed on our grid, this information will become necessary and critical to system performance

10.3.1 Sub-synchronous Resonance – non-Wind, non-CC Generation Units

	ERCOT Confidential		*RETURN TO MAP*	
	Planning Information			
	*This worksheet tab provides subsynchronous resonance planning information for **generation** resources. This tab is UNIT specific for **all non-Win***			
	Please complete this section and select RETURN TO MAP			
GEII (non-wind, non-CC)	**Subsynchronous Resonance - Mass 1**	**TEST_A**	**TEST_B**	
	Name of Mass 1			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Subsynchronous Resonance - Mass 2	**TEST_A**	**TEST_B**	
	Name of Mass 2			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 1 and 2			
	Stiffness units			
	Subsynchronous Resonance - Mass 3	**TEST_A**	**TEST_B**	
	Name of Mass 3			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 2 and 3			
	Stiffness units			
	Subsynchronous Resonance - Mass 4	**TEST_A**	**TEST_B**	
	Name of Mass 4			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 3 and 4			
	Stiffness units			
	Subsynchronous Resonance - Mass 5	**TEST_A**	**TEST_B**	
	Name of Mass 5			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 4 and 5			
	Stiffness units			

10.3.2 Sub-synchronous Resonance – Combined Cycle

This tab contains three parts, for registering up to three trains at one site. This information is required for each unit of the train.

	ERCOT Confidential		*RETURN TO MAP*	
	Planning Information			
	*This worksheet tab provides subsynchronous resonance planning information for **Combined Cycle** generation resources. This tab is UNIT specific fo*			
	Please complete this section and select RETURN TO MAP			
CC1	**Subsynchronous Resonance - Mass 1**	**TEST_A**	**TEST_B**	**TEST_C**
	Name of Mass 1			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Subsynchronous Resonance - Mass 2	**TEST_A**	**TEST_B**	**TEST_C**
	Name of Mass 2			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 1 and 2			
	Stiffness units			
	Subsynchronous Resonance - Mass 3	**TEST_A**	**TEST_B**	**TEST_C**
	Name of Mass 3			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 2 and 3			
	Stiffness units			
	Subsynchronous Resonance - Mass 4	**TEST_A**	**TEST_B**	**TEST_C**
	Name of Mass 4			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 3 and 4			
	Stiffness units			
	Subsynchronous Resonance - Mass 5	**TEST_A**	**TEST_B**	**TEST_C**
	Name of Mass 5			
	Mass Inertia			
	Inertia units			
	Associated damping			
	Damping units			
	Stiffness between Masses 4 and 5			
	Stiffness units			

11.0 Private Use Networks

Private Use Networks require information at both the site and unit level. If the facility is a Private Use Network – load other than auxiliary load behind the EPS meter – then enter Y for the response to “Private Network?” This will open the rest of the hatched cells on the page that must be completed.

11.1 Site Information

Each private network should provide the MW and MVAR that can be generated, that which is typically used by the facility, and that which is net to the grid. ERCOT is aware this net value can swing widely, and telemetry will provide details. If possible, provide an average over the past year.

Similar to the auxiliary load, load characteristics must be provided for the planning studies. Each of the % for MW Load and for MVAR Load areas must add to 100%.

ERCOT Confidential			***RETURN TO MAP***	
Private Network - Site and Unit Information				
	This worksheet tab applies to ***all Private Use Networks.*** *Complete this section then select RETURN TO MAP*			
	Complete the Unit Information tab then answer whether the site is Private Network and the appropriate cells will become un-hatched on this tab.			
SITE	**PRIVATE NETWORK - SITE INFORMATION**	**Labels**		
	Private Network?	Y/N	Y	
	Average Amount of Self-Serve private load	MW		
	Average Amount of Self-Serve private reactive load	MVAR		
	Expected Typical Private Network Net Interchange	MW		
	Expected Typical Private Network Net Reactive Interchange	MVAR		
	Private Network Gross Unit Capability	MW		
	Private Network Gross Unit Reactive Capability	MVAR		
	Load Characteristics:			
	Load Characteristics for MW Load (must equal 100%)			
	Large Motor, percent of total MW load	%		
	Small Motor, percent of total MW load	%		
	Resistive (Heating) Load, percent of total MW load	%		
	Discharge Lighting, percent of total MW load	%		
	Other, percent of total MW load	%		
	Load Characteristics for MVAR Load (must equal 100%)			
	Large Motor, percent of total MVAR load	%		
	Small Motor, percent of total MVAR load	%		
	Discharge Lighting, percent of total MVAR load	%		
	Other, percent of total MVAR load	%		

11.2 Unit Information

After completing the site details, the generation and load must be allocated across the units. Please identify the amount of load allocated to each unit, as well as the percentage of load that will trip if the unit trips. Some facilities become a large load to ERCOT if the generation trips, which can create issues with the reliability studies if the load cannot trip within a minute of the generation unit trip.

	PRIVATE NETWORK - Unit Information	Label	TEST_A	TEST_B	TEST_C
CC1	Average Amount of Self-Serve private load	MW			
	Average Amount of Self-Serve private reactive load	MVAR			
	Expected Typical Private Network Net Interchange	MW			
	Expected Typical Private Network Net Reactive Interchange	MVAR			
	Private Network Gross Unit Capability	MW			
	Private Network Gross Unit Reactive Capability	MVAR			
	If Unit trips, does Load trip?	Y/N			
	If yes, approximate percentage of Load that will trip?	%			

	PRIVATE NETWORK - Unit Information	Label			
CC2	Average Amount of Self-Serve private load	MW			
	Average Amount of Self-Serve private reactive load	MVAR			
	Expected Typical Private Network Net Interchange	MW			
	Expected Typical Private Network Net Reactive Interchange	MVAR			
	Private Network Gross Unit Capability	MW			
	Private Network Gross Unit Reactive Capability	MVAR			
	If Unit trips, does Load trip?	Y/N			
	If yes, approximate percentage of Load that will trip?	%			

	PRIVATE NETWORK - Unit Information	Label			
CC3	Average Amount of Self-Serve private load	MW			
	Average Amount of Self-Serve private reactive load	MVAR			
	Expected Typical Private Network Net Interchange	MW			
	Expected Typical Private Network Net Reactive Interchange	MVAR			
	Private Network Gross Unit Capability	MW			
	Private Network Gross Unit Reactive Capability	MVAR			
	If Unit trips, does Load trip?	Y/N			
	If yes, approximate percentage of Load that will trip?	%			

12.0 Line Data

The Line Data tab is used for registering both, internal lines and lines which go outside of the generation site, but are owned by the resource entity. All lines registered here are those owned by the Resource Entity.

Each line registered must use the Line names as they appear in the ERCOT model.

For connected devices, ERCOT requires at least 1 device, but no more than 10.

Line Data Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
ERCOT Line Name	1) This field is required 2) Warn if > 14 characters 3) This field may not have any special characters, except an underscore "_" and a dash "-"	Alpha
Line Voltage Level	1) This field is required. 2) If the value >= 69kv it must be 69,138, or 345 3) The value must be < 345 4) The value must be > 1	Float
TO STATION - ERCOT Station Code Mnemonic	1) This field is Optional 2) Warn if left blank 3) This field must match ERCOT records (unless new)	Alpha
TO STATION - TSP Name	1) This field is conditionally required if TO STATION - Internal Line - 'N' 2) This field must match ERCOT records (drop down in RARF)	Alpha
TO STATION - Connected Device Name(s) (multiple)	1) This field is required 2) May not be >= than 17 characters 3) May not have duplicates within the TO or FROM Station 4) May not contain special characters except for an underscore "_" and a dash "-"	Alpha
TO STATION - Bus Number (PTI Bus Number)	1) This field is optional 2) This field must be between 1 - 99,999	Integer
TO STATION - Weather Zone / Weather Station (used for Dynamic Ratings)	1) This field is conditionally required if "Line Rating (Static or Dynamic)" = 'DYNAMIC' 2) Value must be from the following list: COAST, EAST, FAR_WEST, NORTH, NORTH_C, SOUTH_C, SOUTHERN, WEST, KABI, KAUS, KBRO, KCRP, KDFW, KGLS, KIAH, KJCT, KLRD, KLFK, KMAF, KMWL, KSJT, KSAT, KTYR, KVCT, KACT, KSPS, KINK, KPRX	Alpha
FROM STATION - ERCOT Station Code Mnemonic	1) This field is required 2) Must match ERCOT records (unless new) 3) Value must be <= 8 characters	Alpha
FROM STATION - Connected Device Name(s) (multiple)	1) This field is required 2) May not be > than 17 characters	Alpha

	3) May not have duplicates within the TO or FROM Station 4) May not contain special characters except for an underscore "_" and a dash "-"	
FROM STATION - Bus Number (PTI Bus Number)	1) This field is optional 2) This field must be between 1 - 99,999 3) Warn if left blank	Integer
FROM STATION - Weather Zone / Weather Station (used for Dynamic Ratings)	1) This field is conditionally required if "Line Rating (Static or Dynamic)" = 'DYNAMIC' 2) Value must be from the following list: COAST, EAST, FAR_WEST, NORTH, NORTH_C, SOUTH_C, SOUTHERN, WEST, KABI, KAUS, KBRO, KCRP, KDFW, KGLS, KIAH, KJCT, KLRD, KLFK, KMAF, KMWL, KSJT, KSAT, KTYR, KVCT, KACT, KSPS, KINK, KPRX	Alpha
Resistance in P.U. (100 MVA Base)	1) Field is required 2) Value must be >= 0.0001 3) If Line Data - Line Voltage Level = 69kV, value must be <= 1.5 If Line Data - Line Voltage Level = 138kV or 345kV, value must be <= 0.5 WARN if value is outside of these conditions	Float
Reactance in P.U. (100 MVA Base)	1) Field is required 2) Value must be >= 0.0001 If Line Data - Line Voltage Level = 69kV, value must be <=1.0 If Line Data - Line Voltage Level = 138kV, value must be <=0.1 If Line Data - Line Voltage Level = 345kV, value must be <=.05 WARN if value is outside of these conditions	Float
Charging Susceptance in PU (100 MVA Base)	1) Field is required 2) Value must be >= 0 If Line Data - Line Voltage Level = 69kV, value must be <=0.3 If Line Data - Line Voltage Level = 138kV, value must be <=0.5 If Line Data - Line Voltage Level = 345kV, value must be <=1.75	Float
Type (overhead / underground)	1) Field is required 2) Value must be at from the following list: OVERHEAD, UNDERGROUND, BOTH	Alpha
Segment Length	1) Field is required 2) Value must > 0 3) Formula on Line Data - Segment Length: The formula to determine the length of a line based on the Reactance (X) and the Charging Susceptance (Chg) is 486 * SQRT(X_pu * Chg_pu). 25% variation This is a warning	Float
Line Rating (Static or Dynamic)	1) Field is required 2) Field must be from the following list: STATIC, DYNAMIC	Alpha
Nominal (Static) - Continuous Rating	1) This field is required regardless of STATIC or DYNAMIC 2) Value must be <= Nominal (Static) - 2-hr Emergency Rating	Integer

	3) Value must be <= Nominal (Static) - 15-min Rating 4) Conditional Rule (if Line Rating (Static or Dynamic) = Dynamic): Value must be <= 20 °F - Continuous Rating AND value must be >= 115 °F Continuous Rating	
Nominal (Static) - 2-hr Emergency Rating	1) This field is required regardless of STATIC or DYNAMIC 2) Value must be >= Nominal (Static) - Continuous Rating 3) Value must be <= Nominal (Static) - 15-min Rating 4) Conditional Rule (if Line Rating (Static or Dynamic) = Dynamic): Value must be <= 20 °F - 2-hr Emergency Rating AND value must be >= 115 °F 2-hr Emergency Rating	Integer
Nominal (Static) - 15-min Rating	1) This field is required regardless of STATIC or DYNAMIC 2) Value must be >= Nominal (Static) - Continuous Rating 3) Value must be >= Nominal (Static) - 2-hr Emergency Rating 4) Conditional Rule (if Line Rating (Static or Dynamic) = Dynamic): Value must be <= 20 °F - 15-min Rating AND value must be >= 115 °F 15-min Rating	Integer
20 °F - Continuous Rating - 115 °F Continuous Rating	1) These field are conditionally required. If Line Rating (Static or Dynamic) = Dynamic this field is required 2) Line Rating (Static or Dynamic) = Static, this field must be blank 3) If required, these values must be <= the subsequent dynamic rating. For example: 20 °F - Continuous Rating >= 25 °F - Continuous Rating 25 °F - Continuous Rating >= 30 °F - Continuous Rating 4) If required, within each temp rating, the following must apply Continuous Rating <= 2-hr Emergency Rating <= 15-min rating	Integer
20 °F - 2-hr Emergency Rating - 115 °F 2-hr Emergency Rating	1) These field are conditionally required. If Line Rating (Static or Dynamic) = Dynamic this field is required 2) Line Rating (Static or Dynamic) = Static, this field must be blank 3) If required, these values must be >= the subsequent dynamic rating. For example: 20 °F - 2-hr Emergency Rating >= 25 °F - 2-hr Emergency Rating 25 °F - 2-hr Emergency Rating >= 30 °F - 2-hr Emergency Rating 4) If required, within each temp rating, the following must apply Continuous Rating <= 2-hr Emergency Rating <= 15-min rating	Integer
20 °F - 15-min Rating - 115 °F 15-min Rating	1) These field are conditionally required. If Line Rating (Static or Dynamic) = Dynamic this field is required 2) Line Rating (Static or Dynamic) = Static, this	Integer

	field must be blank 3) If required, these values must be >= the subsequent dynamic rating. For example: 20 °F - 2-hr 15-min Rating >= 25 °F - 15-min Rating 25 °F - 2-hr 15-min Rating >= 30 °F - 15-min Rating 4) If required, within each temp rating, the following must apply Continuous Rating <= 2-hr Emergency Rating <= 15-min rating	
General	This tab is conditionally required if Private Network - Private Network? = 'Y'	N/A

13.0 Breaker / Switch Data

The Breaker and Switch Data tab is used for registering all breakers and switches. All Breakers and Switches registered here are those owned by the Resource Entity.

Each Breakers and Switches registered must use the name as it appears in the ERCOT model.

For directly connected devices, ERCOT requires at least 1 device, but no more than 10.

Breaker and Switch Business Rules / Basic Validations
Use this section to pre-validate the information entered into the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
ERCOT Station Code Mnemonic	1) This field is required 2) Must match ERCOT records (unless new) 3) Must be <= 8 characters	Alpha
Is this a Fault Isolating Device (e.g. Circuit Breaker)	1) This is a required field 2) Values must from the following list: 'Y', 'N'	Alpha
Switch Name	1) This field is required 2) Value may contain no special characters except an underscore "_" and a dash "-" 3) Must be <=14 characters	Alpha
Normal Operating Status (when in-service)	1) This field is required 2) Value must be from the following list: 'OPEN', 'CLOSED'	Alpha
Voltage Level	1) This field is required. 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0	Float
Side 1 / Side 2 - Directly connected device name(s)	1) This field is required 2) Value may contain no special characters except an underscore "_" and a dash "-" 3) Must be <=17 characters	Alpha

General	This tab is required	N/A

14.0 Capacitor Reactor Data

The Capacitors Reactor Data tab is used for registering all capacitors and reactors. All Capacitor and Reactors registered here are those owned by the Resource Entity.

Each Capacitors Reactor registered must use the name as it appears in the ERCOT model.

Capacitors and Reactors Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
ERCOT Station Code Mnemonic	1) This field is required 2) Must match ERCOT records (unless new) 3) Value must be <= 8 characters	Alpha
Capacitor or Reactor	1) This field is required 2) Value must be from the following list: 'C', 'R'	Alpha
Device Name	1) This field is required 2) Value may contain no special characters except an underscore "_" and a dash "-" 3) Must be <=14 characters	Alpha
Nominal MVAR	1) This field is required 2) Value must be > 0	Float
Voltage Level kV	1) This field is required. 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0	Float

PTI Bus Number	1) This field is optional 2) This field must be between 1 - 99,999	Float
Device Name(s) - that this reactive device is directly connected to	1) This field is optional 2) May not be > than 17 characters 3) May not contain special characters except for an underscore "_" and a dash "-"	Alpha
Automatic Voltage Regulation	1) This field is required 2) Value must be from the following list: 'Y', 'N'	Alpha
Voltage Level of Busbar being regulated	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0	Float
Desired Regulating voltage	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) The value may not exceed 345 3) The value must be > 0 4) The value must >= Minimum Regulating Voltage 5) The value must <=Maximum Regulating Voltage	Float
Minimum Regulating Voltage	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) The value may not exceed 345 3) The value must be > 0 4) The value must be <= Maximum Regulating Voltage 5) Warning if value exceeds 50% from Maximum Regulating Voltage	Float
Maximum Regulating Voltage	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) The value may not exceed 345 3) The value must be > 0 4) The value must be >= Minimum Regulating Voltage 5) Warning if value exceeds 50% from Minimum Regulating Voltage	Float

15.0 Transformers

GSU Transformers

Note that for associated units, this field is only for the GSU (Generator Step-Up) Transformer.

Some resources use multiple transformers for one unit and some have one transformer for multiple units. In order to accommodate this, the GSU section has been developed independent of units.

Ensure the proper unit(s) is(are) assigned to the transformer. A dropdown list is provided to supply the previously supplied unit name as identified on the General Information tab.

All Transformers

The Transformer Data tab is used for registering all transformers. All Transformer registered here are those owned by the Resource Entity.

There is only one Transformer data tab for all resource types.

Each Transformer registered must use the name as it appears in the ERCOT model.

Transformer Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
ERCOT Station Name (Station Code or Station Mnemonic)	1) This field is required 2) Must match ERCOT records 3) Must be <= 8 characters	Alpha
Transformer Name	1) This field is required 2) Warn if >= 14 characters. First 14 characters must be unique 3) May not contain special characters except for an underscore "_" and a dash "-"	Alpha
Is this transformer in Master / Follower of Current Balancing configuration?	1) This field is required 2) Value must be in the following list: 'Y', 'N'	Alpha
Master Name (can be same as this transformer)	1) This field is conditionally required if Transformer Data - Is this transformer in Master / Follower of Current Balancing configuration? = 'Y' 2) Warn if >= 14 characters. First 14 characters must be unique 3) May not contain special characters except for an underscore "_" and a dash "-" 4) Either the Master Name or the Follower Name MUST = Transformer Data - Transformer Name	Alpha
Follower Name (can be same as this transformer)	1) This field is conditionally required if Transformer Data - Is this transformer in Master / Follower of Current Balancing configuration? = 'Y' 2) Warn if >= 14 characters. First 14 characters must be unique 3) May not contain special characters except for an underscore "_" and a dash "-" 4) Either the Master Name or the Follower Name MUST = Transformer Data - Transformer Name	Alpha

Generation Step-Up Transformer?	1) This field is required 2) Value must be in the following list: 'Y', 'N'	Alpha
Unit(s) associated with this transformer	1) This field is conditionally required - if Generation Step-up = 'Y', this is required 2) Value(s) must be <=17 characters 3) Warn if the unit name is not in the Unit Info - GEN or Unit Info - CC or Unit Info - Wind	Alpha
High Side Voltage Level (no-load)	1) This field is required 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0 5) The value must be >= Low Voltage Level (no-load)	Float
High Side Voltage Level (PTI)	1) This field is optional 2) This field must be between 1 - 99,999	Integer
High Side Voltage Connection - Wye or Delta	1) This field is required 2) Value must be of the following: 'Wye', 'Delta'	Alpha
High Side Voltage Connected devices (list on separate lines)	1) This field is required a) Error: if High Side Voltage >= 60kV and Low Side Voltage >1kV b) Warn: if High Side Voltage < 60kV and Low Side Voltage = 1kV 2) Warn if >= 17 characters 3) No special characters except an underscore or a dash	Alpha
High Side Manufactured Nominal Voltage	1) This field is required 2) If value > 60kV **Accepted** if value (using 5%) Deviates < |3.45| kV from 69 Deviates < |6.9| kV from 138 Deviates < |17.25| kV from 345 **Warn** if value (using >= 5% and <10%) Deviates > = |3.45| but deviates < |6.9| from 69 Deviates >= |6.9| but deviates < 13.8 from 138 Deviates >= |17.25| but deviates < 34.5 from 345 **Error** if value (using > =10%) Deviates >= |6.9| kV from 69 Deviates >= |13.8|kV from 138 Deviates >= |34.5|kV from 345 3) Warn if value > 345 4) The value must be > 0 5) High Side Manufactured Nominal Voltage >= Low Side Manufactured Nominal Voltage	Float
Low Side Voltage Level (no-load)	1) This field is required 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0 5) The value must be <= High Voltage Level (no-load) 6) If Generator Step-up Transformer = 'Y' AND Low Side Voltage Level (no-load) > 1kV AND Then the Low Side Voltage Level (no-load) must be equal to Unit Info - GEN / CC / WIND - Unit Generating Voltage	Float

Low Side Voltage Level (PTI)	1) This field is optional 2) This field must be between 1 - 99,999	Integer
Low Side Voltage Connected device(s) (list on separate lines)	1) This field is required a) Error: if High Side Voltage >= 60kV and Low Side Voltage >1kV b) Warn: if High Side Voltage < 60kV and Low Side Voltage = 1kV 2) Warn if >= 17 characters. 3) No special characters except an underscore "_" or a dash "-"	Alpha
Low Side Manufactured Nominal Voltage	1) This field is required 2) If the value >= 69kv: **Accepted** if value (using 5%) Deviates < |3.45| kV from 69 Deviates < |6.9| kV from 138 Deviates < |17.25| kV from 345 **Warn** if value (using >= 5% and <10%) Deviates > = |3.45| but deviates < |6.9| from 69 Deviates >= |6.9| but deviates < 13.8 from 138 Deviates >= |17.25| but deviates < 34.5 from 345 **Error** if value (using > =10%) Deviates >= |6.9| kV from 69 Deviates >= |13.8|kV from 138 Deviates >= |34.5|kV from 345 3) Warn if value > 345 4) The value must be > 0 5) High Side Manufactured Nominal Voltage >= Low Side Manufactured Nominal Voltage	Float
Series Resistance (100 MVA Base)	1) This field is required 2) Value must be >=0	Float
Series Reactance (100 MVA Base)	1) This field is required 2) Warn if value > 1. Error! Reactance (value) > 1.0. Reactance should be expressed in terms of per unit (e.g. not percentage).	Float
Continuous Rating	1) This field is required 2) Value must be <= 2-hr Emergency Rating 3) Value must be <= 15-min Rating	Integer
2-hr Emergency Rating	1) This field is required 2) Value must be >= Continuous Rating 3) Value must be <= 15-min Rating	Integer
15-min Rating	1) This field is required 2) Value must be >= Continuous Rating 3) Value must be >= 2-hr Emergency Rating	Integer
Automatic Voltage Regulation	1) This field is required 2) Value must be from the following list: 'Y', 'N'	Alpha
Does Transformer have a Load Tap Changer?	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) Value must be from the following list: 'Y', 'N'	Alpha
Location of Tap Changer	1) This field is required 2) Value must be of the following: 'HIGH', 'LOW'	Alpha
Base kV of Regulated Side	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) If the value >= 69kv it must be 69,138, or 345	Float

	3) The value may not exceed 345 4) The value must be > 0 5) The value must be >= Low Voltage Level (no-load)	
Target kV of Regulated Side	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) Value must be > 0	Float
Acceptable Deviation of Target Voltage in Percent	1) This field is conditionally required if Automatic Voltage Regulation = 'Y' 2) Value must not exceed 50%	Percentage
Low Tap Settings - Tap position at Manufactured Nominal Voltage	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap Second Condition: This field must be left blank if Low Voltage Level = 1 2) Note: this value may be negative	Integer
Low Tap Settings - Total Number of Tap Positions	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap Second Condition: This field must be left blank if Low Voltage Level = 1 2) Value must be >= 2 3) Warn if value < 16 and "Automatic Voltage Regulation" = 'Y'	Integer
Low Tap Settings - Normal Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out. Note that it is valid for both, Low and High Tap settings to be filled out. Second Condition: This field must be left blank if Low Voltage Level = 1 2) Value must be >= Low Tap Settings - Lowest Tap Position 3) Value must be <= Low Tap Settings - Highest Tap Position 4) Note: this value may be negative	Integer
Low Tap Settings - Lowest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both,	Integer

	Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap Second Condition: This field must be left blank if Low Voltage Level = 1 2) Value must be <= Low Tap Settings - Highest Tap Position 3) Note: this value may be negative	
Low Tap Settings - Voltage at Lowest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap Second Condition: This field must be left blank if Low Voltage Level = 1 2) Value must be <= Low Tap Settings - Voltage at Highest Tap Position 3) Value must be < High Tap Settings - Voltage at Lowest Tap Position 4) Value must be >= 0	Float
Low Tap Settings - Highest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out. Note that it is valid for both, Low and High Tap settings to be filled out. Second Condition: This field must be left blank if Low Voltage Level = 1 2) Value must be >= Low Tap Settings - Low Tap Position 3) Note: this value may be negative	Integer
Low Tap Settings - Voltage at Highest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out. Note that it is valid for both, Low and High Tap settings to be filled out. Second Condition: This field may be left blank if Low Voltage Level = 1 2) Value must be >= Low Tap Settings - Voltage at Lowest Tap Position 3) Value must be <= High Tap Settings - Voltage at Highest Tap Position 4) Value must be >= 0	Float
Low Tap Settings – Size of each Voltage Step	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of	Float

	the Load Tap Second Condition: This field may be left blank if Low Voltage Level = 1 2) Value must > 0 3) Warn if < 0.002 * Low Side Voltage Level (no-load) 4) Warn if > 0.05 * Low Side Voltage Level (no-load)	
High Tap Settings - Tap position at Manufactured Nominal Voltage	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Note: this value may be negative	Integer
High Tap Settings - Total Number of Tap Positions	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must be >= 2 3) Warn if value < 16 and "Automatic Voltage Regulation" = 'Y'	Integer
High Tap Settings - Normal Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must be >= High Tap Settings - LowestTap Position 3) Value must be <= High Tap Settings - Highest Tap Position 4) Note: this value may be negative	Integer
High Tap Settings - Lowest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap	Integer

	2) Value must be <= High Tap Settings - Highest Tap Position 3) Note: this value may be negative	
High Tap Settings – Voltage at Lowest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must be <= High Tap Settings - Voltage at Highest Tap Position 3) Value must be > Low Tap Settings - Voltage at Lowest Tap Position 4) Value must be >= 0	Float
High Tap Settings - Highest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must be >= Low Tap Position 3) Note: this value may be negative	Integer
High Tap Settings - Voltage at Highest Tap Position	1) This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must be >= High Tap Settings - Voltage at Lowest Tap Position 3) Value must be > Low Tap Settings - Voltage at Highest Tap Position 4) Value must be > 0	Float
High Tap Settings – Size of each Voltage Step	1)This field is conditionally required If "Does transformer have a loadtap changer?" = 'Y' then either Low Tap Settings or High Tap Settings must be filled out based on the Location of the Load Tap Changer (e.g. Load Tap is on the high side, high tap settings is now required). Note that it is valid for both, Low and High Tap settings to be filled out if there is a non-load tap on the opposite side of the Load Tap 2) Value must > 0 3) Warn if < 0.002 * High Side Voltage Level	Float

	(no-load) 4) Warn if > 0.05 * High Side Voltage Level (no-load)	
General	This tab is conditionally required if Private Network - Private Network? = 'Y'	N/A

16.0 Static Var Compensator

The Static Var Compensator Data tab is used for registering all Static Var Compensator. All Static Var Compensator registered here are those owned by the Resource Entity.

Each Static Var Compensator registered must use the name as it appears in the ERCOT model.

Static Var Compensator Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
ERCOT Station Name (Station Code or Station Mnemonic)	1) This field is required 2) Must match ERCOT records (unless new) 3) Must be <= 8 characters	Alpha
SVC Name	1) This field is required 2) May not be > than 14 characters 3) May not contain special characters except for an underscore "_" and a dash "-"	Alpha
Device Name(s) - that this reactive device is directly connected to	1) This field is optional 2) May not be > than 17 characters 3) May not contain special characters except for an underscore "_" and a dash "-"	Alpha

SVC Base Voltage Level	1) This field is required 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0	Float
Fixed MVAR (VAR injection at nominal voltage)	1) This field is required 2) Value must be > 0	Float
Minimum Admittance Limits (100 MVA Base)	1) This field is required 2) Value must be <= Maximum Admittance	Float
Maximum Admittance Limits (100 MVA Base)	1) This field is required 2) Value must be >= Minimum Admittance	Float
Minimum Steady State Reactive Power Limits	1) This field is required 2) Value must be >= Maximum Steady State Reactive Power Limits	Float
Maximum Steady State Reactive Power Limits	1) This field is required 2) Value must be >= Minimum Steady State Reactive Power Limits	Float
Minimum Threshold (post contingency) Reactive Power Limits	1) This field is required 2) Value must be <= Maximum Threshold (post contingency) Reactive Power Limits	Float
Maximum Threshold (post contingency) Reactive Power Limits	1) This field is required 2) Value must be >= Minimum Threshold (post contingency) Reactive Power Limits	Float

Minimum Voltage Threshold (100 MVA Base)	1) This field is required 2) Value must be <= Maximum Voltage Threshold (100 MVA Base) 3) The value may not exceed 345 3) The value must be > 0 4) Warn if Max / Min exceed 50% of one another	Float
Maximum Voltage Threshold (100 MVA Base)	1) This field is required 2) Value must be >= Minimum Voltage Threshold (100 MVA Base) 3) The value may not exceed 345 4) The value must be > 0 5) Warn if Max / Min exceed 50% of one another	Float

17.0 Series Device Data

The Series Device Data tab is used for registering all Series Devices. All Series Devices registered here are those owned by the Resource Entity.

Each Series Device registered must use the name as it appears in the ERCOT model.

Series Device Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	Business Rules/Basic UI validations	Datatype
Description of Change	1) This field is conditionally Required - If there is a change to a tab, the change must be described.	Alpha
Series Device Name	1) This field is required 2) Warn if >= 14 characters. First 14 characters must be unique 3) No special characters except and underscore	Alpha
ERCOT Station Name (Station Code or Station Mnemonic)	1) This field is required 2) Must match ERCOT records (unless new) 3) Must be <= 8 characters	Alpha
Voltage Level	1) This field is required 2) If the value >= 69kv it must be 69,138, or 345 3) The value may not exceed 345 4) The value must be > 0	Float
Side 1 - Connected Switching Device Name(s)	1) This field is required 2) May not be > than 17 characters 3) May not have duplicates within the TO or FROM Station 4) May not contain special characters except for an underscore "_" and a dash "-"	Alpha
Side 1 - Bus Number (PTI Bus Number)	1) This field is optional 2) This field must be between 1 - 99,999	Integer
Side 2 - Connected Switching Device Name(s)	1) This field is required 2) May not be > than 17 characters 3) May not have duplicates within the TO or FROM Station 4) May not contain special characters except for an underscore "_" and a dash "-"	Alpha

Side 2 - Bus Number (PTI Bus Number)	1) This field is optional 2) This field must be between 1 - 99,999	Integer
Resistance	1) This value is required 2) Value must be > 0	Float
Reactance	1) This value is required 2) Value must be > 0	Float
Continuous Rating	1) This field is required 2) Value must be <= 2-hr Emergency Rating 3) Value must be <= 15-min Rating	Float
2-hr Emergency Rating	1) This field is required 2) Value must be >= Continuous Rating 3) Value must be <=15-min Rating	Float
15-min Rating	1) This field is required 2) Value must be >= Continuous Rating 3) Value must be >= 2-hr Emergency Rating	Float

18.0 Load Data

The Load Data tab is used for registering Load as it defined in this section. All Load registered here are those owned by the Resource Entity.

Each Load registered must use the name as it appears in the ERCOT model. For equivalent Loads, it may be necessary to work with ERCOT to determine the naming.

Loads which are connected on a Bus greater than or equal to 60kV need to be modeled individually

Loads connected at less than 60kV may be aggregated into an “equivalent load” at the 69kV Bus

Auxiliary and Site Service Load may be combined
Note: Auxiliary load is defined as that which is only present when the generator is running

Load Business Rules / Basic Validations
Use this section to pre-validate the information entered in the RARF.

RARF DATA FIELD	**Business Rules/Basic UI validations**	**Datatype**
Load Voltage Level	1) This field is required 2) Value must be >= 0 3) If the value >= 69kv it must be 69,138, or 345	Float
PTI Bus Number	1) This field is optional 2) This field must be between 1 - 99,999	Integer
Device Name(s) - that this load is physically connected to	1) This field is required 2) Warn if >= 17 characters. First 14 characters must be unique 3) No special characters except an underscore or a dash	Alpha
Average MW Load Under Normal Operations	1) This field is required 2) Value must be > 0	Float
Average MVAR Under Normal Operations	1) This field is required	Float

	2) Value must be > 0	
General	This tab is conditionally required if Private Network - Private Network? = 'Y'	N/A

19.0 Load Resources

Load Resources must complete the General Information tab as well as the two tabs discussed here.

19.1 Load Resource Information

ERCOT Confidential		RETURN TO MAP	
Load Resource Information Tab			
*This worksheet tab provides information for **Load Resources**.*			
Please complete this section and select RETURN TO MAP			
Unit Details	**Labels**	**Load Point #1**	**Load Point #2**
LOAD RESOURCES			
Name of End Use Customer			
Common Name for Load Resource			
Physical Street Address for point of Delivery (POD)			
Name of City for Point of Delivery (POD)			
Is Load Netted From Generation at ERCOT Read Gensite?	Y/N		
Is Load Behind a NOIE Settlement Meter Point?	Y/N		
Load Resource Type (CLR/UFR/Interruptible)			
If CLR, will CLR be Dynamically Scheduling?	Y/N		
Dispatch Asset Code (provided by ERCOT)			
Load Resource Effective Date			
Load Resource Expiration Date			
Substation Name for POD			
Substation Code for POD			
ESIID Station Name			
ESIID Station Code			
Transmission Bus POD (PTI Bus No)			
Voltage Level of Telemetered load(s)	KV		
Meter Reading Entity (TDSP)			
Meter Reading Entity Duns Number			
QSE Name			
QSE Duns Number			
ESI-ID assigned to meter			
Wholesale Delivery Point?	Y/N		
Notice Requirements to Interrupt			
High Set Under-frequency Relay (UFR) Setting	Hz		
Load Resource Control Device			
If CLR, ability to operate as a UFR type Resource?	Y/N		
ERCOT Load Zone			
Maximum POD Total Load	MW		
Summer Interruptible MW	MW		
Winter Interruptible MW	MW		
High Reasonability Limit	MW		
Low Reasonability Limit	MW		
CLR High Reasonability Ramp Rate Limit	MW/min		
CLR Low Reasonability Ramp Rate Limit	MW/min		
Private Use Network?	Y/N		

19.2 Load Resource Parameters

ERCOT Confidential	RETURN TO MAP

Load Resource Parameters

Resource Entity authorizes QSE representing this Generation Resource to submit Resource Parameters on this page for operational purposes in accordance with Section 3.7.1 on behalf of Resource Entity.

*This worksheet tab provides information for **Load Resources**. Resource Parameters - Initial submittal by RE, updat*

Please complete this section and select RETURN TO MAP

Non-CLR Resource Parameters	Labels	TEST_LD1	
Minimum Interruption Time	hours		
Minimum Restoration Time	hours		
Max WEEKLY Deployments	hours		
Max Interruption Time	hours		
Max DAILY Deployments	hours		
Max Weekly Energy	MWh		
Minimum Notice Time	minutes		

CLR Resource Parameters	Labels	TEST_LD1	
Max Deployment Time	hours		
Max Weekly Energy	MW		

19.3 CLR Ramp Rates

CLRs must provide Ramp Rate Curves. For information on building the curves, see section 7.4.

LOAD RESOURCES

CLR - Normal Ramp Rate Curve		TEST_LD1	
MW1	MW		
Upward RampRate1	MW/min		
Downward RampRate1	MW/min		
MW2	MW		
Upward RampRate2	MW/min		
Downward RampRate2	MW/min		
MW3	MW		
Upward RampRate3	MW/min		
Downward RampRate3	MW/min		
MW4	MW		
Upward RampRate4	MW/min		
Downward RampRate4	MW/min		
MW5	MW		
Upward RampRate5	MW/min		
Downward RampRate5	MW/min		
MW6	MW		
Upward RampRate6	MW/min		
Downward RampRate6	MW/min		
MW7	MW		
Upward RampRate7	MW/min		
Downward RampRate7	MW/min		
MW8	MW		
Upward RampRate8	MW/min		
Downward RampRate8	MW/min		
MW9	MW		
Upward RampRate9	MW/min		
Downward RampRate9	MW/min		
MW10	MW		
Upward RampRate10	MW/min		
Downward RampRate10	MW/min		
CLR - Emergency Ramp Rate Curve	**Labels**	**TEST_LD1**	
MW1	MW		
Upward RampRate1	MW/min		
Downward RampRate1	MW/min		
MW2	MW		
Upward RampRate2	MW/min		
Downward RampRate2	MW/min		
MW3	MW		
Upward RampRate3	MW/min		
Downward RampRate3	MW/min		

20.0 Additional Information

A Resource Entity and its assets must be registered separately, using the forms provided on the ERCOT Resource Entities Registration and Qualification webpage.
http://www.ercot.com/services/rq/re/

Each RE must also be represented by a Qualified Scheduling Entity (QSE), which establishes a control interface with ERCOT. If questions arise related to the completion of this or any other registration form, please contact your designated ERCOT Account Manager or email Wholesale Client Services at NodalMarketTransition@ercot.com.

EXHIBIT D

Version			
No.	**ERCOT Department**	**Revision Description**	**Date**
1.1	Manager of Operations Support Engineering	Revision	11/06/2008
1.2	Wholesale Client Services	Added emphasis to initial energizing of interconnection	12/05/2008
1.3	Wholesale Client Services	Added field for QSE Agent	01/06/2009
1.4	Wholesale Client Services	Update telemetry requirement table	03/09/2009
1.5	Manager of Operations Support Engineering	Distinguish telemetry minimum for energizing interconnect	04/07/2009

Purpose/Scope

This checklist shall be performed in accordance with ERCOT Operating Guides 2.2.5, 3.1.3.1, 3.1.4., 3.1.4.1, 3.1.4.5 and 3.1.4.6 of the and ERCOT Protocols.6.5.7.

- The QSE and Resource Entity shall complete and submit the New Generator Commissioning Checklist for requesting to commission station power serving new Resource and for requesting approval for initial synchronization of the new Resource and Start-up Testing. Request to Commission Station Checklist (Attachment 1) is to be submitted by Resource Entity to ERCOT Wholesale Client Services at least 7 business days prior to effective date of request to energize station. Request for Initial Synchronization Checklist (Attachment 2) is to be submitted by QSE at least 7 business days prior to effective date of initial synchronization for new generating unit(s).
- Wholesale Client Services will distribute copies of the completed form to the ERCOT Operations Planning Staff (Attn: Administrative Assistant), Operations Engineering.
- The Operations Planning Staff will create a file for the generator and assign an Operations Engineer to confirm that all required information has been provided. (Any discrepancies or omissions will be reported via e-mail to the QSE's Client Services Representative for follow-up, correction and subsequent re-distribution.)

Procedure

The process of reaching approval for initial synchronization of new generation occurs in two steps. Attachment 1 and Attachment 2 checklists may be submitted complete together or separately.

STEP 1 (Request to Commission Station Checklist, Attachment 1): If no outstanding issues with SCADA data for station power or other issues pending ERCOT Operations Engineering sends "Approval of Initial Energize Date of New Generation

Interconnection" (via e-mail) to the Operations Administrative Assistant, the Client Services Representative, the Shift Supervisors and the Chief System Operator. This notification shall include the planned date the station will be energized. Client Services Representative notifies Resource Entity, TSP, and QSE of approval to energize interconnect.

STEP 2 (Request for Initial Synchronization Checklist, Attachment 2): If there are no outstanding issues with SCADA data or other issues pending for the entire generation station at the time approval is issued to energize interconnect (Attachment 1) then the QSE is cleared to coordinate first synchronization with ERCOT Control Room as per procedure. Otherwise, ERCOT Operations Engineering will send notification separate from Step 1 notification to Client Services Representative if outstanding issues have been satisfactorily addressed and approval to synchronize. Client Services Representative notifies QSE that the initial synchronization date is approved and reminds the QSE of day-ahead notice to ERCOT Shift Supervisor of first day the new generation will synchronize.

If outstanding issues remain and/or the QSE Checklist is not submitted at the time approval for station power is requested then approval for initial synchronization will remain pending. The QSE Checklist in Attachment 2 may then be submitted, or resubmitted with outstanding items resolved for ERCOT to issue approval to proceed with initial synchronization.

After approval of the initial synchronization date has been received from the Operations Engineer for the new unit start-up testing, the following procedures will be used to facilitate the process.

Day Ahead

- The QSE representing the new generating unit to be start-up tested by 1100 on the business day prior to the initial synchronization. The QSE must identify this unit as "testing".
- The QSE will enter the projected output of the new unit into their resource plan.
- The ERCOT Shift Supervisor will notify the Day Ahead Operator and the Transmission and Security Desk Operator.
- The ERCOT Day Ahead Desk Operator will notify the respective TO.

Operating Day

- On the day of the planned initial synchronization, the QSE will re-confirm, via telephone with the Shift Supervisor, plans for unit synchronization. New unit start ups are done in the "Test" mode.
- After the unit has been successfully synchronized to the ERCOT grid, all future unit start-up testing will be communicated by way of QSE resource schedules. If the QSE fails to schedule the output of the unit, then the QSE must notify the Shift Supervisor via the telephone of plans to continue start-up testing. The Shift Supervisor or his/her designee will write an "Information Only" VDI stating that

ERCOT has been notified by the QSE of the planned unit start-up testing for the Operating Day.

- Maximum capability and MVAR testing for the new unit will be planned in accordance with ERCOT procedures.

Attachment 1: Request to Commission Station Checklist

[RESOURCE ENTITY submits checklist to commission station]

RE Name:

Agent (optional):

Date form completed:

Proposed Station Energize Date:

* Actual date contingent on completion of requirements and approval from ERCOT.

Primary contact for Station Commissioning (Contacts may be RE's Agent):

Primary Contact Name:

Primary Contact Telephone Number:

Primary Contact E-mail Address:

Gen Site Name:	TDSP:	ESI ID:

Congestion Zone: Transmission Voltage:

Special Protection Scheme (SPS) Yes ☐ No ☐

Can unit synchronously connect to another grid? Yes ☐ No ☐

Identify the QSE/TDSP responsible for sending ERCOT station telemetry:

QSE primary contact (may be QSE's Agent):	TDSP primary telemetry contact:
Name:	Name:
Telephone Number:	Telephone Number:
E-mail Address:	E-mail Address:

By signing below I attest that information provided on this form (Attachment 1) is true, correct and complete, and that any substantial changes in such information will be provided to the Electric Reliability Council of Texas (ERCOT) in a timely manner.

Signature:

(RE Authorized Representative)

Printed Name:

(RE Authorized Representative)

Date Signed:

The QSE and Resource Entity are required to remain in compliance with ERCOT Protocol and Operating Guide upon initial day the interconnect becomes operational. The QSE will comply with telemetry requirements and procedures for operation of station to new Resource.

☐ Generation facility is in an ERCOT Control Area and is being reported by that RE's QSE to the ERCOT ISO in the manner as specified in Section 3 of the ERCOT Operating Guides, or any applicable ERCOT agreement requiring information on generation.

☐ Unit is greater than 10MW per ERCOT Operating Guide No. 3.1.4.

☐ Station telemetry from the facility's interconnecting station is in place and operational as of _____ (date) to QSE and TDSP (Optional) required under ERCOT Operating Guide No. 3.1.3.1 and ERCOT Operating Guide Attachment 8a. Enter specific comments about status of station telemetry in comment box on telemetry checklist below.

☐ RE's QSE has reliable voice communications for station operations to new Generating Facility, ERCOT Control Area, and TDSP (Optional) ERCOT Operating Guide No. 3.1.3.1.

☐ Resource Entity has provided ERCOT the technical equipment data to be used in modeling studies per ERCOT Operating Guide No. 3.1.4. **Comments:** _____

Station Telemetry

	Data	Frequency	Mode	Reference/Comments
☐	Station Switching Device status	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. (High side Typical TSP telemetry point; Low side typical QSE telemetry point) **RE Comment:**
☐	Station Breaker status	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision.(Typical QSE telemetry point) **RE Comment:**
☐	Generating Unit High Side bus voltage	10 sec	RTU/ICCP	Protocol Section 6.5.7, Voltage Support Service, May be supplied by the TDSP. (Typical TDSP telemetry point) or Low Side voltage with appropriate transformer model may be substituted.(Typical QSE telemetry point) **RE Comment:**
☐	Station Static Reactive Device(s) status	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision.(Typical QSE telemetry point) **RE Comment:**

	Data	Frequency	Mode	Reference/Comments
☐	Transmission Line Flow	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. (RE has confirmed that TSP is providing required points). **RE Comment:**

Attachment 2: Request for Initial Synchronization Checklist

[QSE submits checklist to request initial start-up]

QSE Name:

Agent (optional):

Date form completed:

* Proposed Initial Synchronization Date :

* Actual date contingent on completion of requirements and approval from ERCOT.

Primary and back-up contact personnel for Initial Synchronization (may be QSE's Agent):

Primary for Initial Synchronization Contact Name:

Primary Contact Telephone Number:

Primary Contact E-mail Address:

Back-Up Contact Name:

Back-Up Contact Telephone Number:

Back-Up Contact E-mail Address:

*If the unit is Split Metered:

Identify the QSE responsible for coordinating the start-up testing:

Identify all of the QSE's that are sharing this unit:

Identify all of the ESI ID's that are related to this unit:

Projected Commercial Date (unit available for market and/or reliability commitment):

By signing below I attest that information provided on this form (Attachment 2) is true, correct and complete, and that any substantial changes in such information will be provided to the Electric Reliability Council of Texas (ERCOT) in a timely manner.

Signature:

(QSE Authorized Representative)

Printed Name:

(QSE Authorized Representative)

Date Signed:

The QSE and Resource Entity are required to remain in compliance with ERCOT Protocol and Operating Guide upon initial day the interconnect becomes operational. The QSE will comply with procedures for new unit start-up testing, with initial synchronization schedule communicated to ERCOT Shift Supervisor.

If the new unit does not successfully synchronize to the ERCOT Transmission System within 30 days, as per **Procedure Step 2** above**,** the QSE will notify its ERCOT Client Representative of corrective measures and expected timelines for successful unit synchronization and unit testing.

☐ Generation facility is in an ERCOT Control Area and is being reported by that QSE to the ERCOT ISO in the manner as specified in Section 3 of the ERCOT Operating Guides, or any applicable ERCOT agreement requiring information on generation.

☐ Telemetry from the facility (station and generation) is in place and operational as of _____ (date) to QSE and TDSP (Optional). Enter specific comments about status of telemetry in QSE comment box on telemetry checklist on next page.

☐ QSE telemetry is being provided to ERCOT ISO (This information is summarized in Attachment 2 QSE New Generator Telemetry Checklist and is provided to assist Market Participants in identifying the telemetry required under ERCOT Operating Guide No. 3.1.3.1 and ERCOT Operating Guide Attachment 8a).

☐ QSE has reliable voice communications with the Generating Facility, ERCOT Control Area, and TDSP (Optional) ERCOT Operating Guide No. 3.1.3.1.

☐ Generation facility has automatic voltage regulators (in Voltage Control Mode) (AVR) and power system stabilizers (PSS) in service as of _____ (date) per ERCOT Operating Guide No. 3.1.4.5. AVR and PSS performance tests will be reported ERCOT within 30-days after start of commercial operations. **Comments:** _____

☐ The QSE is able to dispatch the reactive output (VARS) of this generation facility to maintain adequate transmission voltage at the point of Interconnection. (ERCOT Operating Guide 2.10.4.1 and 2.10.4.2). **Describe process for VAR dispatch**: _____

☐ QSE has submitted generation facility machine characteristics and plant design to incorporate the under frequency load shedding philosophy and criteria of ERCOT Operating Guide No. 3.1.4.6.

☐ Generation facility protective relaying is in place and operational, necessary to protect equipment from abnormal conditions consistent with the Control Area protective relaying criteria as described in ERCOT Operating Guide No. 3.1.4.6. **Comments:** _____

New Generator Telemetry Checklist

	Data	Frequency	Mode	Reference/Comments
☐	Real Time data accuracy			Real Time data for reliability purposes must be accurate to within three percent (3%). This telemetry may be provided from relaying accuracy instrumentation transformers. **QSE Comment:**
☐	Generating Unit gross and net MW output	2 sec	RTU	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. Net Generation is preferred. Otherwise, aux load should also be provided. **QSE Comment:**
☐	Generating Unit gross and net MVar output	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. Net Generation is preferred. Otherwise, aux load should also be provided. **QSE Comment:**
☐	Switching Device status other than reported in Attachment 1	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. **QSE Comment:**
☐	Breaker status other than reported in Attachment 1	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. **QSE Comment:**
☐	Generating Unit High Operating Limit	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. **QSE Comment:**
☐	Generating Unit Low Operating Limit	10 sec	RTU/ICCP	Protocol Section 6.5.1.1, Requirement for Operating Period Data for System Reliability and Ancillary Service Provision. **QSE Comment:**
☐	Generating Unit Automatic Voltage Regulator status	10 sec	RTU/ICCP	Protocol Section 6.5.7.2 QSE Responsibilities. Applies to units required to provide VSS. **QSE Comment:**
☐	Generating Unit Power System Stabilizer status			Protocol Section 6.5.7.2 QSE Responsibilities. Applies to units required to provide VSS. **QSE Comment:**

Wind-Generation Resource Only

	Additional Wind Resource Data	Frequency (sec)	Protocol Reference
☐	Wind Speed (Miles per Hour)	10	6.5.11 (7)
☐	Wind Direction (Degrees)	10	6.5.11 (7)
☐	Temperature (Celsius)	10	6.5.11 (7)
☐	Barometric Pressure (Millibars)	10	6.5.11 (7)

QSE Comment: _____

EXHIBIT E

From: Nodal Market Transition [mailto:NodalMarketTransition@ercot.com]
Sent: Friday, November 21, 2008 3:22 PM
To: Hayes, Brian; Freiman, Leslie
Cc: Daniel, Matthew; Hayes, Brian; Carmen, Travis; Nodal Market Transition; Middleton, Scott
Subject: Resource RARF Approval Notice - POST OAK WIND LLC- DUNS# 791082162

Resource Entities:

Your RARF submittal has passed all iterations of Nodal CIM business rules for Resource MMS and EMS parameters and is approved for loading into the Nodal CIM data base in December. We congratulate your staff for meeting and exceeding the time line in helping ERCOT reach the target for production quality data in time for the Critical Path CIM project.

Changes to Resource parameters you may need going forward are to be made using your last approved version and submitted on a TML Service Request as before by the Authorized Representative's digital certificate so ERCOT may properly document the change request.

For a revision initiated by the Resource Entity ERCOT will run an audit report upon receiving the updated RARF data to ensure that it is reviewed and validated against applicable business rules.

The next stage of RARF data submittals and validations ERCOT will initiate is planned for 2009 when the market will be transitioning to the single entry model.

For any assistance with resource registration please call or email your ERCOT Account Manager or email NodalMarketTransition@ercot.com.

Sincerely,

ERCOT Wholesale Client Services

Classification: ERCOT Confidential

EXHIBIT F

PRR Comments

PRR Number	830	PRR Title	Reactive Power Capability Requirement

Date	November 03, 2009

Submitter's Information	
Name	Matt Daniel
E-mail Address	Matthew.Daniel@horizonwind.com
Company	Horizon Wind Energy LLC
Phone Number	713-265-0350
Cell Number	
Market Segment	Independent Generator

Comments

Horizon Wind Energy appreciates this opportunity to comment on PRR 830, Reactive Power Capability Requirement. Horizon supports reliability and efforts to increase reliability on the ERCOT System, but PRR 830 will not provide additional reliability benefits. No study has been done to determine that any existing generation needs to retrofit to accommodate a reliability situation on the grid and neither ERCOT, nor any other party providing comments, has demonstrated that any reliability problem exists with the Wind-powered Generation Resources (WGRs) now connected to the grid. Despite this, existing WGRs are being asked to install retrofits on operating generation at significant expense. For Horizon alone, the costs are estimated to be tens of millions of dollars.

WGRs have sited thousands of megawatts of capacity in the ERCOT market. That capacity has Reactive Power capability consistent with the existing ERCOT Protocols and other guidance. That capability has been reported in asset registration forms. When interconnection studies showed the need, WGRs have installed additional reactive equipment.

Some commenters argue that WGRs shift costs because they only provide half of the "rectangle." This is simply not true. First, the requirement in the Protocols is to comply with a Reactive Power standard of the triangle. Many generators, in fact all built before 1999 (conventional generators), avoid the rectangle requirement because they are exempted. The argument that WGRs are shifting costs is made by the same generators who are largely exempt from these requirements for the bulk of their generation fleet. Yet WGRs are the only Market Participants asked to undergo retrofits. In actuality, instead of shifting costs to other Market Participants, WGRs have paid more to support system reliability by going above the Protocol requirements when the TDSP stated that additional reactive capability was necessary.

PRR Comments

Wind power has lowered the price of power in ERCOT, to the benefit of most Market Participants, particularly Load Serving Entities (LSEs) and ultimately to the consumers. PRR 830 would increase system costs without any real justification. WGRs would be required to increase investment in projects that have been operating for years, which costs would need to be recovered through higher prices. Further, it is possible that WGRs that provide power to the system will need to be taken off-line for these retrofits to be done. Removing wind generation or making wind generation more expensive will serve to benefit only the generators that would not otherwise be dispatched if the wind generation were running—gas-fired generators. A policy of requiring retrofits also increases costs by increasing investor uncertainty about additional costs that may be imposed on existing assets and even more so on new projects.

If the target is to get to the "rectangle" ERCOT-wide, all exemptions should be removed from the rectangle requirement. However, in the instant situation, there is no demonstrated need for the rectangle. PRR 830 also attempts to insert into the Protocols the requirement that Reactive Power capability be provided using more expensive dynamic equipment, instead of static devices that many WGRs now use. No study supports such action by ERCOT or such investment of potentially hundreds of millions of dollars by one segment of the generation market.

ERCOT has known the capability of WGRs in the ERCOT market for years. WGRs have supplied Generation Asset Registration Forms ("GARFs"), and Resource Asset Registration Forms ("RARFs") that clearly demonstrate the capability in the shape of a triangle and not the rectangle. Until recently, the Resource Asset Registration Guide even demonstrated by pictorial that the minimum requirement is the triangle, not the rectangle.

Despite claims to the contrary, ERCOT's current interpretation of the Reactive Power requirements in the Protocols remains in dispute. It is the subject of an appeal active at the Public Utility Commission of Texas (PUCT). PUCT Docket 36482, Appeal of Competitive Wind Generators Regarding the Electric Reliability Council of Texas' Interpretation of the Reactive Power Protocols, demonstrates that a serious controversy remains about required Reactive Power capability. The docket was initiated when a group of WGR owners (the Competitive Wind Generators) appealed ERCOT's November 2008 Legal Interpretation that the Protocols require all Generation Resources that are not otherwise exempt to provide the same amount of Reactive Power that they are capable of at their rated output at any level of output. This puts Generation Resources that had been approved for interconnection without that capability (except those exempted or grandfathered by the Protocols already) at risk of penalties for not complying with Protocol standards. For some Resources, the exposure would be three years of penalties, potentially levied on every wind turbine in WGR.

Throughout the appeal, ERCOT steadfastly maintained that the requirement had always been clear, and that WGRs should retrofit even without some demonstration of need. However, every Standard Generation Interconnection Agreement (SGIA), by contract in the form approved by the PUCT, requires that "unless exempt, the TSP shall timely request **ISO** and all regulatory approvals necessary to carry out its responsibilities." Moreover, before each of these WGRs, that had submitted GARFs or RARFs, depending on the timing, was energized, ERCOT specifically approved interconnection checklists, which include demonstration of Reactive Power capabilities prior to energization. As a System Operator, ERCOT knew exactly what the

requirements were and exactly what the WGRs were connecting to the grid. To now state years later that the standard applicable to these WGRs, that have invested billions in the ERCOT market based on the rules in place at the time, is somehow different and that these WGRs are causing system reliability issues can mean only one of two things. Either 1) ERCOT did not pay attention to its own requirements in the Protocols and what it was connecting to the grid; or 2) ERCOT knew the standards were right and the WGRs were compliant, hence the compliance letters that WGRs met the standards.

What has changed between now and then? As discussed at the PRS meeting in response to the question by the Independent Market Monitor, the modeling for Competitive Renewable Energy Zone (CREZ) transmission evidently assumed that all WGRs were meeting a different standard than that in the Protocols—the full dynamic rectangle standard that ERCOT now claims all WGRs must meet. There is still no evidence that this standard is required to accommodate CREZ generation. However, ERCOT's response has not been to change the model, but to change the requirements so that ERCOT itself can state that it has complied with North American Electric Reliability Corporation (NERC_ requirements relating to planning.

ERCOT's description of PRR 830 says, in part: "This PRR clarifies the Reactive Power capability requirement for all Generation Resources, including existing WGRs". If ERCOT's interpretation of Reactive Power capability requirementsin the Protocols is indeed accurate, there should be no need to clarify the Protocols that ERCOT says are already clear. Leaving that aside, the reality on the ground proves that the Protocols have not been interpreted in practice by WGRs, ERCOT or Transmission and/or Distribution Service Providers (TDSPs) in the way ERCOT reads them now and is attempting to change them through PRR 830. Thousands of megawatts of wind resource capacity have interconnected with the ERCOT Transmission Grid without the capability that is supposedly clearly required by Protocols.

Paragraphs (3) and (4) of Protocol Section 6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability, are explicit about which Generation Resources are exempt from completely meeting the Reactive Power capability requirement. Since the end date of that exemption, over 40 WGRs with approximately 7,000 MW of capacity have interconnected with the ERCOT Transmission Grid. The vast majority of these WGRs do not meet ERCOT's interpretation of the required Reactive Power capability. This fact can be verified by reviewing the asset registration forms that ERCOT accepted from these WGRs, and from the results of an informal survey ERCOT undertook in the last half of 2008 of WGR capabilities and procedures. It is hard to comprehend how so many projects could be interconnected in derogation of ERCOT's interpretation of the Reactive Power requirements, particularly if such interconnections would create reliability problems—which has not been shown in actuality, only discussed hypothetically in the comments of ERCOT and Calpine.

As attendees of the October 22nd PRS meeting were reminded, Reactive Power is a local service; it does not travel well. Requiring all WGRs to install more equipment simply because the requirements are re-interpreted would only increase costs—long after the investment in the Texas market has been financed. There is no demonstrated nexus between the imposition of these extra costs and the improvement in system safety or reliability.

A broader concern is that PRR 830 continues efforts to require retrofits without justification. The retrofit provisions in PRR 830 obviously hurt WGRs that have located in the ERCOT market—particularly given that the ERCOT interpretation of dynamic rectangle was not feasible by any wind turbine on the market at the time the Protocol language was drafted. Attempts to substantively change standards on a going-forward basis, as has always been the case in ERCOT, should be based on actual studies demonstrating need and/or benefits for the market. However, requiring retrofits from WGRs that met the ERCOT standards in effect at the time, and singling out one new generation technology on which the standards have been changed, while continuing to exempt older technologies, raises fairness issues and frustrates the investment-backed expectation of those generators that answered the call to invest in the ERCOT market.

The impact of WGRs on the ERCOT Transmission Grid has been to lower power prices. This result is not unique to ERCOT. Other regions with significant wind capacity are saving money, too. The impacts may be greater in ERCOT, however, given the installed generation fleet. Those impacts have been widely reported. Results of analysis by Bernstein Research showing that increased wind capacity in ERCOT has reduced power prices have appeared in a variety of publications, including a Wall Street Journal Blog[1] and Coal Power magazine[2]. The following excerpt summarizes the expected impact of lower power costs in general terms. For 2008 wind generation is calculated to have reduced the annual average price per MWh by $2.00.

> *"In ERCOT, the growth in wind generation is expected to push gas off the margin during certain off-peak hours and, during the hours when gas plants are operating, to reduce the marginal cost of supply by curtailing the hours run by higher cost combustion turbines."*[3]

It goes without saying that consumers benefit from lower prices. It's equally clear that this benefit comes by displacing high cost generation. As more wind capacity is installed, consumers will benefit while competing generators will see lower revenue. PRR 830 would shift this equation by imposing additional costs on both future and existing WGRs. The true impact analysis of PRR 830 is that it will raise prices in the ERCOT market, diminishing the benefits of wind generation the Texas Legislature and the PUCT have worked to achieve.

PRR 830 should be rejected.

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[1] "Will Wind Power Blow Texas Generators Away?" posted on Wall Street Journal's Environmental Capital Blog, August 10, 2009.
http://blogs.wsj.com/environmentalcapital/2009/08/10/blown-away-wind-power-makes-electricity-cheaper-in-texas/

[2] "Texas Wind Boom Cutting into Fossil Generator Profits" in Coal Power magazine, October 8, 2009
http://www.coalpowermag.com/ops_and_maintenance/223.html

[3] P. 4, Bernstein Commodities & Power: The Impact of Wind on Power Prices and Coal and Gas Consumption, September 4, 2009

PRR Comments

Revised Proposed Protocol Language

None.

EXHIBIT G

PRR Comments

PRR Number	830	PRR Title	Reactive Power Capability Requirement

Date	October 8, 2009

Submitter's Information	
Name	Matt Daniel
E-mail Address	Matthew.Daniel@horizonwind.com
Company	Horizon Wind Energy LLC
Phone Number	713-265-0350
Cell Number	
Market Segment	Independent Generator

Comments

Horizon Wind Energy LLC appreciates the opportunity to offer comments on PRR830, Reactive Power Capability Requirement. Horizon believes that Market Participants have the responsibility to provide capabilities required by the market rules, and has ensured that our Wind-powered Generation Resources (WGRs) fulfill that responsibility.

The introductory comments for PRR830 say it is a clarification of Reactive Power requirements and is intended to be prospective, even a cursory review shows that it goes far beyond clarification. In addition to redefining the terms for Reactive Power service and adding new definitions for existing terms, it imposes new requirements on existing generation that can only be accomplished through significant capital investment in retrofits. This re-write of Reactive Power capability requirements occurs at the same time that the Public Utility Commission of Texas (PUCT) is hearing an appeal of an ERCOT Protocol Interpretation regarding the requirements for Reactive Power capability.

PRR830 broadly re-defines Reactive Power capability requirements for Generation Resources interconnected with the ERCOT Transmission Grid. For example, it changes the concept of Unit Reactive Limit (URL) and adds the requirement that all Reactive Power capability be dynamic. By doing so, it imposes new requirements on WGRs and requires retrofits to the majority of operating WGRs. These new requirements are contrary to existing Protocols and practice, and are proposed without any demonstration of need.

At the time the current Protocols were adopted, the technology for WGRs to perform as ERCOT interprets them did not exist. Only one vendor had even announced that their turbines could do so, as was pointed out in the discussions around their adoption. Clearly imposing a requirement now to reach back will penalize existing WGRs that invested in the market based on the market

rules at the time. They will have to make substantial investments to implement these new Reactive Power requirements, without any study showing that doing so will improve system reliability.

If the true intent is to level the playing field with regard to Reactive Power capability, this PRR does not accomplish that objective. Instead it singles out one group, WGRs, to which this retroactive standard is applied. The current Reactive Power protocols exempt conventional generation pre-1999 from the Reactive Power requirements, and this PRR only seeks to place the retroactive "rectangle" requirements on WGRs, and not other types of generation to which the retroactive provisions could also be applied if the purpose was to make the playing field level—albeit at significant cost to those conventional generators as well.

Reconsideration of Reactive Power capability required by the ERCOT System, and of the most reliable and cost-effective way to provide it, will be a lengthy project, and should be a separate effort from this PRR as part of a study process—however Horizon does not support the retroactive application of Reactive Power requirements or other standards to existing generation once the capital investment has been made and the generator has no way to recover tens of millions of dollars in new, unanticipated capital outlays.

The background relating to Reactive Power is significant. WGRs have given ERCOT their Resource Asset Registration Forms (RARF & GARF) for years demonstrating compliance with the Reactive Power standards in the shape of the "cone." The RARF example clearly demonstrates what the minimum requirement is, and that is the "cone" as can be seen in the pictorial that accompanies it.

WGRs developed their projects on the understanding that ERCOT required, at most, Reactive Power be provided as shown by the "cone" plot, consistent with the rest of the country. However, PRR830 was precipitated by a new interpretation issued by ERCOT as part of its ERCOT Protocol Interpretation issued November 13, 2008 (Interpretation), which was also subsequently withdrawn as a result of defects in the adoption of the Interpretation. This matter is the subject of a contested case before the PUCT. The PUCT will decide the interpretation of the Protocols as applied to existing generation and has indicated its willingness to do so by twice refusing to grant ERCOT's Motions to Dismiss. Instead of embarking on a lengthy debate about re-defining Reactive Power capability requirements as applied to existing WGRs in the consideration of PRR830, Horizon recommends limiting this discussion to clearly defining what new WGRs need to provide. This will remove financial concerns for operating and prospective wind projects, that otherwise may have to make costly retrofits or install unnecessary equipment.

Reactive Power capability requirements for ERCOT are clear from Protocols and other binding documents. Those requirements are the maximum Reactive Power performance required in FERC Order 661A: WGRs are to maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the point of interconnection. All WGRs must maintain at least this capability, using static and/or dynamic reactive equipment, as they decide is most cost-effective. WGRs should only be required to provide additional Reactive Power capability if needed for system reliability, as determined by the Transmission Service Provider (TSP) conducting the

interconnection study. Review of the Protocols and of Other Binding Documents show consistent support for this requirement. Examples from those documents are provided below.

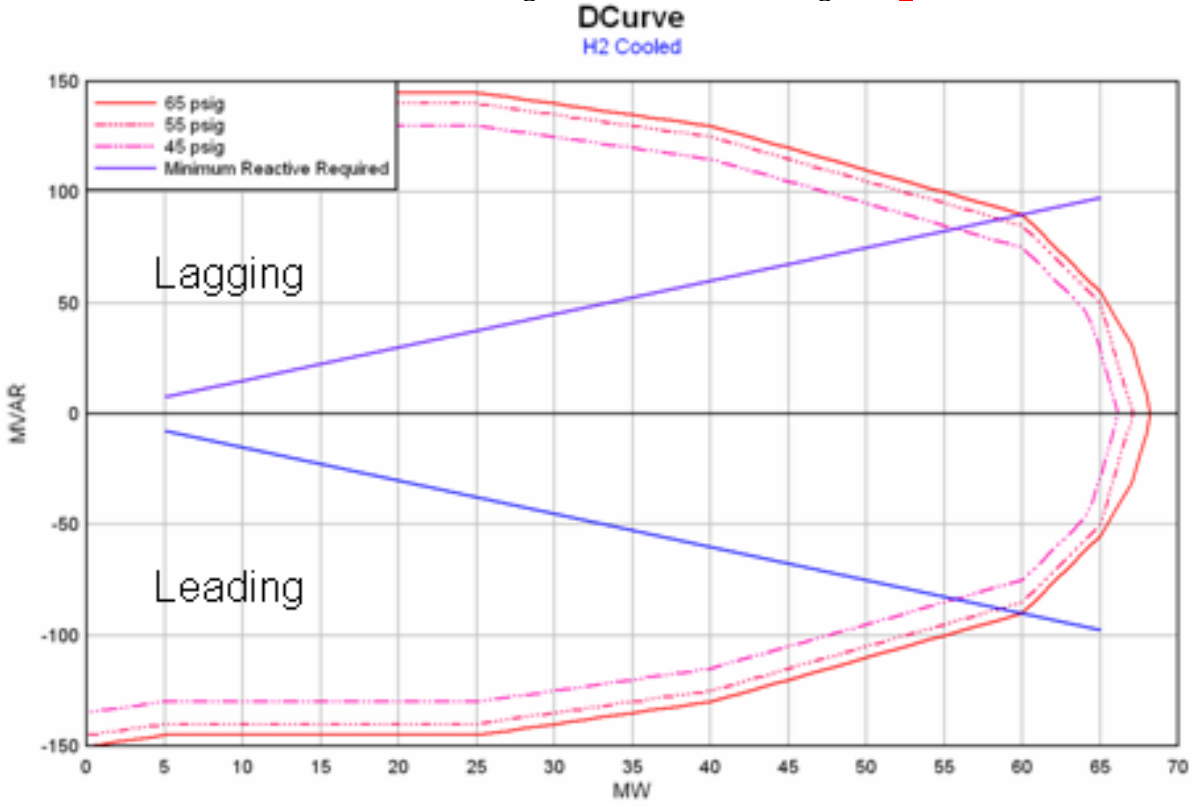
Existing WGRs interconnected with the ERCOT Transmission Grid with the understanding of Reactive Power requirements as described above. Their capabilities were clearly reported in their Interconnection Agreements and Registration Forms. The additional retroactive requirements PRR830 would impose have not been shown to be needed by any study. For all these reasons, in addition to the costly retrofits PRR830 would impose, Horizon recommends rejection of PRR830.

The current Protocols are clear that URL refers to Reactive Power produced when a Resource is operating at its rated capability, and that the required reactive capability varies with the Resource's real power production. At full output, a Resource must be capable of providing reactive power per its URL. There is no confusion there. The Protocols also say: "In no event shall the Reactive Power available be less than the required installed reactive capability multiplied by the ***ratio*** of the lower active power output to the generating unit's continuous rated active power output…" (emphasis added). There should be no confusion that the Protocols intend for Reactive Power capability to vary with output.

This clear meaning is supported by ERCOT's actions and in Other Binding Documents. WGRs have clearly and repeatedly communicated their Reactive Power capability through the interconnection process, the asset registration process, the synchronization approval process, ERCOT surveys, and in response to request letters from ERCOT.

ERCOT's Resource Asset Registration Guide, effective March 10, 2009, reflects the Protocol requirement that the "Minimum Reactive Required" vary with a Resource's output. The chart reproduced below appears in version 4.03 of the Resource Asset Registration Guide, published two months after ERCOT issued its Reactive Power interpretation. WGRs registering their assets clearly indicated that their Reactive Power capability varies with power production.

Resource Asset Registration Guide v4.03, Page 4 of 5~~69~~



From the letters ERCOT sent on June 5, 2009, it appears that many, if not all, WGRs registered their assets indicating that their Reactive Power capability varies with power production. ERCOT sanctioned their interconnection while understanding that their Reactive Power varied with real power production. This understanding is reflected in a draft revision to ERCOT's Generation Interconnection or Change Request Procedure, offered for comments in February 2007, which includes the language quoted below. It would accommodate actual WGR Reactive Power capability and provides that Reactive Power can be provided using either static or dynamic equipment.

4.7 Special Requirements for Wind Generation

4.7.1 Power Factor Design Criteria (Reactive Power)

A wind generating plant shall maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the point of interconnection as defined in the SGIA. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors if agreed to by ERCOT and the TSP. The GE or PGC shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient

> dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system.[1]

There is still no requirement to provide Reactive Power using dynamic equipment in ERCOT's New Generator Commissioning Checklist. The version effective since April 07, 2009 includes a requirement for each Generation Resource to telemeter the status of its "Station Static Reactive Device(s)" status. Clearly ERCOT accepts that Generation Resources could reliably meet their Reactive Power capability requirements with static devices.

Revised Proposed Protocol Language

None.

[1] http://www.ercot.com/content/meetings/ros/keydocs/2007/0215/06._ERCOTGenerationInterconnectOrChangeRequestProcedures0214.doc

EXHIBIT H

PRR Comments

PRR Number	830	PRR Title	Reactive Power Capability Requirement

Date	September 15, 2009

Submitter's Information	
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Market Segment	Independent Generator

Comments

Horizon does not agree with the changes proposed in Protocol Revision Request (PRR) 830, Reactive Power Capability Requirement. The PRR as drafted would require significant retrofitting by wind generators that have been providing service to the ERCOT market for years without justification. It would impose additional capital expenditures for existing generation many years after these assets have been financed. The substantial retrofit obligations to be placed on wind developers are tantamount to enforcement of and retroactive application of the ERCOT interpretation of Reactive Power capability requirements that has been withdrawn. Such requirements placed on a single segment of the generation market harms the investment-backed expectations of wind developers like Horizon who have invested hundreds of millions of dollars in the ERCOT market. PRR830 in its current form should be rejected.

The proposed language attempts to remove all Protocol language that conflicts with the legal interpretation ERCOT issued in its notice, M-D111308-01 Legal, issued November 13, 2008, and replace it with language supporting ERCOT's interpretation. This raises questions about the meaning of the deleted language. PRR830 also requires Wind powered Generation Resources (WGRs) to retrofit their equipment to comply with the new requirements in which the expense would be, for individual wind developers, in the tens of millions of dollars. Significantly, ERCOT has performed no studies that demonstrate that these large expenditures need to be made for any reason and has not shown reliability events that would require costly retrofits to existing generation.

The language proposed in PRR830 goes beyond removing Protocol language that conflicts with ERCOT's interpretation; it is contrary to ERCOT's introductory remarks, in that it is retrospective, not prospective. It would require Wind Generation Resources

that commenced operation on or after February 16, 2004 and have a signed Interconnection Agreement on or before November 1, 2009 to take necessary actions to comply with ERCOT's interpretation, under a mitigation plan that meets ERCOT approval. There is no basis for this requirement. As discussed by the ERCOT Board in taking up Operating Guide Revision Request, (OGRR) 208, Voltage Ride-Through (VRT) Requirement, ERCOT should study whether there is a need for requirements that burden existing generation by retroactive application of new standards. It is also unclear whether reactive power requirements of the level intended by PRR830 will be at all useful to the market as the system is clearly functioning without these requirements, and the investment in retrofits may in fact be wasted capital investment. This is particularly troubling given that most projects are financed through a variety of means ultimately relying on the value of the asset and based on the capital investment associated with construction. These new and substantial capital outlays cannot be "added" into the financing years later.

There may be, in the future, situations when Market Participants need to provide additional services other than those originally contemplated -- including additional Reactive Power above required capability. Protocols now provide that conventional generation will do so – for compensation. However, the key is that such additional expenditures must be compensated in a market such that there is certainty and that investment backed expectations are met. This is not the case with PRR830. Although it singles out a specific technology for retrofits, this requirement is not supported by studies or independent reviews.

WGRs in general and Horizon, in particular, have been willing to modify their equipment and operating procedures when needed for system reliability. Examples include:

- Changing control systems to limit ramp rates in response to ERCOT Dispatch Instructions.
- Revising operating procedures to use ERCOT's Wind-powered Generation Resource Production Potential (WGRPP) forecast for their Day Ahead schedule instead of WGR's own forecasts.
- PRR811**,** Real Time Production Potential, which is likely to be approved, would require WGRs to provide their best estimate of production output at all times, in addition to its Resource Plan.

These changes do not reach the level of significance for unrecoverable cost that ERCOT is now asking one segment of the market to bear through PRR830. ERCOT has not shown the need for a change in the reactive requirement for WGRs and any changes to the Reactive Power requirements should truly be prospective in nature, not creating substantially increased costs for existing generation.

Revised Proposed Protocol Language

None.