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1.0 Introduction

PPL Electric Utilities Corporation (PPL Electric), in order to maintain reliable electric service to its customers, is required to monitor and when appropriate reinforce both its Transmission and Distribution power systems. The Appenzell and Reeders area in south central Monroe County is one of PPL Electric's poorest performing areas. To address this problem, PPL Electric has developed an overall reinforcement plan for the Appenzell and Reeders area. A central part of this plan, and the subject of this filing, requires building approximately 2.2 miles of new 138 kV transmission line which will provide service to a new Appenzell 138-12 kV Substation. Completion of this project will transfer load from Tannersville 138-12 kV Substation and McMichaels 138-12 kV Substation and the distribution lines supplied from them, which serve the Appenzell and Reeders area, and improve the reliability of the distribution system.

The estimated cost to site, design and construct the proposed overhead transmission facilities is \$2,285,000. The total project cost which includes siting, transmission line construction, substation construction, and distribution line installation is \$4,000,000. Construction of this project is scheduled to begin in March 2011 to meet an in-service date of November 2011. A PPL Electric system map showing existing transmission facilities and the proposed new facilities with a design voltage of 35 kV or greater is included in the **B-Map pocket**. This filing seeks approval for the proposed new double circuit (single circuit initial) 138 kV transmission tap in Jackson Township, Monroe County.

2.0 System Planning Process

System Planning is the process which assures that both the Transmission and Distribution power systems can supply electricity to customers in a reliable and economic manner. This process assures that these systems:

- are able to supply load reliably during summer and winter peak conditions;
- provide service at an acceptable voltage level throughout the daily load cycle.

The proper reinforcement of Transmission and Distribution supply facilities requires a set of defined planning standards. PPL Electric's planning standards are set forth in the Reliability Principles and Practices (P&P) manual. PPL Electric developed the Reliability P&P to ensure adequate and appropriate levels of service consistent with good utility practice. The principles upon which these

planning guidelines are based recognize:

- the necessity of maintaining proper balance between service reliability and the cost of providing that service; and
- that large-scale, long term or frequent interruptions are to be avoided due to the adverse effects on the general public.

In accordance with these guidelines, the power distribution system is planned so that, under normal operating conditions:

- loadings on all facilities are within normal guidelines;
- adequate voltage levels are maintained as specified by the PUC at 52 Pa. Code 57.14;
- loadings on underground network facilities are within single contingency limitations.

At times, reinforcement of distribution facilities requires the expansion of the regional transmission system. Such is the case when a new distribution supply substation is necessary to adequately service load in compliance with the Reliability P&P manual. This filing, for example, seeks approval for a new transmission tap which is required to energize the new substation, which in turn is required to relieve overloading and improve reliability on the distribution system in the Appenzell and Reeders area.

The distribution planning process begins with a review of line loadings at each substation across the system. Summer and winter peak loads are projected for four future years based on actual peak loads during the seven most recent years. The load profile, duration of peak loads, and load level are analyzed at the circuit and substation level. These analyses identify the distribution facilities that exceed the planning guidelines. Following the identification of problems on a circuit, or at a substation, options to reinforce the area of concern are considered. The options are weighed in terms of how and over what time period they resolve load and reliability concerns and at what cost. These options are considered over a 10 – 20 year time frame. The optimal option that best resolves load and reliability issues in an economic manner is then chosen.

3.0 Existing Supply

At present, the area of concern receives its distribution service from the Tannersville 57-1 12 kV line and the McMichaels 35-2 12 kV line. The Tannersville 138/69-12 kV Substation has one 34 MVA¹, 138/69-12 kV transformer, and one 34 MVA, 138-12 kV transformer. It supplies four distribution lines. The distribution line of concern is the Tannersville 57-1 12 kV line, which extends west from

the substation and then extends south into Appenzell. It currently serves over 2,200 customers (**Figure B-1**).

The McMichaels 138/69-12 kV Substation has one 34 MVA, 138/69-12 kV transformer, and one 34 MVA, 138-12 kV transformer. It supplies three distribution lines. The distribution line of concern there is the McMichaels 35-2 12 kV line, which extends east from the substation towards Appenzell. It currently serves over 1,500 customers.

The Tannersville 138/69-12 kV Substation is supplied from the Jackson-Stroudsburg 69 kV line and the Monroe-Jackson 138 kV line. Both circuits normally supply the substation. By November 2010, the Jackson-Stroudsburg 69 kV line will be converted to 138 kV operation and at that time either transmission line will be able to supply the entire substation load during maintenance or unplanned outages of the other transmission line. Tannersville Substation will then be supplied from two 138 kV lines named the Monroe-Jackson #1 & #2 138 kV Lines.

4.0 Definition of the Problem

PPL Electric has identified these two circuits as being in the top 5% of its worst performing circuits on the distribution system. This is based on the following indicators of reliability: SAIDI², CAIDI³, more than three outages, and number of outages lasting more than 4 hours. The performance of these circuits must be improved to ensure that these circuits do not continue to be among the worst performing circuits.

The Tannersville 57-1 and McMichaels 35-2 12 kV lines have exhibited unsatisfactory levels of performance over the past several years. The overall PPL Electric system SAIDI averaged 151 minutes from 2002 through 2010. The SAIDI for customers on the Tannersville 57-1 and McMichaels 35-2 averaged 328 and 353 minutes, respectively, from 2002 to 2010.

In addition, PPL Electric's Reliability P&P manual states that the maximum number of customers on a single distribution line should not exceed 1,300. As noted above in section 3.0, the McMichaels 35-2 line and the Tannersville 57-1 lines currently supply 1,500 and 2,200 customers, respectively.

¹All ratings and loads in this filing are expressed in Megavolt Amperes (MVA).

²System Average Interruption Duration Index (SAIDI) - The measure of the total amount of time an average customer is interrupted in a year.

³Customer Average Interruption Duration Index (CAIDI) - The measure of the length of time required to restore customers, once they are interrupted.

Furthermore, the Tannersville 57-1 line is composed of 477 Al XLP conductor, which has normal/emergency/thermal planning guidelines of 11 MVA/13 MVA/17 MVA. The winter 2014 load on the Tannersville 57-1 line is projected to be 11.1 MVA, which exceeds the normal planning guidelines for the conductor.

5.0 Proposed Solution

To improve the integrity of the distribution system and address the load and reliability concerns in the area, PPL Electric proposes a new 138 kV transmission tap to a new 138-12 kV substation in the Appenzell/Reeders area. The transmission tap serving the new substation, and the subject of this filing, will be known as the Appenzell 138 kV Tap. The Tap will be designed to accommodate 138 kV double circuit operations, but will initially operate as a single circuit 138 kV line. A second circuit will be installed when it is appropriate to meet additional load. The new tap is estimated to be approximately 2.2 miles long.

The new distribution substation, named Appenzell 138-12 kV Substation, will relieve the line loadings on the Tannersville 57-1 and McMichaels 35-2 12 kV lines (**Figure B-2**). The site for the new substation was selected because the location is approximately halfway between the existing Tannersville and McMichaels substations and is located in close proximity to existing distribution infrastructure. The new substation will also improve reliability for this area. Transferring load from the Tannersville 57-1 and McMichaels 35-2 12 kV lines to the new distribution circuits served from the new substation will reduce the number of customers served from these lines. The new Appenzell substation will also reduce the exposure that customers have to outages by reducing the overall length of each of these circuits. In addition, the new substation will eliminate the need to serve customers in the Appenzell area from a distribution line which runs through a heavily wooded area.

The Appenzell Substation will initially supply two 12 kV lines that will serve approximately 1,600 customers transferred from the Tannersville and McMichaels substations. Approximately 1,000 customers will be transferred from the Tannersville 57-01 12 kV line, which will reduce its load by 5 MVA. Approximately 600 customers will be transferred from the McMichaels 35-2 12 kV line, which will reduce its load by 3.5 MVA.

6.0 Functional Alternatives

One functional alternative was identified to address the problems outlined in Section 4.0 above. This alternative would build two new 12 kV distribution lines. Under this alternative solution, a new line from Tannersville substation and a new line from McMichaels substation would have to be built. A portion of the Tannersville 57-1 line, including the Appenzell area, would be transferred to the new 12 kV line out of Tannersville Substation. Likewise, the portion of the McMichaels 35-2 line that is north of the McMichaels substation would be transferred to the new 12 kV line from the McMichaels Substation. This option would cost approximately \$1,000,000; however, it would not adequately address, and in fact, would exacerbate the problem of line exposure.

PPL Electric rejected this alternative because the exposure to interruptions for customers on the Tannersville 57-1 line would increase due to increased line exposure. Customers in the Appenzell area would be further away from the substation source under this new line arrangement. Increased line exposure leads to more customer minutes interrupted during outages than the preferred alternative. As a result, these circuits would remain worst performing circuits. The preferred alternative, described in Section 5.0 above, provides increased reliability and operating flexibility than the alternative.