Wien-Stratford-McMillan Reconductor Discussion with MEWD

March 12, 2004

Executive Summary

The potential for overloads and low voltages on the transmission system between the Wien and Arpin substations for summer 2005 forecasted loads has precipitated the need for immediate system reinforcements. The Wien-Stratford-McMillan 115 kV line, built in 1957, is one of two transmission paths that supply power to the Marshfield community. An outage on the Arpin 138/115 kV transformer or the Arpin-Hume 115 kV line results in an overload on the Wien-Stratford and Stratford-McMillan 115 kV lines. These two outages also result in bus voltages below 90% of the nominal value at Hume, Wildwood, and McMillan substations.

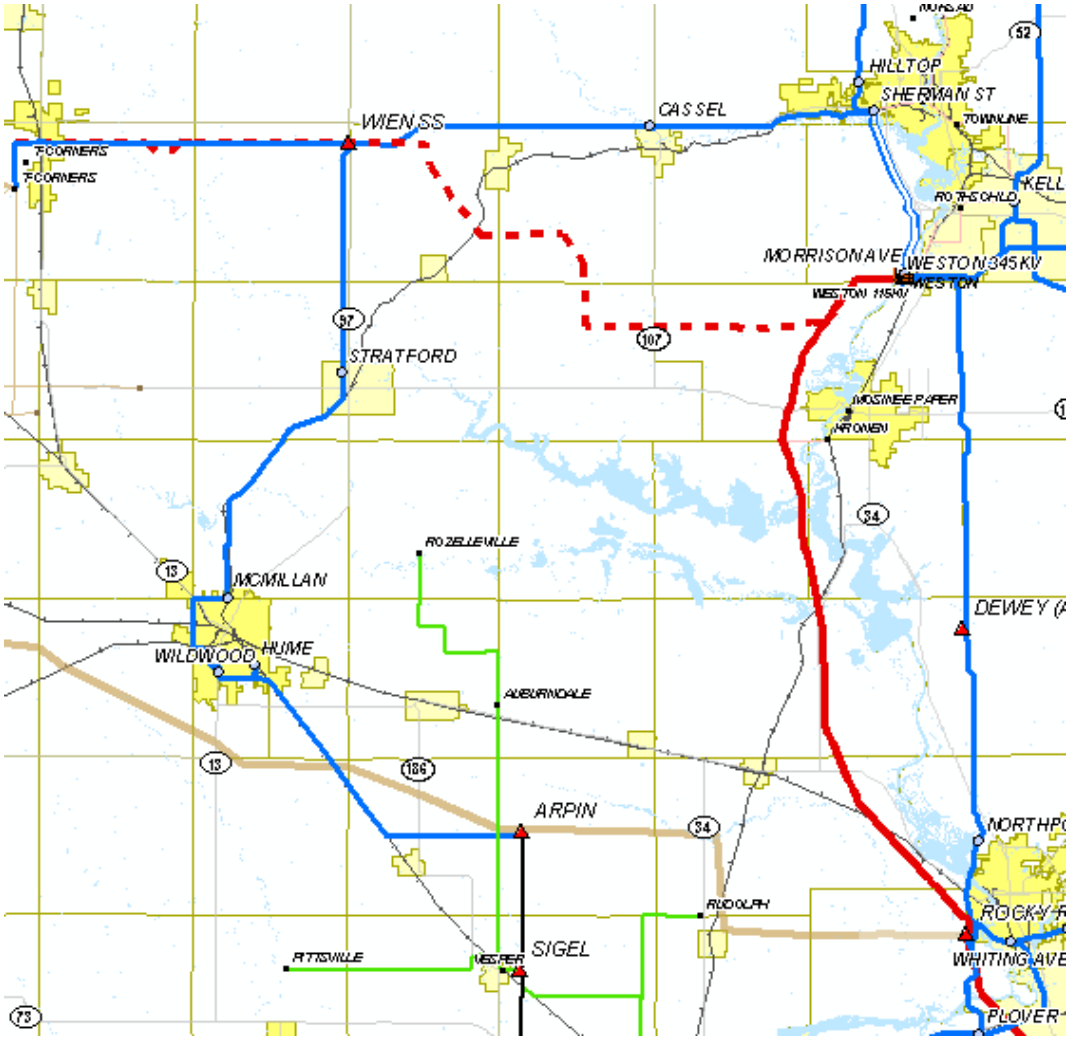
Both Marshfield Electric and Water Department (MEWD) and ATC each currently own portions of the Wien-Stratford-McMillan line. ATC owns the Wien-Stratford segment (8.8 miles) while MEWD owns the Stratford-McMillan segment (10.7 miles). The existing line conductor for both 115 kV line segments is 4/0 ACSR. To improve voltage support in the Marshfield area and to address the line overloads under contingencies, Planning's recommendation is to reconductor ATC's Wien-Stratford 115 kV line with 795 ACSR conductor. From a system performance perspective, it is also planning's recommendation to pursue the reconductoring of MEWD's Stratford-McMillan 115 kV line with 795 ACSR. Over the years MEWD has verbally indicated a willingness to support this project.

The capital cost for this project is broken up into two estimates. The Wien-Stratford 115 kV line reconductor project is estimated cost is $1,600,000 and the Stratford-McMillan 115 kV line reconductor project is estimated to cost $1,500,000. ATC would undertake the responsibility for the reconductor of the Wien-Stratford 115 kV line. Total estimated capital costs for this project are $3,100,000. The projected in-service date is June 2005.

Introduction

The potential for overloads and low voltages on the transmission system between the Wien and Arpin substations for summer 2005 forecasted loads has precipitated the need for immediate system reinforcements. The Wien-Stratford-McMillan 115 kV line, built in 1957, is one of two transmission paths that supply power to the Marshfield community. With an outage on the Arpin 138/115 kV transformer or the Arpin-Hume 115 kV line results in an overload on the Wien-Stratford and Stratford-McMillan 115 kV lines. These two outages also result in bus voltages below 90% of the nominal value at Hume, Wildwood, and McMillan substations. The transmission system is shown below in Figure 1.

Figure 1
Transmission Facilities In The Marshfield Area



The existing line conductor for both 115 kV line segments is 4/0 ACSR. Planning's recommendation is to reconductor the Wien-Stratford-McMillan 115 kV line with 795 ACSR conductor. Reconductoring these two 115 kV transmission lines segments will improve voltage support in the Marshfield area and address the line overloads under contingencies.

The Wien-Stratford-McMillan line is currently owned by both Marshfield Electric and Water Department (MEWD) and ATC. ATC owns the Wien-Stratford portion of this 115 kV line while MEWD owns the Stratford-McMillan portion. Even though ATC does not own this transmission facility, ATC currently has operational responsibility over this and other MEWD transmission lines. From a system performance perspective, it is planning preference to pursue the reconductoring of MEWD's Stratford-McMillan 115 kV line.

This assessment leading to Planning's recommendation included consideration of reliability, capital costs, constuctability and future considerations.

Project Description

The scope of this project calls for the following:

- Replace 8.8 miles of 4/0 ACSR conductor on the existing Wien-Stratford 115 kV line with 795 ACSR conductor.
- Replace 10.7 miles of 4/0 ACSR conductor on the existing Stratford-McMillan 115 kV line with 795 ACSR conductor.
- Conductor clearance should be adequate to permit a minimum continuous summer normal operation at 200F (1215 amps) and emergency operation at 300F (1675 amps).
- Upgrade all terminal equipment, except for bus conductor, at Wien and Stratford to a minimum 1600 amp equipment rating.
- Replace insulators and conductor hardware between Wien and McMillan as needed.
- Replace angle and tangent structures as needed do to increased loading and conductor clearance requirements.

Refer to Appendix A for the Project Diagram outlining the major equipment specifications and ratings. One-lines of the existing transmission system and proposed reconductor project are shown below in Figure 2 and Figure 3.

Project Schedule

The preliminary project schedule has not been developed at this time. A refined and definitive project schedule will be developed once the project has received management authorization. The proposed in-service date for this project is June 2005.

Project Need

The Wien-Stratford-McMillan 115 kV line, built in 1957, is one of two transmission paths that supply power to the Marshfield community. The existing line conductor for both 115 kV line segments is 4/0 ACSR with a summer normal rating of 80 MVA and an emergency rating of 90 MVA. The contingency analysis for this study was conducted using the models developed for the 2003 Ten Year Assessment. They are Summer 2004, Summer 2008, and Summer 2012 cases chosen to evaluate near and longer-term system conditions. The power flow results indicate that the Wien-Stratford-McMillan line will exceed its emergency limit during contingency conditions for summer 2005 forecasted peak loads. An outage on the Arpin 138/115 kV transformer or the Arpin-Hume 115 kV line results in an overload on the Wien-Stratford and Stratford-McMillan 115 kV lines as shown below in Table 1. These two outages also result in bus voltages below 90% of the nominal value at Hume, Wildwood, and McMillan substations.

Table 1
Single Contingency Loadings and Bus Voltages

Transmission Line	**Arpin 138/115 kV Xfmr Outage**			**Arpin-Hume 115 kV line Outage**		
	2004	**2008**	**2012**	**2004**	**2008**	**2012**
Wien–Stratford 115 kV line	98.3%	113.8%	127.2%	98.2%	113.9%	127.3%
Stratford-McMillan 115 kV line	89.5%	102.7%	114.5%	89.7%	102.8%	114.6%
Bus Voltage						
Stratford	96.7%	94.4%	93.6%	96.7%	94.3%	93.5%
McMillan	92.2%	88.8%	87.1%	92.2%	88.6%	87.0%
Wildwood	91.3%	87.7%	85.9%	91.2%	87.5%	85.8%
Hume	91.2%	87.6%	85.7%	91.1%	87.4%	85.6%

Alternative #2: Reconductor Wien-Stratford-McMillan 115 kV Line
This alternative involves the replacement of 8.8 miles of 4/0 ACSR conductor on the Wien-Stratford 115 kV line and 10.7 miles of 4/0 ACSR conductor on the Stratford-McMillan 115 kV line with 795 ACSR conductor. The capital cost for this alternative is broken up into two estimates. ATC would be responsible for the reconductoring of the Wien-Stratford 115 kV line and this line work is estimated to be $1,600,000. MEWD will be responsible for the work associated with the Stratford-McMillan 115 kV line and this is estimated to also be $1,500,000. Total project estimate of $3,100,000. Estimates were provided by Engineering in the level 1 DSD's.

The power flow results indicate that not only does this alternative addresses the overload and voltage violations in the near term, but it also addresses the system needs in the

Marshfield's area for the foreseeable future. A summary of the power flow results is shown below in Table 3.

Table 3
Single Contingency Loadings and Bus Voltages
Outage of Arpin-Hume 115 kV line

Transmission Line	Base Cases Without Alt#2		Base Cases With Alt#2	
	2008	**2012**	**2008**	**2012**
Wien–Stratford 115 kV line	113.9%	127.3%	33.0%	36.3%
Stratford-McMillan 115 kV line	102.8%	114.6%	53.5%	59.2%
Bus Voltage				
Stratford	94.3%	93.5%	99.6%	99.8%
McMillan	88.6%	87.0%	98.4%	98.3%
Wildwood	87.5%	85.8%	97.4%	97.2%
Hume	87.4%	85.6%	97.3%	97.1%

Figure 3
Reconductor Wien-Stratford-McMillan 115 kV Circuit