# *McCamey Wind Generation Transmission Improvement Plan*



From August 1999 through July 2000 there were requests for 900 MW of wind generation to be interconnected into the West Texas Utilities (WTU) Transmission system in and around the McCamey area with generation in-service dates between 2/1/01 and 12/01/01. About 750MW of wind generation capacity additions were interconnected by year-end 2001. Since then, an additional 300 MW of new wind generation capacity is now planned to be interconnected by year-end 2003. Wind generators are already producing energy and additional wind generation interconnection requests are continuing to materialize as a result of the renewable energy mandate of SB7 and the Federal Tax Credit recently extended through 2003. ***(For additional details see interconnection studies 00INR0022, 01INR0025, 01INR0034, 01INR0035, 01INR0027 and 02INR0032)***

At present there is less than 150 MW of fossil generation in-service in the Western region of WTU, which has a non-coincident peak load of 138 MW with a current load projection of 162 MW by year 2010. Of the 150 MW of generation, 140 MW is the conventional natural gas fired Rio Pecos Power Plant, and the remainder is made up of small internal combustion plants and a small combustion turbine located southwest of McCamey. The McCamey area has only two 138-kV paths that provide generation an interconnection to the bulk 345-kV transmission system. One path is north through Crane to the Odessa area and the other is east through Big Lake to San Angelo. Today there exists only one 138-kV line that connects the Rio Pecos substation to the Crane substation and this circuit is currently the limiting element during export of wind generation from the McCamey area. There is also only one existing 138-kV line that connects the North McCamey substation to the Big Lake substation, which would otherwise constrain the export of wind energy.

In order to accommodate the wind generator interconnections of over 1000 ~~785~~ MW in the region, the study was broken into two parts. The first part focused on the infrastructure required to accept the generation into the local network, and the second focused on bulk transmission paths necessary to transport the generation from the local network to the two 345 kV corridors at Odessa and at San Angelo. Full compliance is maintained with all Transmission Planning Reliability Criteria and Standards set forth by West Texas Utilities (WTU), Electric Reliability Council of Texas (ERCOT), and the North American Electric Reliability Council (NERC).

## LOCAL NETWORK IMPROVEMENTS

The local network improvements can be designated as three transmission triangles: ***(refer to attached drawing)***

1. Rio Pecos to Crane to North McCamey to Rio Pecos
2. Rio Pecos to Ft. Stockton to 16$^{th}$ Street to Rio Pecos
3. Rio Pecos to Mesa View Switch Station to West Yates Switch Station to North McCamey to Rio Pecos

The improvements identified in this plan ensure that adequate transmission capacity exists in each of the three triangles in order to facilitate the injection of generation into the local network, while maximizing the use of the existing transmission system by minimizing the need for new right-of-way and the need for CCNs (Certificate of Convenience and Necessity). Since the in-service dates for the wind power generators with interconnection agreements is no later than 12/31/03, the typical five year lead time required to certify and build a new 345 kV line has necessitated the upgrade of the 138 kV transmission system to provide timely transmission enhancements that result in incremental increases of transfer capability within the next three years.

Thus far all wind farm interconnections have been at locations that surround McCamey. As a result, there is an opportunity to use the North McCamey substation as a transmission hub for the collection of wind energy from four transmission line spokes. The spokes are comprised of the North McCamey to West Yates Switch, North McCamey to ~~Big Lake~~SW Mesa Tap, North McCamey to Crane and North McCamey to Rio Pecos 138 kV lines. If each of these spokes is constructed with structures capable of a second circuit as they are rebuilt under the original interconnection plan, then the second circuit can be certified and installed to handle any existing and future expansion of wind generation at the existing wind farm sites. With the exception of the wind farms at Indian Mesa and Woodward Mountain, all other wind farm interconnections could directly be interconnected to one of the four spokes. Even the remote wind farms, which would not be directly interconnected to a spoke, inject power at the Rio Pecos, which is the termination of one of the spokes. Additionally, the capability to add a second circuit to the 138 kV corridors from Rio Pecos-to-San Angelo and Rio Pecos-to-Crane provide the flexibility to interconnect new wind generation as circumstances dictate.

## BULK NETWORK IMPROVEMENTS

In order to maximize the long term export capability of the region, power collected at North McCamey can be transferred to the 345 kV bulk system via a new 345 kV line from North McCamey to Twin Buttes. Without such a line, the capacity of the 138 kV transmission system would ultimately be limited to about 1500 MW of generation in the McCamey area. This limitation is further aggravated by bulk 345 kV transmission constraints as power received from the 138 kV system would continue to flow on the congested Odessa to Abilene to DFW 345 kV path. A 345 kV line from North McCamey to Twin Buttes would direct power to the southern San Angelo to Comanche Peak to DFW 345 kV path, and improve the overall transfer capability out of West Texas. Additionally, the last two 138 kV upgrades to be completed in 2006, Rio Pecos to Crane and North McCamey to Big Lake can be displaced with the new 345 kV line.

Generation Interconnection Agreements for Wind Generators in the McCamey area to date are as follows:

| No. | Plant | In-Service | Capacity |
|---|---|---|---|
| 1 | Southwest Mesa /FPL | 1999 | 75 MW |
| 2 | Indian Mesa / FPL | 2001 | 83 MW |
| 3 | Woodward Mt./FPL | 2001 | 160 MW |
| 4 | King Mt./FPL | 2001 | 280 MW |
| 5 | Desert Sky/AEP | 2001 | 160 MW |
| 6 | Capital/Cielo | 2003 | 60 MW |
| 7 | Noelke Hill/Cielo | 2003 | 240 MW |
| | TOTAL | 2003 | 1058 MW |

The original transmission plan set out to rebuild existing lines, where practical, to avoid the need for new right-of-way. This plan supported approximately 1000 MW of generation, but, without construction of a new line, has reached the ultimate capacity of the 138 kV transmission grid in the McCamey area. Since additional wind generation interconnection requests are continuing to materialize due to the renewable energy mandate of SB7 and the Federal Tax Credit recently extended through 2003, any new transmission lines should accommodate both expected and future wind generation additions. The proposed 345 kV line from North McCamey to Twin Buttes does so by providing an incremental 500 MW increase of transmission capacity.

Since much of the current transmission construction is sequential, in-service dates of the final and most critical lines, have been stretched out to the summer of 2006. The proposed 345 kV line from North McCamey to Twin Buttes will take about five years to certify and construct, which would result in a significant increase in transmission capacity only one year after the final 138 kV rebuilds are to be completed. There are 70 miles of 138 kV line rebuilds (North McCamey to Big Lake and Rio Pecos to Crane) that go in-service just prior to completion of the 345 kV line, and which, while the rebuilds are under construction, will cause curtailments of wind generation. Given the clear need for the new 345 kV line and the minimal benefit of rebuilding these 138 kV lines, it is prudent to avoid the rebuilds entirely by implementing a special protection scheme (SPS). The SPS would allow the most if not all of the wind generation to operate under pre-contingency conditions, and only when overloads occur due to contingency outages, would remove specific wind generation facilities from service.

Roughly a third of the cost of the new 345 kV line is required to rebuild these 138 kV lines, which is avoided by the SPS, while still allowing wind generation to be operated relatively unconstrained. The SPS will be implemented with the help of the hub-and-spoke configuration, which creates two transmission systems, one to serve load and the other to route wind power to the 345 kV system. By diverting the wind power to the upgraded Crane to Odessa or the Fort Lancaster to Twin Buttes 138 kV paths, curtailment due to the constraint limited by the existing North McCamey to Big Lake and Rio Pecos to Crane 138 kV lines is avoided. Specialized substation designs and a proposed fiber optic loop make it possible to automatically route power flow to the extent possible, and remove generation when necessary. Isolating distribution substations from the spokes serving the wind generators retains the reliability of and improves power quality for the retail customers.

With completion of the North McCamey to Twin Buttes 345 kV line, roughly 1500 MW of wind generation will be supported under first contingency criteria. Constructing the North McCamey to Odessa 345 kV line in conjunction with two additional 600 MVA autotransformers at North McCamey could accommodate over 2000 MW of wind generation. This would allow the entire SB7 mandate for renewable generation to be met in the McCamey area alone. It would also serve as a second 345 kV path out of the Midland/Odessa area, improving transfer capability out of West Texas and enhancing access to wind generation from those areas north and west of Odessa. Should the federal tax credits for wind energy be extended beyond 2003, wind generation will remain competitive with conventional energy sources. Given the potential of all of West Texas to produce wind energy and the load growth in Texas, the production and consumption of this source of renewable energy can only be facilitated by the availability of transmission to transport the power from the source to the sink.

The following information details the criteria violations that result from the interconnection of over ~~785~~ 2000 MW wind farm generation into the McCamey area, and the specific transmission system improvements, and their associated schedule, that have been determined to be necessary to relieve the criteria violations.

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-011 | Indian Mesa Wind Generation Interconnection | GR / AB | IPP | WTU | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - TU Crane to Odessa EHV 138 kV | N. McCamey to Big Lake 138 kV line exceeds its emergency rating | Addition of a Ft. Lancaster to Friend Ranch 2x794 ACSR 138 kV line with double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect Indian Mesa 80 MW | ETN100716 10472 | | Customer Line | 06/01 |
| Over current relay at Illinois to Ft. Lancaster | ETN101846 10458 | | n/a | ~~01/02~~12/02 |
| System protection and interrupting devices as result of new and rebuilt lines | ETN101849 9736 | | n/a | ~~09/05~~12/05 |
| Add new 138 kV Terminal @ Ft. Lancaster and Friend Ranch | ETN101847 9948 | | n/a | ~~09/05~~12/05 |
| Add new 40 mile 138 kV Ft. Lancaster to Friend Ranch with 2x795 ACSR) and DC structures | ETN101848 9913 | 40 | To be filed | ~~09/05~~12/05 |

**(04/02 posting assumed no CCN intervention, 10/02 posting includes CCN intervention, which is now anticipated)**

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-012 | Woodward Wind Generation Interconnection | GR / BM | IPP | WTU | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| FPL Energy Power Partner's Woodward #1 wind farm | Interconnection | FPL Energy Power Partner's Woodward #1 Wind Farm generation in Pecos County |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect FPL Energy Power Partner's 83 MW wind generation facility with RTU / Motorized Switch at generation line switch tap | ETN101850 10438/10476 | | Customer Line | 04/01 |
| Add new 138 kV Terminal at Ft. Stockton | ETN101845 10478 | | n/a | ~~09/02~~08/02 |
| Convert 5.6 miles of 69 kV from 16 th Street to Fort Stockton to 138 kV and Airport substation to 138 kV | TNMP | 5.6 | Exempt Line | ~~09/02~~12/02 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - SW Mesa to Big Lake 138 kV | WTU Crane to TU Crane 138 kV bus tie exceeds its emergency rating | Reconfigure WTU/TU Crane substation to a breaker and half scheme and Replace 138/69 kV autotransformer with 130 MVA |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Reconfigure WTU/TU Crane substation to a breaker and half scheme and Replace 138/69 kV autotransformer with 130 MVA | ETN101854 9950 | | n/a | 05/03 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Rio Pecos to Crane 138 kV line | WTU Crane to Rio Pecos 69kV line exceeds its emergency rating | Convert 69 kV North McCamey to Crane line to 138 kV with double circuit 2x795 ACSR conductor ~~and double circuit capable structures~~ |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Over current relay Rio Pecos to WTU Crane 69 kV | ETN101851 10429 | | n/a | 12/02 |
| System protection and interrupting devices as result of re-conductors and new lines | ETN101852 10430 | | n/a | 05/03 |
| Rebuild ~~Convert~~ 25 miles of 69 kV from North McCamey to Crane to 138 kV with 2x795 ACSR and DC structures, build new double circuit line section (requires CCN) from Mc Elroy to Crane | ETN101853 9915 | 25 | To be filed | 05/03 |
| Construct 1.5 miles of 69 kV from McElroy to Crane to close the 69 kV Crane area loop | | 1.5 | To be filed | 05/03 |
| Convert 25 miles of 69 kV from North McCamey to WTU Crane to 138 kV 2x795 ACSR and transfer King Mt. from Rio Pecos/Crane line | | | exempt | 09/03 |
| Add second circuit to the North McCamey to Crane 138 kV line and transfer King Mt. from first North McCamey/Crane circuit | | | To be filed | 12/04 |

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-013 | King Mt Wind Generation Interconnection | GR / BM | IPP | WTU | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| King Mountain Wind Farm 280 MW generation | Interconnection | King Mountain Wind Farm generation in Crane County |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect King Mt NW 80 MW and King Mt SW 80 MW | ETN101857 10447 | | Customer Line | 05/01 |
| Interconnect King Mt NE 80 MW and King Mt SE 40 MW | ETN101858 11472 | | Customer Line | 06/01 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - normal conditions | Crane to Odessa 138 kV line exceeds its rating | Convert 69 kV line from Crane to MIdkiff to 138 kV with ~~795 ACSS~~ conductor rated for 1800a, and rebuild 138 kV Crane to Odessa line with ~~795 ACSS~~ conductor rated for 1800a |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Convert 34 miles of 69 kV Crane to Midkiff line to 138 kV with ~~795 ACSS~~ conductor rated for 1800a | Oncor | 34.3 | Exempt Line | TBD |
| Rebuild 32 miles of 138 kV from Crane to Odessa with ~~795 ACSS~~ conductor rated for 1800a | Oncor | 31.8 | Exempt Line | TBD |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Rio Pecos to North McCamey 138 kV | WTU Crane to Rio Pecos 138 kV line exceeds its emergency rating | Addition of a Twin Buttes to North McCamey 2x1590 ACSR 345 kV line with double circuit capable structures, install 600 MVA autotransformer at North McCamey and second 300 MVA autotransformer at Twin Buttes ~~Re-conductor 138 kV WTU Crane to Rio Pecos line with 2x795 ACSR conductor and double circuit capable structures~~ |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| ~~Re-conductor 11.5 miles of 138 kV from King Mnt West Tap to WTU Crane 138 kV (2x795 ACSR) with DC structures~~ | ~~ETN101861 10404~~ | ~~11.5~~ | ~~Exempt Line~~ | ~~03/04~~ |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Big Lake 138 kV Bus Tie | Big Lake 69/138 kV autotransformers exceed their emergency rating | Reconfigure Big Lake 138 kV to ring bus |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Reconfigure Big Lake substation 138 kV bus to five position ring | ETN101862<br>10482 | | n/a | 09/05 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Friend Ranch to Ft. Lancaster 138 kV | North McCamey to SW Mesa 138 kV line exceeds its emergency rating | Construct 138 kV North McCamey to King Mnt East Tap & SW Mesa with 2x795 ACSR and double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| System protection and interrupting devices as result of re-conductors and new lines | ETN101859<br>11474 | | n/a | ~~07/03~~09/03 |
| Construct 5.85 miles of 138 kV from SW Mesa and King Mt East Tap to North McCamey with 2x795 ACSR and DC structures | ETN101865<br>10392 | 5.85 | To be filed | ~~07/03~~09/03 |
| Reconfigure North McCamey 138 kV substation to breaker and one-half | ETN101866<br>10466 | | n/a | 09/03 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Crane to Odessa 138 kV | Midkiff to Sprayberry to 138 kV line exceeds its rating | Rebuild 138 kV line from Midkiff to Sprayberry with ~~795 ACSS~~ conductor rated for 1800a |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Rebuild 23 miles of 138 kV from Midkiff to Sprayberry with ~~795 ACSS~~ conductor rated for 1800a | Oncor | 23.0 | Exempt Line | TBD |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - TU Crane to Odessa EHV 138 kV | SW Mesa to Big Lake 138 kV line exceeds its emergency rating | Addition of a Twin Buttes to North McCamey 2x1590 ACSR 345 kV line and double circuit capable structures, install 600 MVA autotransformer at North McCamey and second 300 MVA autotransformer at Twin Buttes ~~2x795 ACSR conductor and double circuit capable structures~~ |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Install Line Monitoring Equipment on the King Mnt to WTU Crane 138 kV line | ETN101860<br>11475 | | n/a | ~~03/02~~09/02 |
| ~~Re-conductor 46.79 miles of 138 kV from N. McCamey to Big Lake (2x795 ACSR)~~ | ~~ETN101863<br>10384~~ | ~~46.79~~ | ~~Exempt Line~~ | ~~06/06~~ |

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-014 | Desert Sky~~Indian Mesa~~ I Wind Generation Interconnection | GR / BM | IPP | WTU | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Desert Sky I Wind Farm generation | Interconnection | Desert Sky I Wind Farm generation in Pecos County |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect Desert Sky I 80 MW wind generation facility | ETN101867<br>10450 | | Customer Line | 05/01 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Rio Pecos to Mesa View 138 kV | Ft. Lancaster 69/138 kV autotransformer exceeds its emergency rating | Convert 69 kV North McCamey to Mesa View line to 138 kV with 2x795 ACSR conductor and double circuit capable structures, add new switching station at Mesa View tap, add switching station at West Yates Tap, and move North McCamey 138/69 kV autotransformer to West Yates Switch |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Install Line Monitoring Equipment on the North McCamey to Big Lake 138 kV line | ETN101868<br>11460 | | n/a | ~~03/02~~09/02 |
| System protection and interrupting devices as result of re-conductors and new lines | ETN101869<br>11456 | | n/a | ~~06/02~~09/03 |
| Over current relay West Yates Tap to Iraan 69 kV | ETN101870<br>11449 | | n/a | ~~06/02~~12/02 |
| Re-build 13.46 miles of 69 kV from North McCamey to Tippet to 138 kV with 2x795 ACSR and DC structures, Operated at 69 kV | ETN101880<br>10423 | 13.5 | Exempt Line | 12/02 |
| Re-build 9.98 miles of 69 kV Tippet to West Yates Switch Station 138 kV with 2x795 ACSR and DC structures and operated at 69 kV | ETN101876<br>11462 | 10.0 | Exempt Line | 05/03 |
| Add West Yates and Tippet load to Mesa View 138 kV | ETN101879<br>11461 | | Exempt Substation | 04/03 |
| ~~Convert Tippet 69 kV substation to 138 kV~~ | ~~ETN101874<br>11463~~ | | ~~n/a~~ | ~~09/03~~ |
| ~~Convert West Yates Pump 69 kV Substation to 138 kV~~ | ~~ETN101879<br>11461~~ | | ~~n/a~~ | ~~09/03~~ |
| Convert McCamey 69 kV substation to 138 kV | ETN101873<br>11459 | | n/a | 09/03 |
| Add new West Yates 138 kV Switching Station (five position ring) and move North McCamey 69/138 kV auto to West Yates | ETN101871<br>10483 | | Exempt Substation | 09/03 |
| Convert 23.5 miles of 69 kV North McCamey to West Yates Switch Station to 138 kV | | 23.5 | Exempt Line | 09/03 |
| Convert 4.5 miles of 69 kV from West Yates Switch Station to Mesa View to 138 kV with 2x795 ACSR and DC structures | ETN101878<br>11458 | 4.5 | Exempt Line | ~~08/03~~09/03 |
| Add new Mesa View 138 kV Switch Station (five position ring) | ETN101872<br>10480 | | Exempt Substation | 09/03 |
| Re-build 5.57 miles of 138 kV from Mesa View to Mesa View Switch Station to 138 kV with 2x795 ACSR and DC structures | ETN101875<br>11451 | 5.6 | Exempt Line | 01/04 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Crane to Rio Pecos 138 kV | Rio to WTU Crane 69 kV line exceeds its emergency rating | Convert 69 kV Rio Pecos to WTU Crane line to 138 kV with 2x795 ACSR and double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Convert 23 miles of 69 kV from Rio Pecos - WTU Crane to 138 kV with 2x795 ACSR and DC structures | ETN101881<br>10366 | 23.0 | Exempt Line | ~~10/04~~12/03 |
| Add new 138 kV line terminal @ Rio Pecos | ETN101855 | | n/a | ~~10/04~~12/03 |
| Convert Spudder Flat 69 kV substation to 138 kV | ETN101856<br>10372 | | n/a | ~~10/04~~12/03 |

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-015 | Desert Sky~~Indian Mesa~~ II Wind Generation Interconnection | GR / AB | IPP | WTU | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Desert Sky II Wind Farm generation | Interconnection | Desert Sky II Wind Farm generation in Pecos County |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Desert Sky II 80 MW wind generation facility | ETN101882 11470 | | Customer Line | 10/01 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Crane to Odessa EHV 138 kV | N. McCamey to Big Lake 138 kV line exceeds its emergency rating | Construct 138 kV Friend Ranch to Twin Buttes line with 2x795 ACSR conductor and double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Overcurrent relay Rio Pecos to McCamey 69 kV | ETN101883 11471 | | n/a | ~~06/02~~12/02 |
| Add new 138 kV terminal at Twin Buttes | ETN101884 10475 | | n/a | ~~09/05~~02/06 |
| Add new 138 kV terminal at Friend Ranch | ETN101885 10477 | | n/a | ~~09/05~~02/06 |
| Add new 70 mile 138 kV line from Friend Ranch to Twin Buttes with 2x795 ACSR and DC structures | ETN101886 10449 | 70 | To be filed | ~~07/05~~03/06 |

**(04/02 posting assumed no CCN intervention, 10/02 posting includes CCN intervention, which is now anticipated)**

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| TP-2001-016 | Capital Hill Wind Generation Interconnection | GR / BM | IPP | WTU | Proposed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Capital Hill Wind Farm | Interconnection | Capital Hill Wind Farm generation in Upton County |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect Capital Hill 60 MW wind generation facility at Rio Pecos | ETN101887<br>10386 | | Customer Line | ~~03/02~~09/03 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Fort Lancaster to Mesa View Switching Station 138 kV line | Rio to North McCamey 138 kV line exceeds its emergency rating | Re-conductor 138 kV Rio Pecos to North McCamey line with double circuit 2x795 ACSR conductor ~~and double circuit capable structures~~ |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Re-build 9.67 miles of 138 kV from Rio Pecos to North McCamey with 2x795 ACSR and DC structures | ETN101894<br>10387 | 9.67 | Exempt Line | ~~03/05~~ 05/04 |
| Add second circuit to the Rio Pecos to North McCamey 138 kV 2X795 ASCR | | 9.67 | To be filed | 12/04 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Rio Pecos to North McCamey 138 kV | Rio to Mesa View 138 kV line exceeds its emergency rating | Re-conductor 138 kV Rio Pecos to Mesa View Switching Station line with 2x795 ACSR conductor and double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| System protection and interrupting devices as result of re-conductors and new lines | ETN101888<br>11440 | | n/a | 03/02 |
| Upgrade Indian Mesa substation bus to 2x795 ACSR | ETN101892<br>11441 | | n/a | 03/04 |
| Re-conductor 27.13 miles of 138 kV from Rio Pecos to Mesa View Switch Station with 2x795 ACSR and DC structures | ETN101893<br>10388 | 27.13 | Exempt Line | 08/04 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas - Rio Pecos to Indian Mesa 138 kV | Mesa View Switching Station to Ft. Lancaster 138 kV line exceeds its emergency rating | Re-conductor 138 kV Mesa View Switching Station to Ft. Lancaster line with 2x795 ACSR conductor and double circuit capable structures |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Re-conductor 19.8 miles of 138 kV from Mesa View Switch to Ft. Lancaster with 2x795 ACSR and DC structures | ETN101895<br>10396 | 19.8 | Exempt Line | 02/05 |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Addition of 750 MW of wind generation in West Texas | McCamey area voltages fall below 95% and rise above 105% | Add 28.8 MVAR 138 kV Capacitor Bank and 2x20 MVAR reactors @ Rio Pecos ~~Add 15 MVAR Capacitor Bank @ Mesa View Switching Station 138 kV, 15 MVAR Capacitor Bank @ West Yates Switching Station 138 kV, and 15MVAR Capacitor Bank @ Ft. Lancaster 138 kV~~ |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Add 28.8 MVAR 138 kV Capacitor Bank and 2x20 MVAR reactors @ Rio Pecos | | 28.8 MVAR cap | n/a | 04/03 |
| ~~Add 10 MVAR and 15 MVAR 138 kV Capacitor Banks @ West Yates~~ | ~~ETN101889 10360~~ | ~~15 MVAR cap~~ | ~~n/a~~ | ~~09/03~~ |
| ~~Add 10 MVAR and 15 MVAR 138 kV Capacitor Banks @ Mesa View Switch~~ | ~~ETN101891 10410~~ | ~~15 MVAR cap~~ | ~~n/a~~ | ~~09/03~~ |
| ~~Add 10 MVAR 69 kV Capacitor Bank @ Ft. Lancaster~~ | ~~ETN101911 10417~~ | ~~10 MVAR cap~~ | ~~n/a~~ | ~~03/03~~ |

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| | Cielo/Noelke Hill Wind Generation Interconnection | GR / CS | IPP | LCRA | IA Executed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Noelke Hill 240 MW Wind Farm | Interconnection | Upgrade West Yates Switching Station and add second circuit to the North McCamey to West Yates Switching Station 138 kV line |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Interconnect Noelke Hill Wind 240 MW | | | Customer Line | 10/03 |
| Add new 138 kV Terminal at West Yates Switching Station for IPP | | | n/a | 10/03 |
| Add second circuit to the North McCamey to West Yates Switching Station 138 kV line | | | To be filed | 12/04 |
| Add new 138 kV Terminals at West Yates Switching Station and North McCamey | | | n/a | 12/04 |

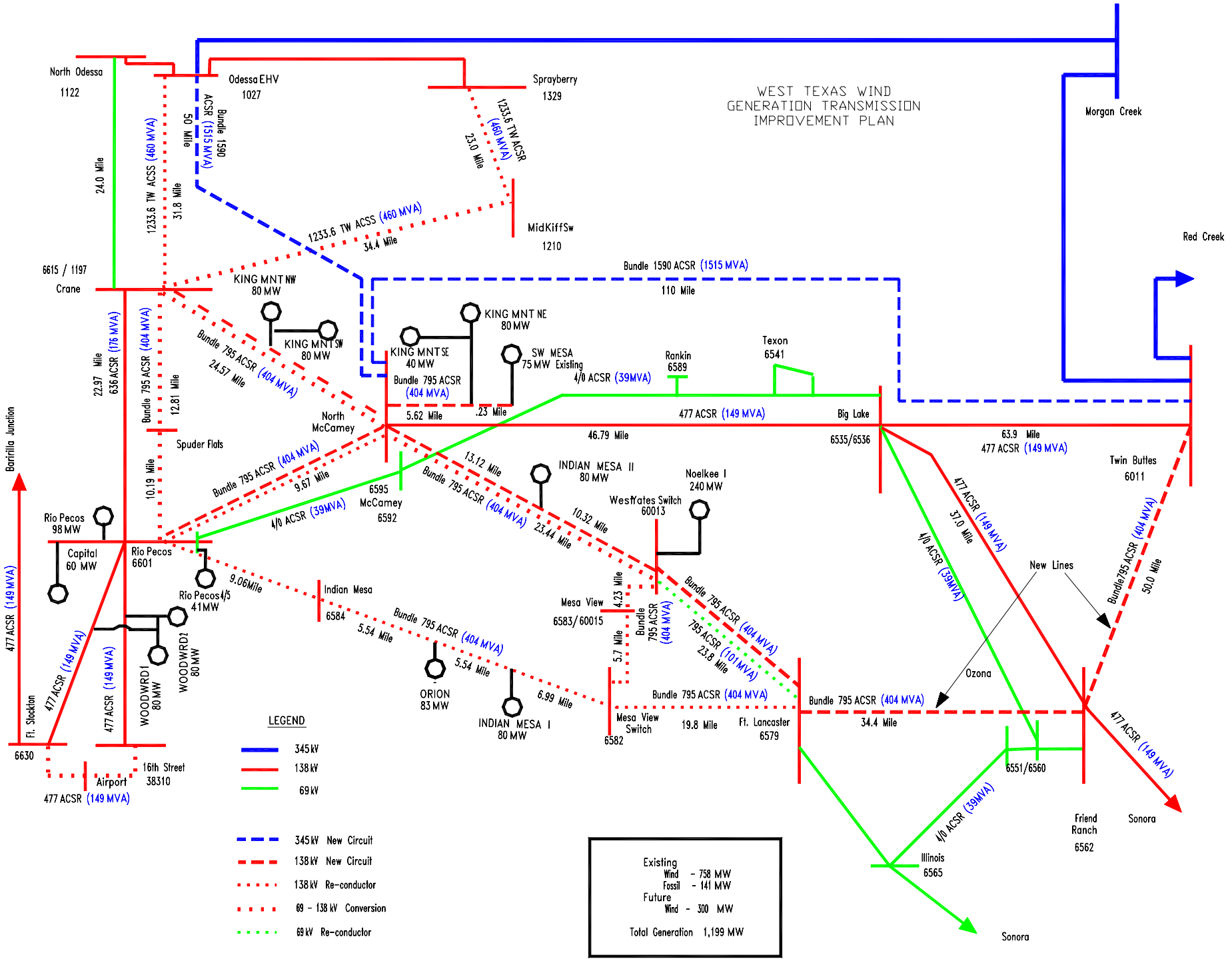
| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Wind generation in excess of 1050 MW in the McCamey area - TU Crane to Odessa EHV 138 kV | North McCamey to Big Lake 138 kV line exceeds its emergency rating | Addition of a Twin Buttes to North McCamey 2x1590 ACSR 345 kV line with double circuit capable structures, install 600 MVA autotransformer at North McCamey and second 300 MVA autotransformer at Twin Buttes |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Add new 138/345 kV 600 MVA autotransformer at North McCamey with associated terminations | | | n/a | 12/07 |
| Add new 110 mile 345 kV Twin Buttes to North McCamey line with 2x1590 ACSR and DC structures | | 110 | To be filed | 12/07 |
| Add new 138/345 kV 300 MVA autotransformer at Twin Buttes with associated terminations | | | n/a | 12/07 |

| *Project Number* | *Title* | *TP/PM* | *Type* | *TSP* | *Status* |
|---|---|---|---|---|---|
| | West Texas Regional Planning Group | GR / BM | ERCOT | LCRA | Proposed |

| *Contingency* | *Problem* | *Solution* |
|---|---|---|
| Wind generation in excess of 1500 MW in the McCamey area - North McCamey to Twin Buttes 345 kV line | North McCamey to Big Lake 138 kV line exceeds its emergency rating | Addition of a Odessa to North McCamey 2x1590 ACSR 345 kV line with double circuit capable structures, install two additional 600 MVA autotransformers at North McCamey and addition of West Yates to Ft. Lancaster 138 kV line |

| *Transmission Improvement Description* | *CI IDs* | *Mileage* | *CCN* | *In-service date* |
|---|---|---|---|---|
| Rebuild 23.8 mile 69 kV West Yates to Ft. Lancaster line to double circuit 69/138 kV with 2x795 ACSR (existing distribution substations to remain 69 kV) | | 24 | proposed | 01/06 |
| Add new 138 kV termination at West Yates | | | n/a | 01/06 |
| Add new 138 kV termination at Ft. Lancaster | | | n/a | 01/06 |
| Add two new 138/345 kV 600 MVA autotransformers at North McCamey with associated terminations | | | n/a | 12/07 |
| Add new 50 mile 345 kV Odessa to North McCamey line with 2x1590 ACSR and DC structures | | 50 | proposed | 12/07 |
| Add new 345 kV termination at Odessa | | | n/a | 12/07 |


WEST TEXAS WIND
GENERATION TRANSMISSION
IMPROVEMENT PLAN
North Odessa
1122
Odessa EHV
1027
Sprayberry
1329
Morgan Creek
Red Creek
MidKiffSw
1210
6615 / 1197
Crane
KING MNT NW
80 MW
KING MNT NE
80 MW
KING MNT SW
80 MW
KING MNT SE
40 MW
SW MESA
75 MW Existing
Rankin
6589
Texon
6541
Bundle 1590 ACSR (1515 MVA)
110 Mile
50 Mile
Bundle 1590 ACSR (1515 MVA)
24.0 Mile
31.8 Mile
1233.6 TW ACSS (460 MVA)
23.0 Mile
1233.6 TW ACSR (460 MVA)
34.4 Mile
1233.6 TW ACSS (460 MVA)
22.97 Mile
636 ACSR (176 MVA)
Bundle 795 ACSR (404 MVA)
24.57 Mile
12.81 Mile
Bundle 795 ACSR (404 MVA)
5.62 Mile
.23 Mile
Bundle 795 ACSR (404 MVA)
4/0 ACSR (39MVA)
477 ACSR (149 MVA)
46.79 Mile
Big Lake
6535/6536
63.9 Mile
477 ACSR (149 MVA)
Twin Buttes
6011
Spuder Flats
North McCamey
10.19 Mile
Bundle 795 ACSR (404 MVA)
9.67 Mile
6595
McCamey
6592
4/0 ACSR (39MVA)
13.12 Mile
Bundle 795 ACSR (404 MVA)
INDIAN MESA II
80 MW
Noelkee I
240 MW
WestTates Switch
60013
10.32 Mile
23.44 Mile
Barrilla Junction
Rio Pecos
98 MW
Capital
60 MW
Rio Pecos
6601
Rio Pecos 4/5
41MW
9.06Mile
Indian Mesa
6584
Mesa View
6583/ 60015
4.23 Mile
5.7 Mile
Bundle 795 ACSR (404 MVA)
795 ACSR (101 MVA)
23.8 Mile
Bundle 795 ACSR (404 MVA)
37.0 Mile
4/0 ACSR (39MVA)
New Lines
Bundle 795 ACSR (404 MVA)
50.0 Mile
477 ACSR (149 MVA)
Ozona
Bundle 795 ACSR (404 MVA)
34.4 Mile
477 ACSR (149 MVA)
Ft. Stockton
6630
477 ACSR (149 MVA)
477 ACSR (149 MVA)
WOODWRD1
80 MW
WOODWRD2
80 MW
Airport
16th Street
38310
477 ACSR (149 MVA)
5.54 Mile
Bundle 795 ACSR (404 MVA)
5.54 Mile
ORION
83 MW
6.99 Mile
INDIAN MESA I
80 MW
Mesa View
Switch
6582
19.8 Mile
Ft. Lancaster
6579
6551/6560
4/0 ACSR (39MVA)
Illinois
6565
Friend
Ranch
6562
Sonora
Sonora
LEGEND
345 kV
138 kV
69 kV
345 kV New Circuit
138 kV New Circuit
138 kV Re-conductor
69 - 138 kV Conversion
69 kV Re-conductor
Existing
Wind - 758 MW
Fossil - 141 MW
Future
Wind - 300 MW
Total Generation 1,199 MW