

**PJM 2014/2015
Long Term Proposal Window
Independent Cost Review
White Paper**

**Version 1
04.28.2016**

Table of Contents

1 EXECUTIVE SUMMARY	1
2 METHODOLOGY	1
3 PROJECT SCOPE DESCRIPTIONS.....	1
4 SUMMARY OF STUDY FINDINGS.....	2
4.1 Project 6C	2
4.2 Project 6D	3
4.3 Project 9A.....	4
4.4 Project 14A.....	4
4.5 Project 19G	5

Document Tables

Table 1 Cost and Schedule Summary.....	1
Table 2 Project Scope Summaries.....	2

1 Executive Summary

The PJM 2014/2015 Long Term Proposal Window was opened to solve both reliability criteria violations and Market Efficiency constraints. This white paper summarizes the independent cost, schedule and constructability analyses completed for the evaluation of the Market Efficiency projects that were proposed in the window.

The PJM Operating Agreement Section 1.5.7(g) requires PJM to develop an independent cost estimate for Market Efficiency projects with costs in excess of \$50 million. In this study, PJM has also verified the proposed schedule durations and examined other risks to both cost and schedule.

Projects were selected in the fourth quarter of 2015 given the state of analysis at that time. Additionally, only those projects that were near or above the \$50 million dollar threshold were reviewed.

Table 1 below summarizes the cost and schedule estimates for the projects.

Project	6C	6D	9A	14A	19G
Cost Estimate (Millions)	\$41.1	\$38.5	\$267.1	\$52.6	\$46.6
Schedule Estimate (Months)	32	30	59	42	33

Table 1 Cost and Schedule Summary

The cost estimate results of the study were near those proposed in a range of one to twelve percent difference. Schedule duration estimates were also very similar to those proposed.

2 Methodology

The study analyzed the proposed projects for cost, schedule and constructability.

Cost estimates were performed at a conceptual level based upon the current and recent transmission line and substation design experience of the engineer of choice.

Schedules were generated by identifying the high-level milestones of all major tasks required to complete the project. Timeframes and project sequencing are based on the contractor's experience on similar projects and are consistent with general industry durations.

The constructability review was completed as a high-level desktop analysis utilizing publicly available data leveraging the expertise of the engineer of choice.

3 Project Scope Descriptions

The scope of work for each of the analyzed projects is summarized below in Table 2.

Project Number	Project Description
201415_1-6C	Build one 500kV Thyristor Controlled Series Capacitor (TCSC) at Loudoun substation on the Loudoun to Meadowbrook line and build five 230 kV capacitor banks at five existing DVP substations to alleviate congestion on AP South and other PJM interfaces
201415_1-19G	Build 500/230 kV Substation (Keyzers Run) interconnecting Conastone-Brighton 500 kV line to Northwest 230 kV substation.
201415_1-6D	Build a new 500kV station (Palmyra) by connecting at the intersection of two 500kV lines of North Anna to Midlothian 500kV line and Cunningham to Elmont 500kV line and build five capacitor banks in the DVP zone to alleviate AP South and AEP-DOM congestion.
201415_1-14A	A hybrid series capacitor and thyristor controlled series capacitor near the midpoint of Conemaugh to Hunterstown 500 kV line in southern Pennsylvania. Install a phase angle regulator on the Messick Road to Morgan 138 kV line and close the circuit in Maryland.
201415_1-9A	Tap the Conemaugh to Hunterstown 500 kV line with a new station named "Rice" and construct a new 230 kV double circuit line between Rice and Ringgold stations. Tap the Peach Bottom to Three Mile Island 500 kV line with a new station named "Furnace Run" and construct a new 230 kV double circuit line between Furnace Run and Conastone stations. Add three 86.4 MVAR cap banks to Jackson's Ferry and Bradford 138 kV stations. Add one 175 MVAR cap bank to Lexington and Dooms 230 kV stations. Add two 175 MVAR cap banks to Ashburn and Brambleton 230 kV stations. Rebuild the Conastone to Northwest 230 kV double circuit corridor.

Table 2 Project Scope Summaries

4 Summary of Study Findings

4.1 Project 6C

The project cost estimate provided in the proposal was \$39,060,000 and the project completion date was specified as June, 2019. The independent cost was verified to be in general agreement with what was proposed and the schedule was found to support a 2019 completion date.

4.1.1 Project Cost Estimate

The independent project cost estimate is \$41,151,000.

4.1.2 Project Schedule

The conceptual project schedule review indicates that the project will take approximately 32 months to complete, from project initiation to energization.

4.1.3 Constructability Summary

Preliminary review of potential rare, threatened, and endangered species located within the study area identified the northern long-eared bat as a potentially impacted species. Surveys potentially required for mitigation of impacts to this species could implement time-of-year restrictions for tree clearing. Based on the area proposed for the substation expansion, it appears that Project associated tree clearing can be avoided and stream and wetland impacts could also be avoided. If these impacts can be realized by project design, the need for surveys and time-of-year restrictions associated with the Northern

long-eared bat could potentially become void. For these reasons, wetland and stream avoidance should be a key factor in the final design of the substation expansion.

4.2 Project 6D

The project cost estimate provided in the proposal was \$42,736,000 and the project schedule was approximately 31 months. The independent cost and schedule was verified to be in general agreement with what was proposed.

4.2.1 Project Cost Estimate

The independent project cost estimate is \$38,506,589.

4.2.2 Project Schedule

The conceptual project schedule review indicates that the project will take approximately 30 months to complete, from project initiation to energization.

4.2.3 Constructability Summary

Several critical constraints issues were identified for the proposed Palmyra 500kV Switching Station project. Of these, the most problematic is likely to be impacts associated with approximately 10 acres of tree clearing necessary to construct the project. Potential presence of the federally threatened northern long-eared bat and state endangered Rafinesque's eastern big-eared bat could result in requirement of mist net surveys or other presence absence surveys, time of year restrictions for tree clearing, and mitigation plans. The other critical constraints involving the permitting of a forested site is the potential for the presence of forested wetlands. If mechanical clearing or conversion of the wetland is necessary, a pre-construction notification (PCN) may be required and compensatory mitigation would be expected. Although a review of National Wetlands Inventory (NWI) data did not indicate the presence of wetlands within the presumed location of the proposed project, forested and scrub/shrub wetlands are present approximately 600-feet to the east and the presence or absence of wetlands within the 10-acre project site cannot be fully determined until a formal wetland delineation is performed. Additional potential risks include:

- Any work being conducted within open fields could result in the need for a Loggerhead Shrike Presence/Absence Survey if the time of year restriction on ground disturbance (April 1- July 31) cannot be met;
- Due to the presence of several residences in close proximity to the site, the potential for public opposition and associated delays should be taken into consideration;
- If required, an individual Section 404 permit could extend the permitting timeframe by several months;
- If necessary, historic and archaeological investigations (Phase II and III) beyond the initial Phase I reconnaissance survey, along with ongoing consultation and reporting, can have a substantial impact on schedule and cost; and issuance of Certificate of Public Convenience and Necessity will likely occur concurrently with approvals from the USACE, USFWS, and state agencies.

4.3 Project 9A

The project cost estimate provided in the proposal was \$269,073,000 and the project schedule was approximately 58 months. The independent cost and schedule was verified to be in general agreement with what was proposed.

4.3.1 Project Cost Estimate

The independent project estimate is \$267,110,000.

4.3.2 Project Schedule

The conceptual project schedule review indicates that the project will take approximately 59 months to complete, from project initiation to energization.

4.3.3 Constructability Summary

Four critical constraints were identified for the proposed Southern Pennsylvania project. Of these, the most problematic is likely to be surveys associated with rare bat species and timeline associated with environmental permitting. The other critical constraints involve the access and/or usage of state lands, right of way acquisition, and cultural resources investigations and clearances (as necessary). The major potential risks are:

- Based on the length of the East and West lines, and the rebuild project, it is assumed that a Joint (Individual) Permit will be needed for the Pennsylvania and/or Maryland project facilities once final alignment and access roads are laid out. This will involve coordination between federal and state agencies. This type of review process can require 12 months or more.
- The East and West lines, rebuild project, and associated substation expansions and installations are all within the range of rare bat species. Surveys could be required that have time of year requirements, furthermore time of year restrictions on tree clearing could be implemented pending coordination with U.S. Fish and Wildlife Service and results of surveys.
- The East line crosses Pennsylvania State Game Land 327. Acquiring easements on state public lands typically involve multiple reviews and coordination between state environmental and real estate divisions.
- The vast majority of the Southern Pennsylvania project is located on undeveloped land that would potentially be subject to archaeological surveys. Historic and archaeological investigations (Phase II and Phase III) beyond initial Phase I reconnaissance surveys, along with ongoing consultation and reporting, can have a substantial impact on schedule and cost.

4.4 Project 14A

The project cost estimate provided in the proposal was \$47,140,000 and the project schedule was approximately 41 months. The independent cost and schedule was verified to be in general agreement with what was proposed.

4.4.1 Project Cost Estimate

The independent project cost estimate is \$52,643,000.

4.4.2 Project Schedule

The conceptual project schedule review indicates that the project will take approximately 42 months to complete, from project initiation to energization.

4.4.3 Constructability Summary

Two critical constraints were identified for the proposed project. Of these, the most problematic is likely to be the surveys associated with rare bat species and timeline associated with environmental permitting, and the risk that none of the suggested sites can be acquired through landowner agreements. The other critical constraints involve the access and/or usage of state lands, right of way acquisition, and cultural resources investigations. The major potential risks are:

- Preliminary review of potential rare, threatened, and endangered species located within the study area identified the Northern long-eared bat and the Indiana bat as a potentially impacted species. Surveys potentially required for mitigation of impacts to this species could implement time-of-year restrictions for tree clearing.
- In the event that none of the proposed substation sites can be acquired through land negotiations, the proposed substations will need to be placed in an area not previously reviewed for sensitive features. Both transmission lines, and especially the Messick to Morgan transmission line, have numerous areas located along the route designated as an environmental or cultural area of concern. If a suitable site cannot be located along the existing right of way, and the new substations need to be constructed off- right of way, a transmission line will need to be constructed to tap the existing lines. Depending on the transmission line length, a Public Utility Council filing may be warranted.

4.5 Project 19G

The project cost estimate provided in the proposal was \$48,600,000 and the project schedule was approximately 33 months. The independent cost and schedule was verified to be in general agreement with what was proposed.

4.5.1 Project Cost Estimate

The independent project cost estimate is \$46,603,000.

4.5.2 Project Schedule

The conceptual project schedule review indicates that the project will take approximately 33 months to complete, from project initiation to energization.

4.5.3 Constructability Summary

Two critical constraints were identified for the proposed Keyzers Run substation project, surveys and consultations associated with rare bat species and potential public input from nearby residences. The major potential risks are:

- Preliminary review of potential rare, threatened, and endangered species located within the study area identified the Northern long-eared bat as a potentially impacted species. Surveys potentially required for mitigation of impacts to this species could implement time-of-year restrictions for tree clearing.

- Six residences are identified within 0.25-mile of the proposed project site. These residences could present opposition to the construction of the substation, based on the close proximity to their homes.