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| NPRR Number | [780](http://www.ercot.com/mktrules/issues/NPRR780) | NPRR Title | Revise North 345kV Hub Definition  |
| Date Posted | May 31, 2016 |
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| Requested Resolution  | Normal  |
| Nodal Protocol Sections Requiring Revision  | 3.5.2.1, North 345 kV Hub (North 345) |
| Related Documents Requiring Revision/Related Revision Requests | None |
| Revision Description | This Nodal Protocol Revision Request (NPRR) revises the North 345kV Hub (North 345) definition to remove Hub Bus VLYRN from the ERCOT Network Operations Model and the Congestion Revenue Right (CRR) Network Model. |
| Reason for Revision |  Addresses current operational issues. Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/news/presentations/2013/ERCOT%20Strat%20Plan%20FINAL%20112213.pdf) or directed by the ERCOT Board). Market efficiencies or enhancements Administrative Regulatory requirements Other: (explain) The Transmission Service Provider (TSP) is planning to change the transmission topology that would permanently remove the Hub Bus VLYRN from the ERCOT Transmission Grid. *(please select all that apply)* |
| Business Case | This NPRR aligns ERCOT Protocols with planned changes to the transmission topology. |

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| Proposed Protocol Language Revision |

3.5.2.1 North 345 kV Hub (North 345)

(1) The North 345 kV Hub is composed of the following Hub Buses:

|  | ERCOT Operations |  |
| --- | --- | --- |
| No. | Hub Bus | kV | Hub |
| 1 | ANASW | 345 | NORTH |
| 2 | CN345 | 345 | NORTH |
| 3 | WLSH | 345 | NORTH |
| 4 | FMRVL | 345 | NORTH |
| 5 | LPCCS | 345 | NORTH |
| 6 | MNSES | 345 | NORTH |
| 7 | PRSSW | 345 | NORTH |
| 8 | SSPSW | 345 | NORTH |
| 9 | VLSES | 345 | NORTH |
| 10 | ALNSW | 345 | NORTH |
| 11 | ALLNC | 345 | NORTH |
| 12 | BNDVS | 345 | NORTH |
| 13 | BNBSW | 345 | NORTH |
| 14 | BBSES | 345 | NORTH |
| 15 | BOSQUESW | 345 | NORTH |
| 16 | CDHSW | 345 | NORTH |
| 17 | CNTRY | 345 | NORTH |
| 18 | CRLNW | 345 | NORTH |
| 19 | CMNSW | 345 | NORTH |
| 20 | CNRSW | 345 | NORTH |
| 21 | CRTLD | 345 | NORTH |
| 22 | DCSES | 345 | NORTH |
| 23 | EMSES | 345 | NORTH |
| 24 | ELKTN | 345 | NORTH |
| 25 | ELMOT | 345 | NORTH |
| 26 | EVRSW | 345 | NORTH |
| 27 | KWASS | 345 | NORTH |
| 28 | FGRSW | 345 | NORTH |
| 29 | FORSW | 345 | NORTH |
| 30 | FRNYPP | 345 | NORTH |
| 31 | GIBCRK | 345 | NORTH |
| 32 | HKBRY | 345 | NORTH |
|  |  |  |  |
| 33 | JEWET | 345 | NORTH |
| 34 | KNEDL | 345 | NORTH |
| 35 | KLNSW | 345 | NORTH |
| 36 | LCSES | 345 | NORTH |
| 37 | LIGSW | 345 | NORTH |
| 38 | LEG  | 345 | NORTH |
| 39 | LFKSW | 345 | NORTH |
| 40 | LWSSW | 345 | NORTH |
| 41 | MLSES | 345 | NORTH |
| 42 | MCCREE | 345 | NORTH |
| 43 | MDANP | 345 | NORTH |
| 44 | ENTPR | 345 | NORTH |
| 45 | NCDSE | 345 | NORTH |
| 46 | NORSW | 345 | NORTH |
| 47 | NUCOR | 345 | NORTH |
| 48 | PKRSW | 345 | NORTH |
| 49 | KMCHI | 345 | NORTH |
| 50 | PTENN | 345 | NORTH |
| 51 | RENSW | 345 | NORTH |
| 52 | RCHBR | 345 | NORTH |
| 53 | RNKSW | 345 | NORTH |
| 54 | RKCRK | 345 | NORTH |
| 55 | RYSSW | 345 | NORTH |
| 56 | SGVSW | 345 | NORTH |
| 57 | SHBSW | 345 | NORTH |
| 58 | SHRSW | 345 | NORTH |
| 59 | SCSES | 345 | NORTH |
| 60 | SYCRK | 345 | NORTH |
| 61 | THSES | 345 | NORTH |
| 62 | TMPSW | 345 | NORTH |
| 63 | TNP\_ONE | 345 | NORTH |
| 64 | TRCNR | 345 | NORTH |
| 65 | TRSES | 345 | NORTH |
| 66 | TOKSW | 345 | NORTH |
| 67 | VENSW | 345 | NORTH |
| 68 | WLVEE | 345 | NORTH |
| 69 | W\_DENT | 345 | NORTH |
| 70 | WTRML | 345 | NORTH |
| 71 | WCSWS | 345 | NORTH |
| 72 | WEBB | 345 | NORTH |
| 73 | WHTNY | 345 | NORTH |
| 74 | WCPP | 345 | NORTH |

(2) The North 345 kV Hub Price is the simple average of the Hub Bus prices for each hour of the Settlement Interval of the Day-Ahead Market (DAM) in the Day-Ahead and is the simple average of the time-weighted Hub Bus prices for each 15-minute Settlement Interval in Real-Time, for each Hub Bus included in this Hub.

(3) The Day-Ahead Settlement Point Price of the Hub for a given Operating Hour is calculated as follows:

DASPP *North345* = (HUBDF *hb, North345* \* DAHBP *hb, North345*), if HB*North345*≠0

DASPP *North345* = DASPP*ERCOT345Bus*, if HB*North345*=0

Where:

DAHBP *hb, North345* = (HBDF *b, hb, North345* \* DALMP *b, hb, North345*)

HUBDF *hb, North345* = IF(HB *North345*=0, 0, 1 **/** HB *North345*)

HBDF *b, hb, North345* = IF(B*hb, North345*=0, 0, 1 **/** B *hb, North345*)

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| DASPP *North345* | $/MWh | *Day-Ahead Settlement Point Price*⎯The DAM Settlement Point Price at the Hub, for the hour. |
| DAHBP *hb, North345* | $/MWh | *Day-Ahead Hub Bus Price at Hub Bus*⎯The DAM energy price at Hub Bus *hb* for the hour. |
| DALMP *b, hb, North345* | $/MWh | *Day-Ahead Locational Marginal Price (LMP) at Electrical Bus of Hub Bus*⎯The DAM LMP at Electrical Bus *b* that is a component of Hub Bus *hb* for the hour. |
| HUBDF *hb, North345* | none | *Hub Distribution Factor per Hub Bus*⎯The distribution factor of Hub Bus *hb*.  |
| HBDF *b, hb, North345* | none | *Hub Bus Distribution Factor per Electrical Bus of Hub Bus*⎯The distribution factor of Electrical Bus *b* that is a component of Hub Bus *hb*.  |
| *b* | none | An energized Electrical Bus that is a component of a Hub Bus. |
| B *hb, North345* | none | The total number of energized Electrical Buses in Hub Bus *hb*. |
| *hb* | none | A Hub Bus that is a component of the Hub. |
| HB *North345* | none | The total number of Hub Buses in the Hub with at least one energized component in each Hub Bus. |

(4) The Real-Time Settlement Point Price of the Hub for a given 15-minute Settlement Interval is calculated as follows:

RTSPP *North345* = Max [-$251, (RTRSVPOR + RTRDP +

 (HUBDF *hb, North345* \* ((RTHBP *hb, North345, y* \*

 TLMP *y*) / (TLMP *y*))))], if HB*North345*≠0

RTSPP *North345* = RTSPP*ERCOT345Bus*, if HB*North345*=0

Where:

RTRSVPOR = (RNWF  *y* \* RTORPA *y*)

RTRDP = (RNWF*y* \* RTORDPA*y*)

RNWF *y* = TLMP *y* / TLMP *y*

RTHBP *hb, North345, y* = (HBDF *b, hb, North345* \* RTLMP *b, hb, North345, y*)

HUBDF *hb, North345* = IF(HB*North345*=0, 0, 1 **/** HB *North345*)

HBDF *b, hb, North345* = IF(B*hb, North345*=0, 0, 1 **/** B *hb, North345*)

The above variables are defined as follows:

|  |  |  |
| --- | --- | --- |
| Variable | Unit | Description |
| RTSPP *North345* | $/MWh | *Real-Time Settlement Point Price*⎯The Real-Time Settlement Point Price at the Hub, for the 15-minute Settlement Interval. |
| RTHBP *hb, North345, y* | $/MWh | *Real-Time Hub Bus Price at Hub Bus per Security-Constrained Economic Dispatch* (*SCED) interval*⎯The Real-Time energy price at Hub Bus *hb* for the SCED interval *y*. |
| RTRSVPOR | $/MWh | *Real-Time Reserve Price for On-Line Reserves*⎯The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval. |
| RTORPA*y* | $/MWh | *Real-Time On-Line Reserve Price Adder per interval*⎯The Real-Time price adder for On-Line Reserves for the SCED interval *y*. |
| RTRDP | $/MWh | *Real-Time On-Line Reliability Deployment Price*⎯The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that are calculated from the Real-Time On-Line Reliability Deployment Price Adder.  |
| RTORDPA *y* | $/MWh | *Real-Time On-Line Reliability Deployment Price Adder*⎯The Real-Time price adder that captures the impact of reliability deployments on energy prices for the SCED interval *y.*  |
| RNWF *y* | none | *Resource Node Weighting Factor per interval*⎯The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the Settlement Interval. |
| RTLMP *b, hb, North345, y* | $/MWh | *Real-Time Locational Marginal Price at Electrical Bus of Hub Bus per interval*⎯The Real-Time LMP at Electrical Bus *b* that is a component of Hub Bus *hb*, for the SCED interval *y*. |
| TLMP *y* | second | *Duration of SCED interval per interval*⎯The duration of the portion of the SCED interval *y* within the 15-minute Settlement Interval |
| HUBDF *hb, North345* | none | *Hub Distribution Factor per Hub Bus*⎯The distribution factor of Hub Bus *hb*.  |
| HBDF *b, hb, North345* | none | *Hub Bus Distribution Factor per Electrical Bus of Hub Bus*⎯The distribution factor of Electrical Bus *b* that is a component of Hub Bus *hb*.  |
| *y* | none | A SCED interval in the 15-minute Settlement Interval. The summation is over the total number of SCED runs that cover the 15-minute Settlement Interval. |
| *b* | none | An energized Electrical Bus that is a component of a Hub Bus. |
| B *hb, North345* | none | The total number of energized Electrical Buses in Hub Bus *hb*. |
| *hb* | none | A Hub Bus that is a component of the Hub. |
| HB*North345* | none | The total number of Hub Buses in the Hub with at least one energized component in each Hub Bus. |