

## **NextEra Energy Appeal of PRR 830 Regarding Reactive Power**

NextEra Energy Resources (NextEra) respectfully requests the ERCOT Board of Directors remand PRR 830 to TAC with instructions to address material defects in the PRR as discussed below or, in the alternative, approve the PRR as set forth in Attachment A.

Proper levels of reactive power in the ERCOT system are essential for the reliable delivery of electricity service to customers throughout the state. No one disputes this fact. However, there is significant dispute regarding: (a) the appropriate reactive power capability needs in various locations on the ERCOT transmission system; (b) whether multi-million dollar retrofits of some wind farms are either technically necessary or economically efficient; and (c) whether the ERCOT Protocol revision process can be used to interfere with pending Alternative Dispute Resolution (ADR) and Public Utility Commission of Texas (Commission or PUCT) contested case processes which address the same issue as the proposed Protocol revision.

No matter one's position on the core issues above, PRR 830 as recommended by TAC lacks clarity in key respects and risks unintended consequences from the inclusion of insufficiently vetted new concepts. The PRR would clearly benefit from further refinement.

NextEra strongly recommends the Board decline to approve PRR 830 in its current form because it conflicts with prudent ERCOT policy precedent and lacks sufficient technical support. NextEra remains committed to working through the stakeholder process to improve the PRR if the Board chooses to remand it to TAC. However, NextEra also recognizes the urgent need for resolution of this issue and, therefore, offers amendments for Board consideration which would sufficiently improve the PRR to enable immediate adoption, while reserving remaining issues for subsequent resolution in accordance with the applicable procedures.

### **I. Background**

Well before submitting PRR 830, ERCOT Staff sent letters to wind generators asking them to demonstrate compliance with the existing Protocol language requiring generators to provide reactive power capability. Wind generators, including NextEra, submitted responses to ERCOT's request and consistently presented evidence that showed compliance by providing what is commonly called a "triangle," *i.e.*, increasing reactive power as the amount of available wind increases. Similar evidence had in many cases been presented to ERCOT Staff and Transmission Service Providers (TSPs) through the generation interconnection and asset registration processes as these units were developed and certified for operation. Nonetheless, ERCOT Staff in November 2008 announced an interpretation of the existing Protocol language to require what is commonly called a "rectangle," *i.e.*, the same amount of reactive power would be expected from wind turbines regardless of whether or how strong the wind blows.

As a result of the conflict between ERCOT Staff's interpretation and that of multiple owners of wind resources installed over a four-year period, several ADRs and a contested case have resulted. NextEra is currently in the final stages of an ADR process which preceded the

contested case at the Commission and the proposal of PRR 830. It was in the midst of these activities, which are defined by Section 21 of the Protocols and by the PUCT Procedural Rules that, ERCOT Staff on September 8 submitted PRR 830 which was described as a “clarification” of existing Protocol language even though it proposed substantive new language, introduced new compliance deadlines, and contained substantive deletions of many key elements of the current reactive power capability standard language.

In response to the clear deficiencies of PRR 830 and in the desire to find a mutually agreeable compromise, NextEra filed PRR 835, included as Attachment B, on September 30. PRR 835 would have required application of the “rectangle” requirement where generation interconnection studies or other studies demonstrated the need for it, but maintained the previously used “triangle” as the minimum reactive power capability requirement. In support of PRR 835, NextEra presented preliminary results of engineering studies to ROS on October 15. The NextEra presentation to the ROS is included as Attachment C. ERCOT Staff sought to dismiss the engineering studies offered by NextEra as insufficient in scope, but did not offer, and has still yet to offer, any alternative studies or data to support the PRR 830 requirement. The ROS, TAC’s subcommittee of technical experts in the area of system reliability, endorsed PRR 830 as filed based upon a “fairness” argument and an assumption that “more is better,” rather than on any technical analysis of system conditions or likely future scenarios. NextEra notes with some concern that the ROS filed only 24 words in its technical endorsement of the PRR, none of them providing technical guidance on any of the fundamental issues. Similarly, both PRS and TAC subsequently endorsed PRR 830 as filed, despite acknowledgement by several parties, including ERCOT Staff, that some issues remained unresolved and that the amendments proposed by multiple parties might improve the clarity and workability of the PRR.

On November 3, prior to the TAC deliberation, NextEra submitted the alternative language included in Attachment A which cured the original language’s interference with the ADR process; preserved the Commission’s jurisdiction over the subject matter in contested case proceedings; provided the exact “rectangle” requirement sought by ERCOT Staff for all new generation; and proposed solutions for identified technical concerns with the PRR – all without closing the door on requiring retrofits of existing units where needed to address system security needs. NextEra’s proposal also incorporated a number of suggestions offered by other parties which the ROS, PRS, and TAC either completely ignored or only briefly considered. NextEra notes that at no point in the Protocol revision process has PRR 830 been studied by the kinds of working groups or task forces where thorough, substantive, detailed discussion by specialized subject matter experts typically occurs in the stakeholder process. NextEra requests the Board remedy these procedural and substantive defects by remanding or amending the PRR.

## **II. PRR 830 as recommended by TAC does not meet the ERCOT policy standard for retroactive application of technical capabilities.**

Implementation of PRR 830 as recommended by TAC is estimated to cost wind generators approximately \$100 million, yet no evidence has been presented to suggest such an investment would yield a commensurate benefit to system reliability. Indeed, the first mention of known reliability concerns related to existing units did not appear until the discussion at TAC,

when ERCOT Staff referenced “two recent incidents” where grid operator actions were required to address reactive power capability deficiencies. No details about these incidents were provided and there was no analysis or discussion whether the reactive power capability retrofits required by PRR 830 would have sufficiently addressed the referenced incidents. There was also no analysis or discussion about whether ERCOT’s actions to support voltage in the referenced incidents provided a more economically beneficial solution to the challenge than imposition of retrofit requirements. In fact, the only thing clear from the brief discussion of known “incidents” is that multiple solutions other than the PRR 830 approach are available to ERCOT and TSPs to resolve voltage support and reactive power issues. In each instance where anecdotal support for PRR 830 has been offered it has been in the form of extemporaneous oral argument – no studies, data, or written comments have been provided.

As the Board is aware, NextEra and other wind generators in ERCOT have spent millions of dollars in the past 18 months to implement numerous PRRs which required new or upgraded capabilities and processes for existing units to support operational reliability. Examples include upgrading generation control systems to implement ramp rate limitations (PRR 778); installing additional data-gathering equipment and telemetry to support development of the ERCOT system-wide wind forecast and accelerated implementation of Texas Nodal Market requirements deemed to have immediate benefit (PRR 794); as well as changes to key operational processes to support ERCOT’s ability to manage wind variability-related issues (PRRs 763, 773, and 793). Indeed, all of these new requirements on existing units were supported, even authored, by wind generators. NextEra has not and will not argue that existing units cannot be required to provide new or upgraded technical capabilities when technically feasible to do so. However, NextEra notes that when such new requirements necessarily involve substantial unit outages and/or dedication of significant technical and financial resources, wind generators have never opposed retrofits out of hand but rather have requested those proposing the major modifications provide reasonable justification for the retrofits and some analysis to support the value of the proposed requirements. PRR 830 noticeably lacks such evidentiary support.

On previous occasions, most notably in the Appeal of OGRR 208, the Board has required a meaningful analysis to support major retrofits on existing investments. In OGRR 208, TAC approved universal application of a voltage ride-through standard which would have forced a number of generators to extensively retrofit existing units. The recommendation was based on a general sense that more capability would be better for the system but there was no study or evidence to support the contention that the benefit would meet or exceed the costs to retroactively apply the new standard. The Board noted the lack of adequate evidence to demonstrate the need for such a significant investment and appropriately approved the new VRT standard on a prospective basis, while directing that a study be performed to identify system needs and recommend solutions. Moreover, the Board recognized the danger of sending a signal to investors and developers that no project *pro forma* was safe from arbitrary *ex post facto* action and that all investment decisions in ERCOT should be made with the understanding that future financial and capital risk could be boundless. NextEra requests the Board remain committed to the reasonable policy precedent that evolving technical requirements be implemented prospectively unless compelling evidence supporting retroactive application is presented.

### **III. PRR 830 merits refinement of important secondary issues independent of any decision on the issue of retroactive application of the “rectangle” standard.**

Even if the Board chooses to ignore the procedural and policy concerns raised in this appeal, it is important to note the TAC-recommended language should be improved to provide additional clarity and to avoid unintended consequences. In so doing, the Board could also minimize the risk that vague or confusing language would prompt additional needs for ADR sessions and contested cases at the Commission. Specifically, NextEra directs the Board to proposed amendments Nos. 1, 2, 3, 7, and 9 in Attachment A. Each proposed amendment addresses issues unrelated to the retrofit question such as whether an ERCOT-ordered disconnection from the grid to support voltage is temporary or permanent and how to best provide ERCOT the information needed for Real Time reactive power capability modeling, among others.

NextEra is disappointed that as late in the process as the November 5, 2009 TAC deliberation, several parties who ultimately supported PRR 830 as filed, including ERCOT Staff, acknowledged some of the concerns and potential solutions raised by NextEra, Invenergy, Vestas, and the Wind Coalition, yet declined to dedicate the time necessary to vet the identified issues. NextEra is concerned that the push to do something has morphed into a willingness to do anything, whether or not fully considered. Such a rush to judgment on critical issues of system reliability and economics does not reflect well on the stakeholder process.

### **IV. PRR 830 merits further examination of key technical issues.**

Sources of reactive power typically provide more benefit to the system by being nearer to load. Wind resources, with almost no exception, are located in remote areas that are far from load. Therefore, even if wind resources were able to provide significant amounts of reactive power, there would likely be no benefit to loads that are hundreds of miles away since reactive power does not travel well. NextEra’s study and presentation to ROS showed this fact. The need for additional reactive power near wind farms typically occurs when the amount of energy generated by the turbines increases. The “triangle” provides this by definition, *i.e.*, the amount of reactive power produced increases as the amount of energy is produced. ERCOT Staff has offered no data or studies to quantify the system benefits which might result from burdensome reactive power requirements in regions with low load levels.

Moreover, NextEra is concerned that adding superfluous amounts of reactive power in remote generation pockets can actually harm reliability and can compel expensive equipment additions by TSPs. Where there is too much reactive power in a region, TSPs will be compelled to add equipment on their lines in order to remove these excesses. Although the PUCT approved a plan more than one year ago to add more than 10,000 MW of new wind generation to the western portion of the ERCOT network, a study of the reactive power needs associated with that build out is only now under development. The fact that such a study is under development, and that such a study is similar to the OGRR 208 VRT Study currently underway begs the question: why should anyone, including the Board, feel compelled to make major changes now based on

speculation and conjecture when quantifiable data and analysis is under development and expected within a reasonable time frame? NextEra recommends the Board correct PRR 830's procedural and technical deficiencies by setting aside the legacy issues and directing ERCOT Staff to move forward with an appropriate reactive power requirements study which takes into account the impact of thousands of additional megawatts of new wind capacity in the West Zone generation pocket which must comply with the new "rectangle" requirement of a prospectively applied PRR 830.

#### **V. PRR 830 does not maximize consumer benefit.**

Although it has been argued that the reactive power capability from generation units is insufficient for system needs and some, albeit scant and anecdotal, evidence has been offered that ERCOT has taken various actions to address voltage support issues in the west, no meaningful discussion or analysis has occurred to address which approach to the reactive power issue provides the best solution for Texas consumers. If it costs generators more than it would cost TSPs, then consumers will benefit from TSPs providing the solution because the costs of implementation must be recovered regardless of whether they are borne by a generator or a TSP. There is absolutely no evidence that the single option included in PRR 830 is the most cost-effective way to address reactive power. This tunnel vision could cost Texas consumers millions of dollars and burden them with a less efficient system design in the process. NextEra recommends the Board recognize the deficiency of analysis from the consumer viewpoint and refrain from prematurely adopting a policy which may ultimately require significant wasteful spending which would trickle down into customer impacts.

#### **VI. The ERCOT Protocols cannot be "clarified," they can only be "revised."**

The ERCOT Staff has described PRR 830 as a "clarification" of existing Protocol language. NextEra is concerned, as many other entities have been over time, with the idea that the Protocols can be "clarified." Section 21.1 of the Protocols clearly states any, "request to make additions, edits, deletions, revisions, or clarifications to these Protocols, including any attachments and exhibits to these Protocols, is called a 'Protocol Revision Request.'" There is no "clarification" which is separate and distinct from a "revision."

ERCOT and all Market Participants are bound by the requirements of the Protocols. When there is a lack of clarity regarding those requirements, parties may proceed at their own risk of an adverse interpretation by a jurisdictional entity or may seek to revise the Protocols to provide new language which makes the Protocols requirement at issue clearer upon the effective date of approved clarifying language. But such revisions never resolve what the language meant in the past, they can only attempt to make clear what the language means once that language is an effective part of the Protocols. All disputes regarding Protocols requirements belong under the jurisdiction of the PUCT. No matter what ERCOT Staff or a particular Market Participant thinks any particular requirement of the Protocols meant at any particular point in time, only the PUCT can actually interpret the language of the Protocols when an irresolvable dispute is raised, as is the case regarding the reactive power capability requirements of Section 6.5.7.

Even to the casual reader, PRR 830 clearly stretches the boundaries of what could reasonably be considered a clarification. In Section 2.1, PRR 830 proposes a new definition which has never appeared in the Protocols and makes a fundamental distinction in another which had previously never been contemplated. PRR 830 strikes entire existing paragraphs, inserts entirely new paragraphs, complete with new technical standards, compliance deadlines, and ERCOT authority to review and approve various plans and actions. In many respects, one could argue PRR 830 is less clear on some issues than the existing Protocols language, such as the Section 6.5.7.1(7) allowance for generators to pay TSPs to install reactive capability equipment. The section currently contains precise language approved by the Board in PRR 493 to ensure consumers did not bear unwarranted costs through transmission rates. That specificity would be stripped by PRR 830 and replaced with vague language allowing generators and TSPs to “enter into an agreement.”

NextEra recommends the Board reject on principle the notion that backward-looking “clarifications” of the Protocols are even possible and amend PRR 830 to comport with the long-held standard that Protocol revisions are only prospectively effective and retroactive application of new standards requiring major financial commitment is permissible only when supported by a demonstration of need and/or cost-effectiveness.

## **VII. Circumvention of the ADR process and the Commission’s jurisdiction by PRR 830 is inappropriate.**

PRR 830 is unique in that, to NextEra’s knowledge, it marks the first time ERCOT Staff has submitted a “clarifying” PRR which seeks to impose the viewpoint of one party in an active ADR process conducted under Section 21 of the Protocols. Typically, as one of the terms to a successful conclusion of ADR, ERCOT requires the Market Participant to file a PRR which provides the clarification in the Protocols needed to avoid another ADR for the same issue in the future. Never before has NextEra known ERCOT to abandon the ADR process and attempt to apply a retroactive interpretation of the Protocols in an effort to render the ongoing ADR proceeding moot. Not only is such an approach unique, it is also quite disturbing because it seems designed to prevent an affected entity from relying on the due processes described in the Protocols and the PUCT rules.

PRR 830 was submitted while a contested case was pending at the PUCT and while multiple companies were engaged in ADR with ERCOT Staff. Each of the ADRs and the contested case focused on the proper interpretation of the existing Protocol language related to reactive power. The contested case has since been dismissed, purely on procedural grounds; however the ADR processes continue and appear to be on track for multiple appeals to the Commission. By actively pushing PRR 830 through the revision process, ERCOT Staff has effectively forum-shopped in a manner that seeks to neuter the ADR process and to end run the Commission’s contested case processes. As a matter of procedural principle, it is inappropriate for any participant, including ERCOT Staff, to ignore the proper tools of ADR and contested cases for interpretation and clarification of existing Protocol language. For this reason, NextEra recommends PRR 830 be designed solely for prospective application at this time. The existing

wind farms can and will be addressed in the pending ADRs and likely in contested cases that relate to them.

**VIII. NextEra’s proposal addresses key deficiencies in PRR 830 while delivering the full “rectangle” solution and keeps the door open on the retrofiting issue by respecting the PUCT’s authority to interpret the Protocols and by proposing technical analysis to develop the right solution.**

For the reasons described above, NextEra firmly believes successful resolution of the issues addressed by PRR 830 requires the adoption of revised Protocol language which clearly defines the reactive power capability requirements for generation Resources on a going forward basis. NextEra further believes that such revised language should avoid unnecessary, unclear, or unvetted changes which might produce unintended consequences. Finally, NextEra believes such revised language should avoid an arbitrary retroactive application of major technology changes or language intended to meddle with legal processes outside the PRR process which invite litigation and threaten implementation of a clear standard for market participants. PRR 830 as recommended by TAC fails each of these tests.

The proposal offered by NextEra in Attachment A meets each of these important considerations. It clearly offers the same “rectangle” requirement proposed by ERCOT and endorsed by ROS, PRS, and TAC while setting aside the legacy issues which threaten implementation of the clarified reactive power standard. NextEra’s proposal comports with long-standing ERCOT practice for Protocol revisions and with previously adopted Board policy regarding major changes to technical standards for existing infrastructure.

Importantly, NextEra’s proposal does not preclude the adoption of a subsequent PRR to require retrofits to existing units. Clearly, if the PUCT decides that multiple wind developers over the last four years somehow all misunderstood the requirements of Section 6.5.7, then those asset owners will obviously be obligated to meet the requirements of the Protocols in effect at that time as interpreted by the PUCT decision. If a PRR is needed to effectuate that change, then such a PRR consistent with a Commission order will be filed and approved. Even if the PUCT decides, as wind generators anticipate, that the existing Protocols language allows the provision of a “triangle”-shaped reactive power capability, there is no reason a new PRR cannot be filed in the future to require generators currently incapable of providing the “rectangle” to make the upgrades necessary to achieve such a standard, provided such a change is sufficiently supported by compelling evidence of necessity.

In short, the NextEra proposal does not preclude the possibility that the ultimate resolution of the reactive power capability issue may eventually include all the elements of PRR 830. However, the NextEra proposal ensures that the most reliable and economically efficient solution has a chance to emerge from the deliberative stakeholder process; preserves the integrity of the stakeholder process and PUCT rules; and follows previous Board policy on fundamental issues of market design and market rules implementation. NextEra strongly recommends the Board do what TAC and its subcommittees failed to do – seriously consider a methodical

approach which breaks this issue into achievable pieces leading to the best long-term result for the ERCOT market and the ERCOT system.

#### **IX. Recommendation of NextEra Energy Resources.**

Consistent with ERCOT precedent and sound market policy principles, NextEra recommends the Board decline to approve PRR 830 as recommended by TAC. Rather, NextEra recommends the Board adopt one of the two draft motions below, listed in order of preference.

1. Remand PRR 830 to TAC with instructions to redesign the PRR solely for prospective application and reconsider the need for changing the definition of WGR throughout the Protocols solely for purposes related to Section 6.5.7.; or
2. Adopt PRR 830 with NextEra's November 3, 2009 comments.



## **Attachment A**

### **November 3, 2009 Comments of NextEra Energy Resources Regarding PRR 830**

PRR Number	830	PRR Title	Reactive Power Capability Requirement
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Date	November 3, 2009
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Submitter's Information	
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Comments
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NextEra Energy Resources submits the following comments regarding PRR 830, Reactive Power Capability Requirement, for consideration by the TAC. The redline language proposed below is based upon the PRS Recommendation Report of October 22, 2009 and incorporates concepts and specific amendments proposed in comments submitted by LCRA (10/08/09), The Wind Coalition (10/21/09), ERCOT (10/29/09), and Invenenergy (11/02).

NextEra's new compromise proposal below does not insert the PRR 835 approach, which was not endorsed by the ROS and which was rejected by the PRS on Oct. 22. Although NextEra still believes ERCOT's proposed Reactive Power capability standard as set forth in PRR 830 is potentially inefficient and wasteful, NextEra nonetheless respects the opinion of the ROS and the PRS regarding the minimum standards for the ERCOT System going forward. NextEra's proposal, therefore, utilizes the "rectangle" requirement for all technologies as proposed by ERCOT.

### **Summary of NextEra's proposal**

1. Prospectively, the compromise proposal applies the exact Reactive Power capability requirement proposed by ERCOT, endorsed by the ROS, and recommended by the PRS.
2. It provides a means to accomplish ERCOT's Reactive Power capability modeling needs without the unintended consequences of ERCOT's proposed change to the definition of Wind-powered Generation Resource (WGR) in Sec. 2, which

would apply throughout the Protocols for many purposes other than that intended by ERCOT.

3. It sets aside the legacy issues applicable to existing units for resolution following a PUCT decision in the related contested case (Docket No. 36482) and/or through Alternative Dispute Resolution (ADR) processes pursuant to Commission order or pursuant to existing Protocols regarding ADR.

### **Explanation of each of NextEra's proposed amendments**

1. Section 2.1: NextEra strikes ERCOT's proposed re-definition of Wind-powered Generation Resource (WGR) and inserts alternate language which comports with the way WGRs are interconnected to the ERCOT Transmission Grid. As discussed in more detail below, NextEra believes ERCOT's stated desire to more easily model the Reactive Power capability of Resources with multiple units can be achieved with amendments applicable only to Section 6.5.7.1(10) rather than inviting the unintended consequences of re-defining WGRs for all purposes throughout the Protocols.
2. Section 2.2: NextEra includes ERCOT's 10/29 correction to the acronym "GSU" and adopts The Wind Coalition's 10/21 proposed addition of the "WTG" acronym, which is used in the proposed amendment to Section 6.5.7.1(10) to address the Resource Reactive Power capability modeling concerns.
3. Section 6.5.7.1(1): NextEra incorporates ERCOT's 10/29 correction to "10 percent." NextEra also adds clarifying language that the requirement that WGRs disconnect from the grid when unable to support voltage at the POI is a "temporary" disconnection at ERCOT's instruction to address a Real Time condition and that the WGR is allowed to re-connect at ERCOT's instruction. NextEra further incorporates the concept advocated by the 10/08 LCRA comments that execution of ERCOT's instruction to disconnect from the ERCOT System to address a Real Time voltage event precludes a finding that the WGR violated Section 6.5.7.
4. Section 6.5.7.1(2): NextEra incorporates ERCOT's 10/29 correction striking "November" and inserting "December" to reflect the revised expected effective date of PRR 830. NextEra also strikes "February 17, 2004" and inserts "July 1, 2010" for the reasons identified below.
  - a) Paragraph (2) specifically requires WGRs to meet the "rectangle" standard for Reactive Power capability. As drafted by ERCOT, this paragraph creates several problems. Despite ERCOT's claims to be only a clarification of existing language and a prospective application of the clarified standard, ERCOT's proposed paragraph (2) clearly requires retrofitting existing units with new equipment. The interpretation of the existing Protocol language and whether it historically required a

“rectangle” is before the Public Utility Commission of Texas and is the subject of ADR processes that are ongoing. Therefore, these forums should be allowed to continue to address the issue rather than muddying the process with a Protocol revision that may be reversed by existing proceedings. NextEra’s proposal does not eliminate the possibility that retrofitting existing units could be required in the future. However, it does reserve this issue for the appropriate jurisdictional entity, the PUCT. The prudent course of action is to address prospective standards and implement the terms of the PUCT final order on the legacy issues, whatever the PUCT determines, once a final order is issued.

- b) Paragraph (2) as drafted by ERCOT also fails to meet the ERCOT Board’s policy direction set with the adoption of Operating Guide Revision Request 208, Voltage Ride Through Requirement. In that decision, the Board made a sound policy decision that retroactive application of technical standards can be applied only when a body of evidence indicates such application is required to maintain system reliability. While ERCOT and the ROS have presented sufficient argumentation to support the refinement of the Reactive Power capability standard on a prospective basis, the lack of evidence demonstrating historical deficiencies and the lack of any study at all which would support spending tens of millions of dollars for unit retrofits is seriously troubling and invites scrutiny by policymakers.
  - c) NextEra’s amendment to paragraph (2) keeps ERCOT’s proposed effective date (as revised by its 10/29 comments) for signed Interconnection Agreements but proposes July 1, 2010 as the effective date for new units. The date is drawn from the historical record in which the ERCOT Board last approved substantive changes to this section of the Protocols. With the approval of PRR 473, Reactive Standards, the Board provided 15 months for new units to comply with the revised standard in order to not force immediate retrofit for units which had already been designed and for which equipment had already been procured. NextEra proposes less than half that amount of time – 7 months from the effective date of PRR 830.
  - d) Finally, NextEra strikes the ERCOT-proposed sentence establishing a Dec. 2010 deadline for retrofit for the same reasons outlined above. NextEra is unaware of a single PRR in the history of ERCOT which imposed tens of millions of dollars of equipment costs on any Market Participant or group of Market Participants without demonstration that the benefit would clearly outweigh the cost. PRR 830 should not be the first PRR to broach this slippery slope.
5. Section 6.5.7.1(3): NextEra strikes “February 17, 2004” and replaces it with “December 1, 2009” which is the anticipated effective date of PRR 830. This

change is recommended for the reasons described above. Because paragraph (3) clearly references the revised standards set forth in paragraph (1), existing units should be held only to the existing Protocols requirement and their URLs submitted to ERCOT in accordance with the Operating Guides absent some compelling evidence to abandon previous policy on the retrofit issue. This change sets aside the legacy issues likely to delay implementation of PRR 830 and allows the PUCT to address the issues duly before it.

6. Section 6.5.7.1(4): NextEra proposes changing the two dates in accordance with the reasons set forth above.
7. Section 6.5.7.1(10) and (12): NextEra endorses the 10/21 comments of The Wind Coalition which provides ERCOT with the Real Time Reactive Power capability modeling information requested from WGRs but without the unintended consequences of changing the definition of WGR throughout the Protocols in Sec. 2. NextEra adopts The Wind Coalition's proposed language with minor modifications for clarity and to avoid redundancy. NextEra's revisions to paragraphs (10) and (12) are also consistent with ERCOT's 10/29 technical corrections.
8. Section 6.5.7.1(11): Delete the word "automatically".
9. Section 6.5.7.1(13): NextEra adopts Invenergy's 11/02 proposal in a new paragraph (13) to approximate the treatment of the Reactive Power obligation for other Resources which have multiple turbines located behind the POI.
10. Section 6.7.6(1)-(3): NextEra incorporates the technical corrections proposed in 10/29 ERCOT comments.
11. Section 6.7.6(5): NextEra rejects ERCOT's strikethrough of the existing paragraph(5), returning the blackline language of existing Protocols and offers an amendment to clarify this language only applies to existing units, as it does not comport with the new requirement established in ERCOT's proposed Section 6.5.7.1(1). The reinstated Sections are highlighted in yellow.
12. Section 6.7.6(6): NextEra rennumbers due to reinsertion of deleted paragraph (5).

### **Response to ERCOT Comments of October 29 and request for new CEO Review and Impact Analysis**

NextEra appreciates ERCOT's attempt to address the concerns of wind generators regarding the proposed change to the definition of WGR in its 10/29 comments. However, NextEra notes that while ERCOT addressed the uses of "WGR" in the Protocols, ERCOT did not address the more complex issue that WGRs are simply referred to as "Resources" and "generation units" throughout the Protocols and Guides when there is not a specific need to separately address WGRs and they are treated like

all other Resources. It is precisely in this area where NextEra believes the unintended consequences of ERCOT's proposal will reveal themselves. The rapid timeline on which PRR 830 has advanced through the process has not afforded NextEra the opportunity to evaluate the hundreds of such references throughout ERCOT's controlling documents and so requests stakeholders re-evaluate the wisdom the WGR definition change and adopt NextEra's proposed methodology below to deliver the same results in a Section-specific way.

Additionally, NextEra points to ERCOT's 10/29 comments which state on page 2, "The proposed definition change may require some wind owners to form multiple WGRs instead of allowing only one depending on their equipment." NextEra agrees with this comment but questions whether the CEO Review and Impact Analysis consider the resource impacts of handling new RARF submissions in both zonal and nodal, whether new sub-QSEs would also need to be created, tested, and certified, or any other impacts on ERCOT Staff to process the changes associated with implementation of this change.

Finally, NextEra notes that the unnecessary WGR definition change would effectively preclude many activities which would benefit the ERCOT System and Texas consumers. NextEra often uses wind turbines in Texas as test models for various hardware and software enhancements to provide better unit control, power uprating, ramp rate control, etc. If each new technological application requires forming a new WGR and submitting RARF data, etc., then such activity becomes overly burdensome and may not be undertaken. A more beneficial approach would be to ensure that the section of the Protocols addressing Reactive Power requirements clearly places the burden on the generator to telemeter the Reactive Power capability to ERCOT, as proposed by NextEra, rather than forcing some definition on units which does not reflect the realities of their configuration in the field.

## **Conclusion**

NextEra's proposal below delivers the full range of Reactive Power capability for all generation units sought by ERCOT and endorsed by ROS in a manner consistent with the application of ERCOT Protocols from the beginning of this market in 2001. NextEra strongly encourages TAC to weigh the policy and market implications of deviating from the market rules philosophy which has served Texas consumers well by continually encouraging major investment in new, more efficient, cleaner generation Resources across a variety of technology types for the past several years. NextEra does not believe the proposed language below in any way precludes addressing the legacy issues now under dispute at the PUCT. However, NextEra predicts serious harm to individual Market Participants, an entire segment of the electric power industry, overall faith in the stability of the ERCOT market rules, and efforts to fulfill state policy on renewable resources should PRR 830 be adopted in its current form.

## 2.1 Definitions

### Point of Interconnection (POI)

The location(s) where a Generation Entity's interconnection Facilities connects to the Transmission Facilities as reflected in the Standard Generation Interconnection Agreement (SGIA) between a Generation Entity and a Transmission and/or Distribution Service Provider (TDSP).

### **Wind-powered Generation Resource (WGR)**

A Generation Resource that is powered by wind, which may consist of an aggregation of wind turbines connected to the ERCOT Transmission Grid through one Point of Interconnection (POI). ~~Wind turbines may be aggregated together to form a WGR if each turbine is the same model and size and located behind the same Generation Step Up Transformer (GSU).~~

## 2.2 Acronyms

POI	<u>Point of Interconnection</u>
GSU	<del>Generation</del> Generator Step Up Transformer
SGIA	<u>Standard Generation Interconnection Agreement</u>
WTG	<u>Wind-powered Turbine Generator</u>

### 6.5.7 *Voltage Support Service*

All Generation Resources (including self-serve generating units) that have a gross generating unit rating greater than twenty (20) MVA or those units connected ~~to~~ at the same ~~transmission bus~~ Point of Interconnection (POI) that have gross generating unit ratings aggregating to greater than twenty (20) MVA, that supply power to the ERCOT Transmission Grid, shall provide Voltage Support Service (VSS).

#### 6.5.7.1 Installed Reactive Power Capability Requirement for Generation Resources Required to Provide VSS ~~Installed Reactive Capability~~

- (1) Generation Resources required to provide VSS must be capable of producing a defined quantity of Reactive Power ~~at rated capability (MW)~~ to maintain a Voltage Profile established by ERCOT. ~~This quantity of Reactive Power is the Unit Reactive Limit (URL).~~
- ~~(2) —~~ Generation Resources ~~required to provide VSS except as noted below in items (3) or (4);~~ shall ~~have and maintain a URL which~~ comply with the following Reactive Power requirements: ~~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 ERCOT ~~t~~Transmission gGrid and at the transmission

system Voltage Profile established by ERCOT, and both measured at the ~~point-of interconnection~~POI to the TDSP. The Reactive Power requirements shall be available at all MW output levels and may be met through a combination of the Generation Resource's Unit Reactive Limit (URL), which is the generating unit's dynamic leading and lagging operating capability, and/or dynamic VAR capable devices. For Wind-powered Generation Resources (WGRs), the Reactive Power requirements shall be available at all MW output levels at or above 10 percent (10%) of the WGR's nameplate capacity. When a WGR is operating below 10% of its nameplate capacity and is unable to support voltage at the POI, ERCOT may require a WGR to temporarily disconnect from the ERCOT System. WGRs which comply with instructions to temporarily disconnect from the ERCOT System in accordance with this Section will not be found in violation of Section 6.5.7 Voltage Support Service. The Reactive Power requirements of this paragraph shall apply to all Generation Resources except as otherwise provided in paragraphs (2) through (4) below.

- (2) WGRs that commenced operation on or after ~~February 17, 2004~~July 1, 2010, and have a signed Standard Generation Interconnection Agreement (SGIA) on or before ~~November~~December 1, 2009, must be capable of producing a defined quantity of Reactive Power to maintain a Voltage Profile established by ERCOT in accordance with the Reactive Power requirements established in paragraph (1) above. However, the Reactive Power requirements may be met through a combination of the WGR's URL and/or automatically switchable static VAR capable devices and/or dynamic VAR capable devices.~~WGRs shall comply with the Reactive Power requirements of this paragraph by no later than December 31, 2010, unless it is known by July 31, 2010, that related retrofits are required by the Voltage Ride Through study conducted in accordance with Operation Guide Section 3.1.4.6.1, Protective Relaying Requirement and Voltage Ride Through Requirement for Wind-powered Generation Resources, in which event ERCOT may in its discretion modify the deadline for an affected WGR. ERCOT, in its sole discretion, also may grant an extension of time for other reasons.~~
- (3) Qualified renewable Generation Resources (as described in Section 14, State of Texas Renewable Energy Credit Trading Program) in operation before ~~February 17, 2004~~December 1, 2009, 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~~Reactive Power requirements established in paragraph (1) above, will be required to maintain a ~~URL~~Reactive Power requirement as defined by the qualified renewable Generation Resource's URL that ~~was submitted to ERCOT and established per the~~ 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.
- (4) New generating units connected before ~~May 17, 2005~~July 1, 2010, whose owners demonstrate to ERCOT's satisfaction that design and/or equipment procurement decisions were made prior to ~~February 17, 2004~~December 1, 2009, based upon previous standards, whose design does not allow them to meet the ~~URL as stated above~~Reactive Power requirements established in paragraph (1) above, will be required to maintain a ~~URL~~Reactive Power requirement as defined by the Generation Resource's URL that was



~~submitted to ERCOT and established per the~~ 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 described in the Operating Guides.

- (5) ~~Upon request to, and with the approval of ERCOT, multiple generating units connected to the same transmission bus may be treated as a single generating unit for the purposes of these URL requirements only.~~ For purposes of meeting the Reactive Power requirements in paragraphs (1) and (2) above, multiple generation units including wind turbines shall, at a Generation Entity's option, be treated as a single Generation Resource or WGR if the units are connected to the same transmission bus.
- (6) ~~Upon submission by a Generation Resource Entities required to provide VSS may submit to ERCOT of a specific proposals for requirements to substitute for these URL meet the Reactive Power requirements established in paragraph (1) above by employing a combination of the URL and added VAR capability, provided that the added VAR capability shall be automatically switchable static and/or dynamic VAR devices. ERCOT shall may, at its sole discretion, either approve or deny a specific proposal, provided that in either case, ERCOT shall such alternative requirements or provide the submitter an explanation of its objections to the proposal decision. Alternative requirements may include supplying additional static and/or dynamic Reactive Power capability as necessary to meet the area's Reactive Power requirements.~~
- (7) ~~An induction generator may elect to make a contribution in aid of construction in lieu of meeting the installed capacity VSS requirements contained herein. In order to comply with the VSS requirements under this paragraph (7), the generator must make payment to the interconnecting TDSP under its generation Interconnection Agreement in a manner similar to that used to collect payments for the direct assignment of interconnection Facilities under applicable Public Utility Commission of Texas (PUCT) rules. The level of payment shall reflect the cost to the TDSP of procuring, installing, operating, and maintaining any Reactive Power equipment required to replace the Reactive Power capability that otherwise would be necessary for the interconnection of the generator. In order for this paragraph (7) to be effective for VSS compliance, the TDSP shall certify to ERCOT that the induction generator has complied with these requirements. A Generation Resource and Transmission and/or Distribution Service Provider (TDSP) may enter into an agreement in which the Generation Resource compensates the TDSP to provide VSS to meet the Reactive Power requirements of paragraph (1) above in part or in whole. The TDSP shall certify to ERCOT that the agreement complies with the Reactive Power requirements of paragraph (1) above.~~
- (8) ~~For Generation Resources required to provide VSS Unless specifically approved by ERCOT, no unit equipment replacement or modification at a Generation Resource shall reduce the capability of the unit below the Reactive Power requirements to be met by that unit applied prior to the replacement/modification, unless specifically approved by ERCOT.~~

- (9) Generation Resources ~~required to provide VSS~~ shall not reduce high reactive loading on individual units during abnormal conditions without the consent of ERCOT (conveyed by way of their QSE) unless equipment damage is imminent.
- (10) ~~WGRs must provide a Real Time SCADA point that communicates to ERCOT the number of wind turbines that are available for real power and/or Reactive Power injection into the ERCOT Transmission Grid.~~ Wind-powered Turbine Generators (WTGs) of the same model and size located behind the same Generator Step Up Transformer (GSU) must be aggregated to form a WTG aggregation. Effective June 1, 2010, ~~WGRs must also provide two other~~ the following Real Time Supervisory Control and Data Acquisition (SCADA) points ~~that communicate~~ must be communicated to ERCOT ~~the following~~ for each WTG aggregation by the WGR's QSE, selected for this purpose:
- (a) The number of ~~wind turbine~~ WTGs that are not able to communicate and whose status is unknown; and
  - (b) The number of ~~wind turbine~~ WTGs out of service and not available for operation; and
  - (c) The number of WTGs that are available for real power and/or Reactive Power injection into the ERCOT Transmission Grid. ~~WGRs must comply with these requirements by no later than six months after the effective date of this paragraph.~~
- (11) For the purpose of complying with the Reactive Power requirements under this Section, Reactive Power losses that occur on privately-owned transmission lines behind the POI may be compensated by ~~automatically~~ switchable static VAR capable devices.
- (12) ERCOT and the TSPs shall, at a minimum, represent WGRs in the ERCOT and TSP Real Time control systems and their off-line studies to include: GSUs, substation reactive devices, and the equivalent of the WTG aggregation connected to each GSU.
- (13) The reactive power requirements for a WGR under this Section shall be reduced proportionally to the nameplate capacity of the WGR's WTGs that are out of service and not available for operation. Any WTG not able to produce more than 10% of its nameplate capacity shall be considered to be out of service and not available for operation for the purpose of the Reactive Power requirements under this Section.

#### **6.7.6 Deployment of Voltage Support Service**

- (1) ERCOT, or Transmission and/or Distribution Service Providers (TDSPs) designated by ERCOT, will instruct Generation Resources required to provide Voltage Support Service (VSS) to make adjustments for voltage support within the Unit Reactive Limit (URL) capacity limits provided by the QSE to ERCOT. Generation Resources providing VSS will not be requested to reduce megawatt output so as to provide additional Mmegavolt - Aamperes Reactive (MVAR), nor will they be requested to operate on a voltage schedule outside the ~~Unit Reactive Limits (URL)~~ specified by the QSE without a Dispatch Instruction requesting unit-specific Dispatch or an OOME instruction.

- (2) ERCOT and ~~Transmission and/or Distribution Service Providers (TDSPs)~~ shall develop operating procedures specifying Voltage Profiles of transmission controlled reactive Resources to minimize the dependence on generation-supplied reactive Resources. For Generation Resources required to provide VSS, ~~step-up transformer~~GSU tap settings will be managed to maximize the use of the ERCOT System for all Market Participants while maintaining adequate reliability.
- (3) The TDSP, under ERCOT direction, is responsible for monitoring and ensuring that all Generation Resources required to provide VSS dynamic reactive sources in a local area are deployed in approximate proportion to their respective installed ~~Reactive~~Power capability requirements.
- (4) All Generation Resources required to provide VSS shall ~~maintain~~support the transmission voltage at the ~~point of interconnection~~POI to the ERCOT ~~Transmission~~gGrid, or at the transmission bus in accordance with paragraph (5) of Section 6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability, as directed by ERCOT within the operating Reactive Power capability of the unit(s).
- (5) At all times a Generation Resource unit which commenced operation before July 31, 2010, has a signed SGIA before December 1, 2009, and which is 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.
- (6) The QSEs providing ~~Voltage Support Service~~SSe shall meet the deployment performance requirements specified in Section 6.10.4, Ancillary Service Deployment Performance Measures.

## **Attachment B**

**PRR 835**

PRR Number	835	PRR Title	Reactive Capability Requirement
Date Posted	September 30, 2009		

Protocol Section(s) Requiring Revision (Include Section No. and Title)	<p>2.1, Definitions</p> <p>2.2, Acronyms</p> <p>6.5.7, Voltage Support Service</p> <p>6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability</p> <p>6.5.7.4, Wind-powered Generation Resources Required to Provide VSS Installed Reactive Capability (new)</p> <p>6.7.6, Deployment of Voltage Support Service</p>
Requested Resolution (Normal or Urgent, and justification for Urgent status)	<p><u>Urgent.</u> Due to conflicting interpretations of Protocol Sections 6.5.7.1, Generation Resources Required to Provide VSS Installed Reactive Capability and 6.7.6, Deployment of Voltage Support Service, ambiguity exists as to what the requirements are for existing and future Wind-powered Generation Resources (WGRs) in providing Reactive Power and Voltage Support Service (VSS). This Protocol Revision Request (PRR) clarifies the Reactive Power and VSS requirements for WGRs, and provides a means for maintaining and ensuring reliability without unnecessarily burdening existing and future WGRs with the cost of installing supplemental reactive capability in locations where it will have little or no value.</p> <p>This PRR requires existing WGRs interconnected after May 17, 2005 to provide +/- .95 power factor at the Point of Interconnection (POI) over the full output range of the Resource which is consistent with the interpretation and criteria applied by the Transmission Service Providers (TSPs) at the time these Resources were interconnected.</p> <p>This PRR differentiates Reactive Power and VSS requirements for WGRs from other non-wind types of Resources primarily because of the unique characteristics of the ERCOT Transmission Grid where the majority of the wind Resources currently are, and will be, interconnected. The Western zone of ERCOT has very little Load as compared to the magnitude of installed and planned WGRs and therefore has very different Reactive Power requirements from other regions of ERCOT. The imposition of a “one size for all” approach, as proposed in PRR830, Reactive Power Capability Requirement, to all generating Resources for ensuring reliability is not economically efficient in that it will necessitate the installation of reactive Resources at locations where, as a practical matter, grid reliability benefits will not be realized or ensured.</p> <p>This PRR also provides for the imposition of additional Reactive</p>

	Power capability to support VSS by WGRs if the TSP shows, through the System Impact Study, that such capability is required to ensure grid safety or reliability.
Revision Description	This PRR clarifies the Reactive Power capability requirement for WGRs by specifying +/- 0.95 power factor criteria as the minimum requirement, and the Generation Resources Unit Reactive Limit (URL) criteria as the maximum requirement contingent upon a System Impact Study by the TSP.
Reason for Revision	Clarification of requirements for Resources.
Overall Market Benefit	This PRR provides additional clarity to the reactive requirements for wind generation to ensure grid safety and reliability while avoiding the cost of additional equipment where it is not justified.
Overall Market Impact	None.
Consumer Impact	This PRR may cause the cost of energy generation to increase for WGRs, however, it provides a responsible, economically efficient and technically justified option for consumers should Market Participants find that WGRs should provide additional Reactive Power.
Credit Implications (Yes or No, and summary of impact)	Unknown.
Relevance to Nodal Market (Yes or No, and summary of impact)	Yes.
Nodal Protocol Section(s) Requiring Revision (Include Section No. and Title, and submit NPRR if applicable)	To be determined based upon final resolution of this issue in the Zonal Protocols.

Quantitative Impacts and Benefits			
Assumptions	1	<i>Additional 10,000 MW of wind generation in Competitive Renewable Energy Zones (CREZs) and unknown amount of existing affected wind Resources under the proposed PRR830.</i>	
	2	<i>Avoidance of unnecessary cost impacts to existing wind generators assumed to be \$10k/MW installed.</i>	
	3	<i>Avoids installation of additional reactive capability not justified for reliability.</i>	
	4		
Market Cost		Impact Area	Monetary Impact
	1	WGRs.	Potentially \$100M.
	2		
	3		
	4		
Market Benefit		Impact Area	Monetary Impact

	1	System reliability	Potentially none
	2		
	3		
	4		
Additional Qualitative Information	1	Avoidance of the imposition of additional reactive requirements under the presumption of reliability without technical justification is economically inefficient.	
	2		
	3		
	4		
Other Comments	1		
	2		
	3		
	4		

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Proposed Protocol Language Revision
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## 2.1 Definitions

### Point of Interconnection (POI)

The location(s) where a Generation Entity's interconnection Facilities connect to the Facilities of the Transmission and/or Distribution Service Provider (TDSP) as specified in the Standard Generation Interconnection Agreement (SGIA) between a Generation Entity and the TDSP.

## **Wind-powered Generation Resource (WGR)**

A Generation Resource that is powered by wind, which may consist of an aggregation of wind turbines connected to the ERCOT Transmission Grid through one Point of Interconnection (POI).

### **P<sub>max</sub>**

A wind power generation facility's revised maximum output submitted in Real Time via SCADA based on the number of wind turbine generators that are out of service.

## **2.2 Acronyms**

POI Point of Interconnection

SGIA Standard Generation Interconnection Agreement

### **6.5.7 Voltage Support Service**

All Generation Resources (including self-serve generating units) that have a gross generating unit rating greater than twenty (20) MVA or those units connected ~~to~~at the same ~~transmission bus~~Point of Interconnection (POI) that have gross generating unit ratings aggregating to greater than twenty (20) MVA, that supply power to the ERCOT Transmission Grid, shall provide Voltage Support Service (VSS).

#### **6.5.7.1 Generation Resources, Other Than Wind-powered Generation Resources, Required to Provide VSS Installed Reactive Capability**

- (1) Generation Resources required to provide VSS must be capable of producing a defined quantity of Reactive Power at rated capability (MW) to maintain a Voltage Profile established by ERCOT. This quantity of Reactive Power is the Unit Reactive Limit (URL).
- (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~~ERCOT Transmission Grid and at the transmission system Voltage Profile established by ERCOT, and both measured at the ~~point of interconnection~~POI to the TDSP.
- ~~(3) Qualified renewable Generation Resources (as described in Section 14, State of Texas 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~~

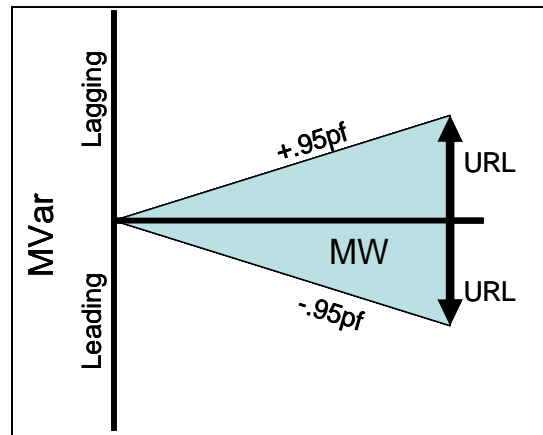


~~quantity of Reactive Power that the Generation Resource can produce at its rated capability (MW) as determined using procedures and criteria as described in the Operating Guides.~~

- ~~(4) — New generating units connected before May 17, 2005, whose owners demonstrate to ERCOT's satisfaction that design and/or equipment procurement decisions were made prior to February 17, 2004, based upon previous standards, whose 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 described in the Operating Guides.~~
- (53) Upon request to, and with the approval of ERCOT, multiple generating units connected to the same transmission bus may be treated as a single generating unit for the purposes of these URL requirements only.
- (64) Upon submission by a Generation Resource required to provide VSS to ERCOT of a specific proposal for requirements to substitute for these URL requirements, ERCOT shall either approve such alternative requirements or provide the submitter an explanation of its objections to the proposal. Alternative requirements may include supplying additional static and/or dynamic Reactive Power capability as necessary to meet the area's Reactive Power requirements.
- ~~(7) — An induction generator may elect to make a contribution in aid of construction in lieu of meeting the installed capacity VSS requirements contained herein. In order to comply with the VSS requirements under this paragraph (7), the generator must make payment to the interconnecting TDSP under its generation Interconnection Agreement in a manner similar to that used to collect payments for the direct assignment of interconnection Facilities under applicable Public Utility Commission of Texas (PUCT) rules. The level of payment shall reflect the cost to the TDSP of procuring, installing, operating, and maintaining any Reactive Power equipment required to replace the Reactive Power capability that otherwise would be necessary for the interconnection of the generator. In order for this paragraph (7) to be effective for VSS compliance, the TDSP shall certify to ERCOT that the induction generator has complied with these requirements.~~
- (85) For Generation Resources required to provide VSS, no unit equipment replacement or modification shall reduce the capability of the unit below the requirements to be met by that unit prior to the replacement/modification, unless specifically approved by ERCOT.
- (96) Generation Resources required to provide VSS shall not reduce high reactive loading on individual units during abnormal conditions without the consent of ERCOT (conveyed by way of their QSE) unless equipment damage is imminent.

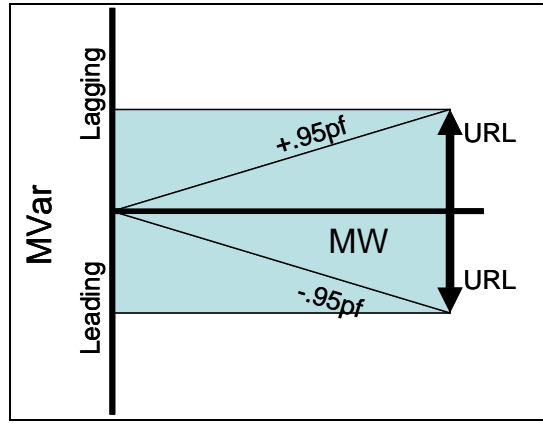
#### **6.5.7.4 Wind-powered Generation Resources Required to Provide VSS Installed Reactive Capability**

- (1) WGRs are required to provide VSS and must be capable of operating at a power factor of +/- .95 or less over the full (MW) net power output range of the Resource, supplied to the ERCOT Transmission Grid, and measured at the POI to the TDSP in order to maintain a Voltage Profile established by ERCOT. This requirement is graphically depicted in Figure 1. The quantity of Reactive Power measured at the full rated capability of the Resource is the URL.



**Figure 1. +/- .95 Power Factor Criteria**

- (2) WGRs may be required to provide VSS beyond what is required in paragraph (1) above only if the TSP or ERCOT shows, through a System Impact Study, that such capability is required to ensure grid safety or reliability. The amount of additional reactive capability required to be provided by the Resource shall not exceed the URL specified in paragraph (1) above and be available at all MW output levels over the full output range of the Resource. This requirement is graphically depicted in Figure 2. This additional reactive capability may be provided through any combination of automatically switchable static reactive devices (i.e. switched shunts) and/or dynamic reactive devices (i.e. SVC, Statcom, etc.) so long as the requirement to ensure safety and reliability is met.



**Figure 2. Fixed URL Criteria (based on +/- .95 Power Factor)**

- (3) Demonstration and measurement of reactive capability will be based on system Voltage Profile criteria specified by ERCOT. This Voltage Profile criteria will consist of a low system voltage  $V_{sys-l}$ , where the wind Resource will be operating in a lagging power mode to produce the required amount of Reactive Power to support system voltage, and  $V_{sys-h}$ , where the wind Resource will be operating in a leading mode to absorb the required amount of Reactive Power to suppress system voltage. The scheduled system voltage under normal conditions should fall somewhere in between  $V_{sys-l}$  and  $V_{sys-h}$ .
- (4) WGRs capable of remaining On-line at low output levels considered outside of their net power output range where VSS can not be provided at the POI shall be capable of operating such that they appear “VAR Neutral” at the POI. The amount of allowable deviation from unity (1.0) power factor will be specified by the TDSP. WGRs that cannot meet the “VAR neutrality” requirement may be required to disconnect from the ERCOT System.
- (5) Qualified renewable WGRs (as described in Section 14, State of Texas 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.
- (6) WGRs connected before May 17, 2005, whose owners demonstrate to ERCOT’s satisfaction that design and/or equipment procurement decisions were made prior to February 17, 2004, based upon previous standards, whose 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 described in the Operating Guides.

- (7) WGRs connected after May 17, 2005 are required to provide VSS as described in paragraph (1) above.
- (8) Upon request to, and with the approval of ERCOT, multiple wind generating units connected to the same transmission bus may be treated as a single generating unit for the purposes of these URL requirements only.
- (9) Upon submission by a WGR required to provide VSS to ERCOT of a specific proposal for requirements to substitute for these URL requirements, ERCOT shall either approve such alternative requirements or provide the submitter an explanation of its objections to the proposal. Alternative requirements may include supplying additional static and/or dynamic Reactive Power capability as necessary to meet the area's Reactive Power requirements.
- (10) A wind induction generator may elect to make a contribution in aid of construction in lieu of meeting the installed capacity VSS requirements contained herein. In order to comply with the VSS requirements under paragraph (7) above, the generator must make payment to the interconnecting TDSP under its generation Interconnection Agreement in a manner similar to that used to collect payments for the direct assignment of interconnection Facilities under applicable Public Utility Commission of Texas (PUCT) rules. The level of payment shall reflect the cost to the TDSP of procuring, installing, operating, and maintaining any Reactive Power equipment required to replace the Reactive Power capability that otherwise would be necessary for the interconnection of the generator. In order for paragraph (7) above to be effective for VSS compliance, the TDSP shall certify to ERCOT that the induction generator has complied with these requirements.
- (11) For WGRs required to provide VSS, no unit equipment replacement or modification shall reduce the capability of the unit below the requirements to be met by that unit prior to the replacement/modification, unless specifically approved by ERCOT.
- (12) WGRs required to provide VSS shall not reduce high reactive loading on individual units during abnormal conditions without the consent of ERCOT (conveyed by way of their QSE) unless equipment damage is imminent.
- (13) WGRs must provide Real Time Supervisory Control And Data Acquisition (SCADA) points that communicate to ERCOT the Facility's available  $P_{max}$  and revised URL values reflecting the amount of installed turbine capacity that is out of service.

#### **6.7.6      *Deployment of Voltage Support Service***

- (1) ERCOT, or Transmission Service Providers (TSPs) designated by ERCOT, will instruct Generation Resources required to provide Voltage Support Service (VSS) to make adjustments for voltage support within the Unit Reactive Limit (URL) capacity limits provided by the QSE to ERCOT. Generation Resources providing VSS will not be requested to reduce megawatt output so as to provide additional ~~megavolt~~Megavolt amperes-Ampere reactive Reactive (MVAR), nor will they be requested to operate on a

voltage schedule outside the ~~Unit Reactive Limits (URL)~~ specified by the QSE without a Dispatch Instruction requesting unit-specific Dispatch or an OOME instruction.

- (2) ERCOT and [Transmission and/or Distribution Service Providers \(TDSPs\)](#) shall develop operating procedures specifying Voltage Profiles of transmission controlled reactive Resources to minimize the dependence on generation-supplied reactive Resources. For Generation Resources required to provide VSS, step-up transformer tap settings will be managed to maximize the use of the ERCOT System for all Market Participants while maintaining adequate reliability.
- (3) The TSP, under ERCOT direction, is responsible for monitoring and ensuring that all Generation Resources required to provide VSS dynamic reactive sources in a local area are deployed in approximate proportion to their respective installed reactive capability requirements.
- (4) All Generation Resources required to provide VSS shall ~~maintain~~ [support](#) the transmission voltage at the ~~point~~ [Point](#) of ~~interconnection~~ [Interconnection \(POI\)](#) to the [ERCOT transmission grid](#) ~~Grid~~ as directed by ERCOT within the operating Reactive Power capability of the unit(s).
- ~~(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.~~
- (~~6~~[5](#)) The QSEs providing ~~Voltage Support Service~~ [VSS](#) shall meet the deployment performance requirements specified in Section 6.10.4, Ancillary Service Deployment Performance Measures.

## **Attachment C**

### **PRR 835 presentation to ROS**



# **PRR835 – Reactive Power Capability Requirement**

**Peter Wybierala**

**Regional Director of Transmission & Interconnects**

**Presentation to the ERCOT Reliability and Operations Subcommittee (ROS)**

**October 15, 2009**

# The current ERCOT Protocol on reactive power capability requirements is obsolete

## Ancillary Services Section 6.5.7 needs to be revised

- **All generators are not the same**
  - Synchronous generators have their own inherent reactive power characteristics
  - The reactive capability of wind generators is evolving
    - Early machines were Type 1 and 2 induction generators with no reactive capability
    - Type 3 machines consist of a Doubly Fed Induction Generator (DFIG)
    - Type 4 machines employ a full bridge converter design coupled to either an induction or synchronous machine
- **Other technologies such as solar and energy storage will have their own unique characteristics**
- **The imposition of a “one size fits all” approach to reactive power capability requirements will result in economic inefficiency and create barriers to entry for the adoption of new technologies**



# Not only is the current ERCOT Protocol obsolete...it's also ambiguous

## Ancillary Services Section 6.5.7 needs to be revised

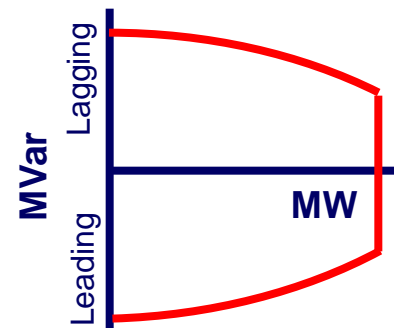
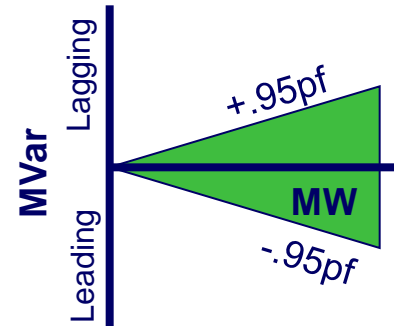
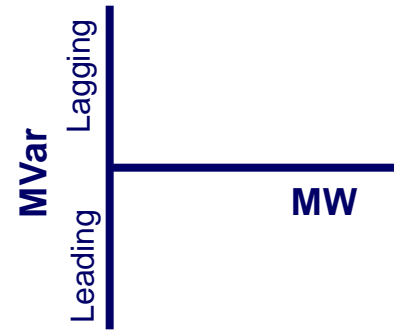
- **Protocol 6.5.7.1 (2) states that...**

*“Generation Resources required to provide VSS....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.”*

- **Does “shall have and maintain” mean going forward in time or does it mean over the output range of the unit?**
- **PRR830, if adopted, would require a wind generator interconnected after February 17, 2004 to maintain a URL over the output range of the unit.**

# Wind turbine generator technology continues to evolve

- Type 1 and 2 induction generators – no inherent reactive production capability
- Type 3 doubly fed induction generators - +/- 0.95 pf (typical of GE 1.5 MW machines)
- Type 4 machines – reactive capability comparable to synchronous generators (typical of Siemens 2.3 MW machines and comparable to conventional synchronous units)

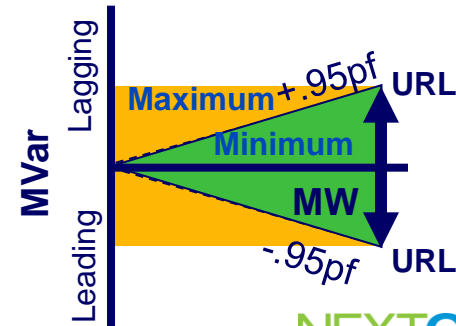
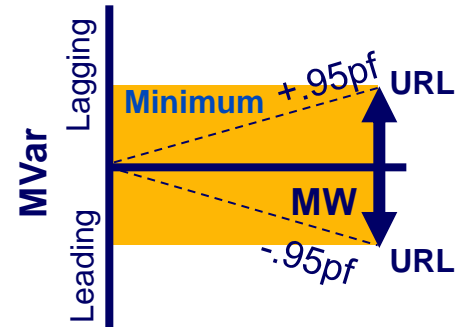
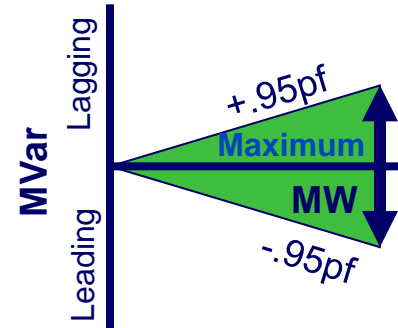


## PRR835 does several things...

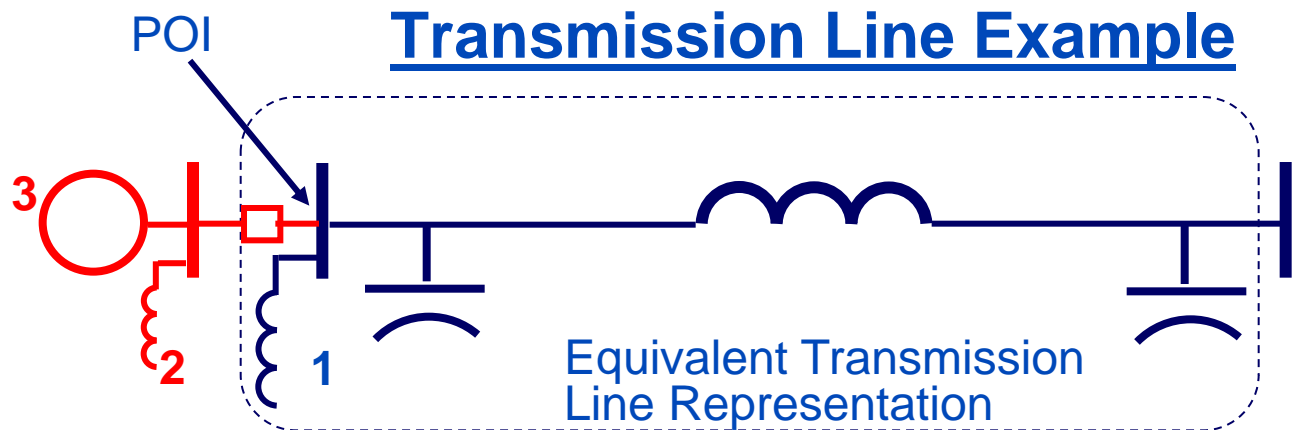
- It carves out a separate section for the reactive power requirements of Wind Generating Resources and requires a +/- 0.95 power factor range as the minimum requirement
- It provides for the imposition of additional reactive requirements consistent with PRR830 where it can be demonstrated through a system impact study that such capability is required to ensure safety and reliability
- PRR835 avoids requiring generators already interconnected to make costly investment in additional reactive capability where it is not justified
- PRR 835 exceeds FERC Order 661-A requirements

# Comparison of PRR835 to PRR830 and FERC Order 661-A

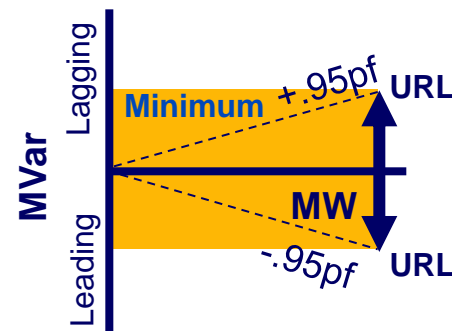
- FERC Order 661-A
  - Adopts +/- 0.95PF range as the maximum requirement
  - Requires wind plants to maintain the required power factor range only if the Transmission Provider shows, through the System Impact Study, that such capability is required of the plant to ensure safety and reliability
- PRR830
  - Adopts the URL measured at +/-0.95 PF and maximum net MW output
  - Requires URL over the full operating range of the plant
- PRR835
  - Adopts +/-0.95PF as the minimum reactive capability
  - May require URL over the full operating range of the plant only if the Transmission Provider demonstrates it is needed to ensure safety and reliability through a System Impact Study



# PRR830 will result in redundant and excessive reactive capability where it is not needed



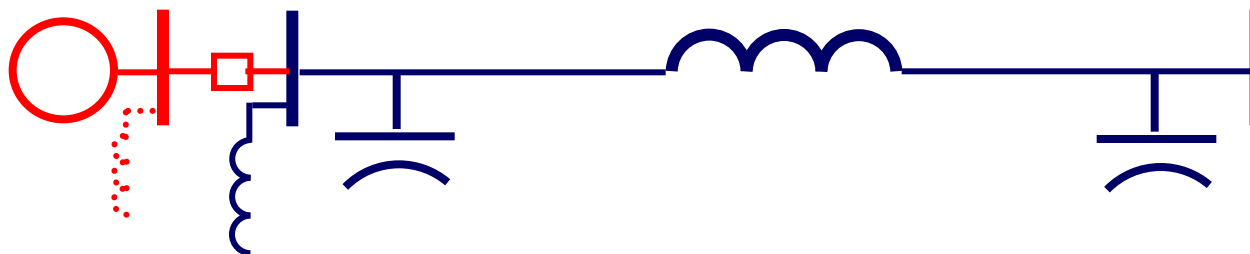
1. Transmission Owner must provide shunt reactors to offset line charging when wind is calm and generator is not generating
2. PRR830 would have the Generator install an additional shunt reactor to meet its URL requirement for leading reactive capability over its range of output
3. Inherent Generator reactive capability



**PRR830 will result in the wasteful installation of redundant reactive resources.**

**PRR835 ensures system safety and reliability without mandating investment in reactive capability for providing VSS where it is not needed**

## Transmission Line Example



**Generator shunt reactor (or capacitor) would not be required to meet its URL requirement for leading (or lagging) reactive capability over its range of output unless shown to be required by the System Impact Study**

# NextEra has engaged the services of Siemens-PTI to assess the current need for additional reactive resources in Western ERCOT

## Study Assumptions

- **Reference case from ERCOT**
  - 2010/2011 Winter off-Peak (09/17/2009 update)
  - 39,569 MW total generation; 3,719 MW wind generation (9.4%)
- **Wind farms represented per ERCOT's modeling**
  - Reactive power capability expressed by  $Q_{\min}$  and  $Q_{\max}$  as given in the reference case (rectangular reactive power capability)
  - Wind farms represented by equivalent (aggregated) models
- **Sensitivity cases**
  - Different reactive power capability (triangular capability)
  - Different levels of wind generation

**Scenarios based on ERCOT case, from no wind to high wind penetration.  
Limited reactive power capability in the wind farms (conservative).**

# Wind Farm Generation Re-Dispatch was performed to model the following sensitivity scenarios

## Sensitivity Scenarios

- **No-Wind scenarios**
  - Constant load (conventional generation increased by 3,719 MW)
  - Constant conventional generation (system load scaled down by 3,719 MW)
- **Increased wind generation scenarios**
  - Scenario 3 (5,849 MW of wind generation, 14.7% of total)
    - Maximum wind generation in the Gulf Coast and Horse Hollow gen-tie
    - West Texas wind generation increased by 1,040 MW
  - Scenario 4 (6,369 MW of wind generation, 16% of total)
    - Scenario 3 with an additional 520 MW of wind in West Texas
  - Scenario 5 (same as scenario 4 but with additional wind in west Texas dispatched against local generation)



# Preliminary results indicate that voltage violations are not the issue for the current Western ERCOT system

## Results

- **AC contingency analysis**
  - ERCOT contingency file (9,000+ cat. B and cat. C contingencies)
- **Few post-contingency voltage violations**
  - Generally unrelated to the wind generation dispatch
  - Also unrelated to reactive power capability at the wind farms
- **Thermal violations**
  - Existing system configuration → restrictions to dispatch of West Texas wind generation
  - Significant overloads already identified before reaching full power output of wind generation in West Texas

**Thermal overloads are the limiting factors. No condition has been identified that shows the need for additional reactive power capability from wind farms**

# Generator reactive capability requirements are driven by system topology and the imbalance between generation and load in Western ERCOT. This trend will become further exaggerated with CREZ implementation

- **Current ERCOT System**
  - West Zone load – approximately 4,000 MW
  - West Zone Generation – approximately 8,000 MW
- **ERCOT System post CREZ**
  - West Zone load – approximate 4,400 MW
  - West Zone Generation – 18,000 MW
- **WGR lagging reactive capability will need to increase with MW output to compensate for transmission line reactive losses.**
- **WGR leading reactive capability will have little value since shunt reactors will be required to offset transmission line charging anyway when the wind is calm.**

**CREZ doesn't make things worse but amplifies the consequences of adopting PRR830!**

# Highlights of PRR835

- Sets minimum requirement of  $\pm 0.95$  Power Factor at the Point of Interconnection
- May require additional reactive requirements when supported by a System Impact Study
- Addresses the “Cone” versus “Rectangle” debate
- Wind generator reactive requirements and VSS are distinguished from non-wind generators
- Requires wind generators to provide real-time reactive capability through SCADA
- Does not unnecessarily limit aggregation of wind turbine generators based on size and type as does PRR830
- Grandfathers WGRs interconnected after May 17, 2005 and before the adoption of PRR835 in meeting the  $\pm 0.95$  PF requirement

**What differentiates PRR835 from PRR830 is that it provides superior economies while ensuring system safety and reliability where justified and needed!**