DATA REQUEST

KPSC 1_2 Refer to the Ali Testimony, unnumbered page 14, lines 12-17.
a. Identify the nine project components that were previously designated as Supplemental Projects but are now reclassified as Baseline Projects by PJM.
b. Explain when these project components were designated by PJM as Baseline Projects along with the identified need for these particular project components and the determination that these components represent the optimal solution to address those needs.

RESPONSE

a. The following nine components were previously identified as Supplemental and are now classified as Baseline:

Hazard Station Work	**Exhibit 2 One Line Identifier**
1. Replacement of the 161 kV circuit breaker (M) pointing towards Wooton Station.	1
2. Replacement of devices for line protection and circuit breaker control associated with the 161kV Wooton line position	1
3. Installation of a 138 kV circuit breaker with relay control on the low side of the 161 kV/138 kV transformer #3	2
4. Replacement of devices for transmission transformer protection associated with Transformer #3	2
5. Replacement of coupling capacitor voltage transformers on 138kV Bus #2	19
6. Replacement of devices for 138kV Bus #2 protection	19
Wooton Station Work	**Exhibit 2 One Line Identifier**
7. Installation of station class surge arresters attached to the upper beam of the existing 161kV box bay structure on the 161kV Hazard Line position	A
8. Installation of two coupling capacitor voltage transformers on Phase 2 and Phase 3 of the 161kV bus	B
9. Installation of telecommunication fiber equipment	C

b. The project designation changes were reviewed with stakeholders by PJM during the April 23, 2019 Subregional RTEP Western meeting. The project was subsequently approved by the PJM Board on July 29, 2019.
The information presented can be found at: https://www.pjm.com/-/media/committees-groups/committees/srrtep-w/20190423/20190423-reliability-analysis-update.ashx

Witness: Kamran Ali

<u>January 29, 2020 Supplemental Response</u>

Please see KPCO_SR_KPSC_1_2 Attachment_1 and KPCO_SR_KPSC_1_2 Attachment_2 for the information presented at the April 23, 2019 Subregional RTEP Western meeting. The link described above expired.

AEP Transmission Zone

B2761.1 – Scope Clarification /Cost Update

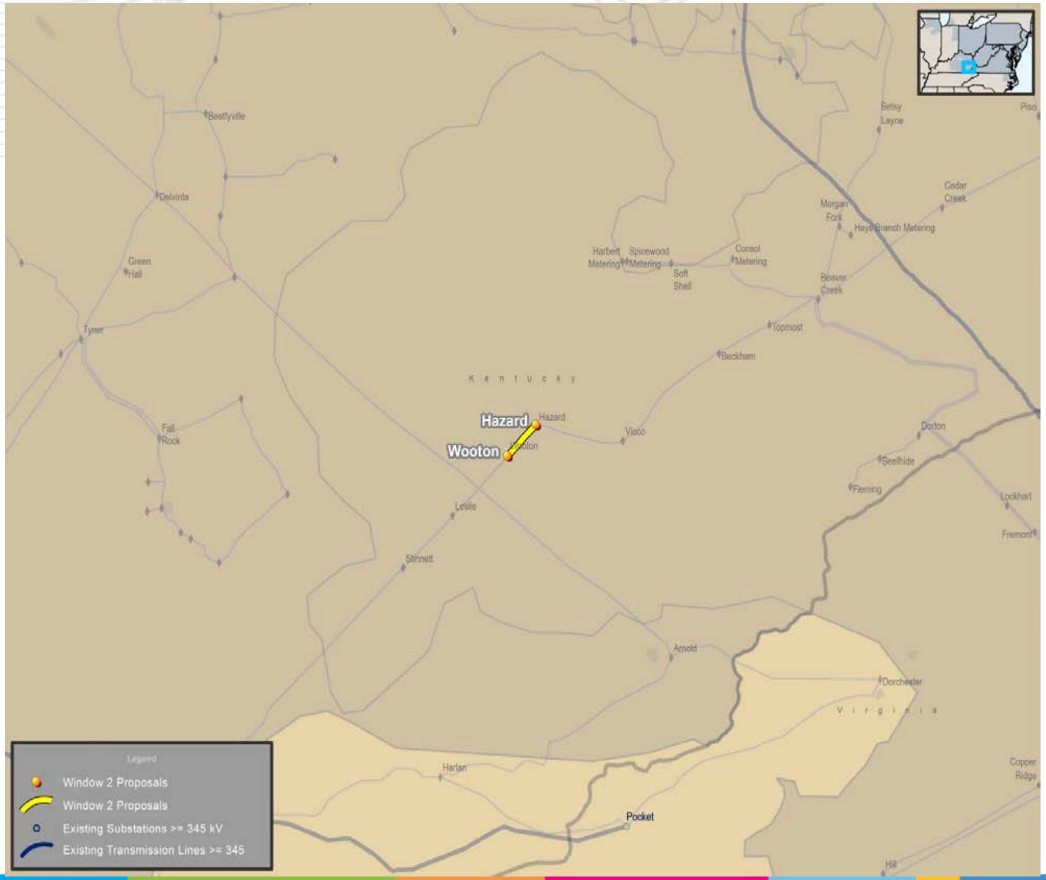
Previously Presented: 10/6/2016 SRRTEP

Original Scope Description: Replace the Hazard 161/138 kV Transformer
Original Estimated Cost: $2.3 M

New Scope Description: Replace and relocate the Hazard 161/138 kV Transformer and circuit breaker 'M'. Upgrade protection scheme on the new Transformer including installation of low side breaker.

New Estimated Cost: $ 3.8 M

Required IS Date: 6/1/2021



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AEP Transmission Zone: Baseline
Hazard – Wooton 161kV Circuit

B2761.3 –Scope Clarification/Cost Update

Previously Presented: 9/11/2017 SRRTEP

Original Scope Description: Rebuild the Hazard – Wooton 161 kV line utilizing 795 26/7 ACSR conductor (300 MVA rating).

Original Estimated Cost: $16.48 M

New Scope Description: Rebuild the Hazard – Wooton 161 kV line utilizing 795 26/7 ACSR conductor (300 MVA rating). Replace line relaying and associated termination equipment .

New Estimated Cost: $16.8 M

Required In-service: 6/1/2021

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Changes to Existing Supplemental Projects Before M-3 Process

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AEP Transmission Zone: Supplemental
Hazard Station

Previously Presented: 11/2/2017, 12/18/2017 SRRTEP

Problem Statement:

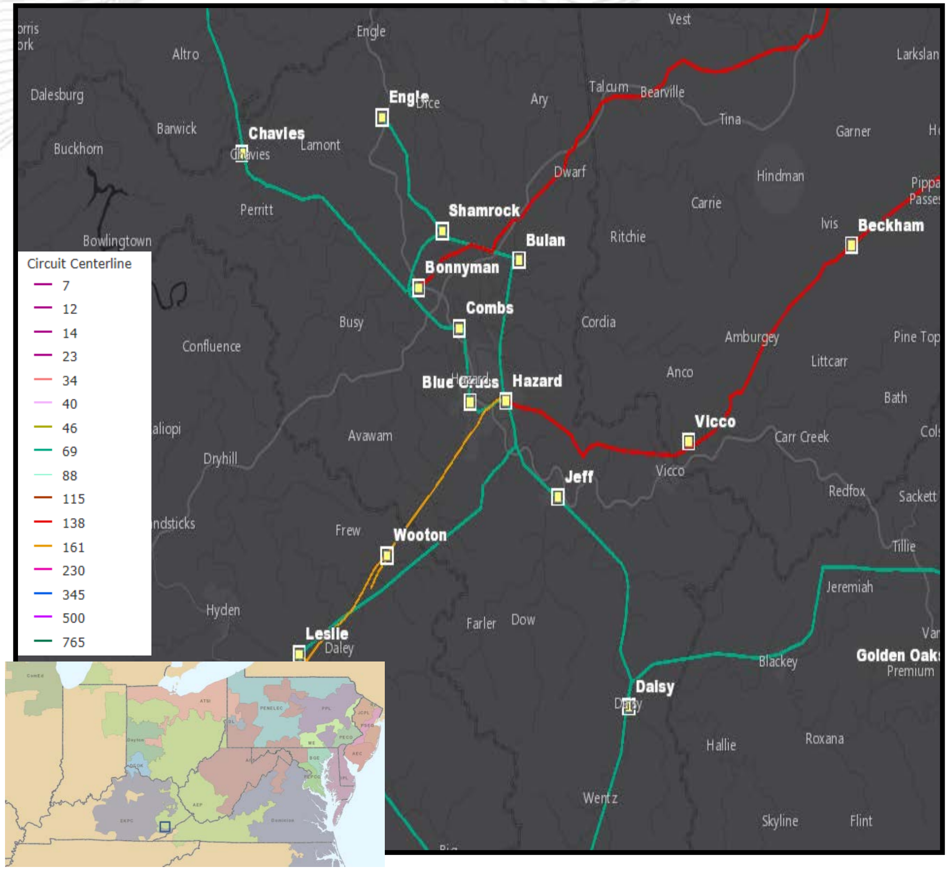
Equipment Material/Condition/Performance/Risk:

Circuit breakers S (1100 A, 11.3 kA) and E (1800 A, 27 kA) at Hazard station are FK type breakers all over 40 years old. Circuit breaker F at Hazard is a 1200 A, 31.5 kA CG type breaker. These are oil breakers that have come more difficult to maintain due to the required oil handling. In general, oil spills occur often during routine maintenance and failures with these types of breakers. Other drivers include PCB content, damage to bushings and number of fault operations exceeding the recommendations of the manufacturer. Breakers S, E, and F have experienced 82, 184, and 193 fault operations respectively, well above the manufactures recommendation of 10.

Circuit breaker M (2000 A, 40 kA) will need to be relocated in association with the baseline project to replace the existing 161/138 kV transformer at Hazard station (b2761) in order to limit outage times. The breaker is an SF6-gas breaker, 29 years old and has experienced 21 fault operations, which exceeds the manufacturer recommendation of 10.

Transformer #1 (1974 vintage, 50 MVA) and #2 (1973 vintage, 130 MVA) show dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to amount of through faults). Transformer #1 also shows signs of corrosion on radiators as well as oil leaks.

Circuit Switcher BB a MARK V unit which have presented AEP with a large amount of failures and mis-operations. AEP has determined that all MARK V's will be replaced and upgraded with the latest AEP cap-switcher design standard. ~~Capacitor bank BB will need to be relocated in association with the baseline project to replace the existing 161/138 kV transformer at Hazard station (b2761).~~ Additional engineering design has indicated that Capacitor bank BB would not need to be relocated to accommodate the baseline 161/138 kV transformer replacement/relocation.



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AEP Transmission Zone: Supplemental
Hazard Station

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Capacitor switcher CC has oil leaks on all three phases and cannot be repaired. Capacitor bank CC was a non standard design and its components (fuses and cans) have begun to fail.

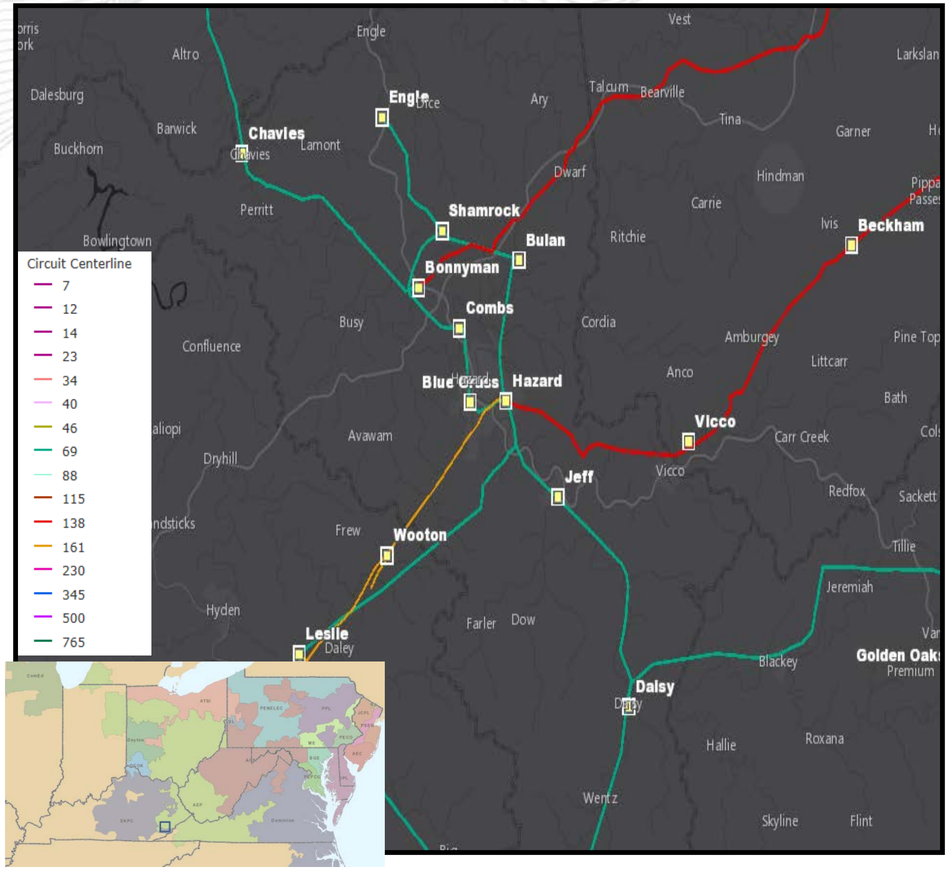
Safety concerns associated with existing equipment platforms at the station will also be addressed. The majority of the platforms at the station were field designed with thought of access, not safety, adequate clearances, or structural integrity in mind. Drainage issues at the station will also be addressed. Water from an adjacent parking lot and an incorrectly sloped 69 kV yard is causing water to pool on the fence line at Hazard Station.

Operational Flexibility and Efficiency

A 138 kV circuit breaker will be added at Hazard station on the line exit towards Beckham station, along with a circuit switcher and low side breaker on transformer #1 to separate three dissimilar zones of protection. The 138 kV bus, the Hazard – Beckham 138 kV line, and the 138/69 kV transformer #1 are all on the same protection zone. This can lead to mis-operations and over tripping.

138 kV circuit switchers will be added to transformer #2 and #4, as well as low side breakers on transformer #2, #3, and #4 to separate four dissimilar zones of protection.

Transmission Operations has requested a 69 KV bus tie circuit breaker be installed to improve operational flexibility to the 69 kV networks served out of Hazard. The 69 kV tie breaker will also help facilitate the retirement of Capacitor AA which is currently located off the line to Bonnyman, is beginning to show issues, and requires its VBM type cap switcher replaced. Tying the 69 kV buses together requires the 138/69 kV transformers to be the same size to avoid circulating currents and to be able to serve the 69 kV area independently for loss of one.



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AEP Transmission Zone: Supplemental
Hazard Station

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Selected Solution:

Install a new 3000 A 40 kA 138 kV circuit breaker at Hazard station on the line exit towards Beckham station. (s1412.1)

Add a 138 kV circuit switcher to the high side of transformer #4. (s1412.2)

Replace 138 kV capacitor bank and switcher BB with a new switcher and 43.2 MVAR capacitor bank. (s1412.3)

Replace 138/69 kV transformers #1 and #2 with new 138/69 kV 130 MVA transformers with 138 kV circuit switchers on the high side and 3000 A 40 kA 69 kV breakers on the low side. (s1412.4)

Replaces 69 kV circuit breakers S, E, and F with 3000 A 40 kA 69 kV circuit breakers with a bus tie 3000A 69 kV circuit breaker being installed between the existing 69 kV box bays. (s1412.5)

Replace 69 kV capacitor bank and switcher CC with a new switcher and 28.8 MVAR capacitor bank. 69 kV capacitor bank and switcher AA will be retired.

Replace 161 kV circuit breaker M towards Wooton with a 161 kV 3000 A 40 kA breaker. ~~(s1412.6)~~ This work is already included in the baseline project (b2761).

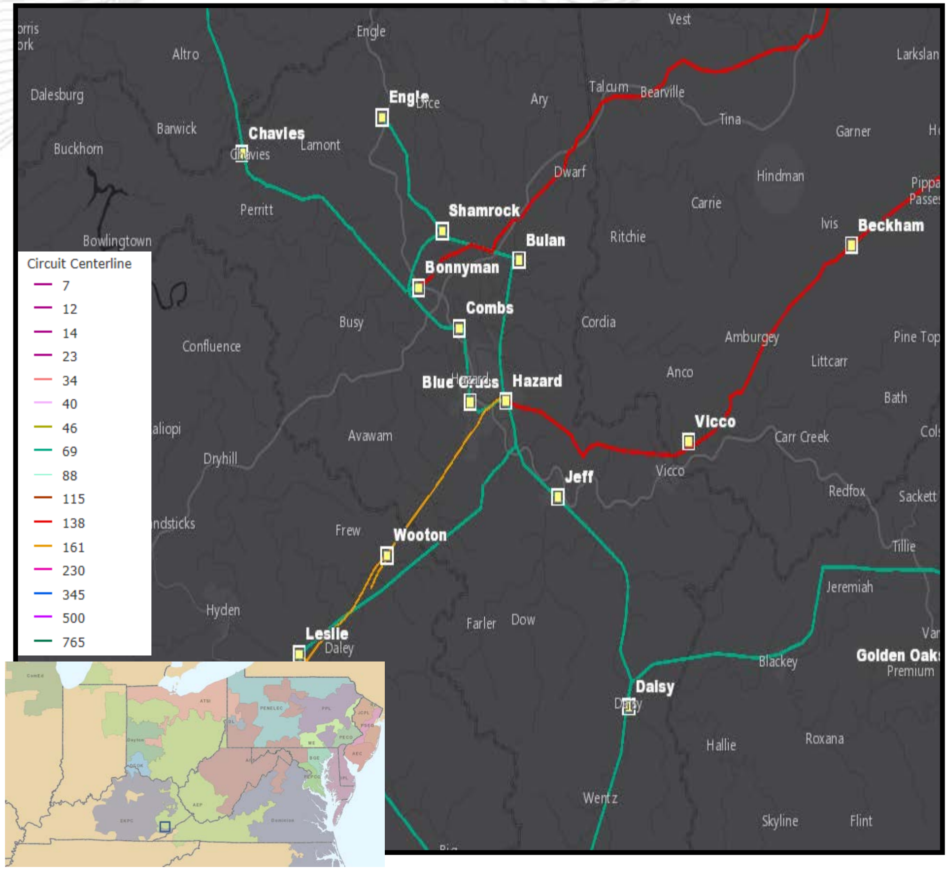
Add a 3000 A 40 kA 138 kV circuit breaker to the low side of 161/138 kV transformer #3. ~~(s1412.7)~~ This work is already included in the baseline project (b2761).

Address safety and access issues associated with existing equipment platforms and drainage issues at the station. (s1412.8)

Estimated Transmission Cost: ~~$20.0M~~ $23.3 M

Projected In-service: 12/31/2019

Project Status: Scoping



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DATA REQUEST

KPSC 2_9 Refer to Kentucky Power's response to Staff's First Request, Item 5.a.

a. Provide a brief description of an electrical discharge of high energy, thermal faults, stray gassing, and overheating due to system conditions and explain what causes these events.

b. Explain the cause of the Transformer #4 failure in May 2017 and provide the life expectancy of that transformer at the time of its failure.

RESPONSE

a. The term "electrical discharges of high energy" refers to electrical faults where the level of electric current rises to the highest level the electrical grid can supply. These high currents flow through the transformer windings and produce powerful electromechanical forces that attempt to push the windings apart. Depending on the number of faults and the amount of energy contained in the faults, the windings can move and loosen resulting in under-oil arcing and hot spots (thermal faults).
Stray gassing refers to unexpected gas formations at lower temperatures (usually between 80 and 250 degrees Celsius). The stray gases are dissolved in the transformer insulating oil and can also migrate to the nitrogen filled gas space that is located above the insulating oil in the transformer tank.

A thermal fault is a high temperature hot spot in the winding of the transformer that may not produce an arc but is of sufficiently high temperature to degrade the cellulosic (paper) insulation of the windings.

Internal arcing represents a rapid release of electrical energy which causes deterioration of the insulation materials.
Internal arcing, thermal faults, stray gassing and overheating are conditions that can be detected by the concentration of dissolved gases in the oil (Dissolved Gas Analysis). Combustible gases that have migrated to the gas space above the transformer insulating oil can be detected by a Total Combustible Gas Analysis (TCG) test. The TCG test does not identify the individual types of combustible gases present, but does give a percent of total combustible gases.

Internal arcing in the transformer can be detected by elevated levels of acetylene in the insulating oil inside the transformer. A breakdown in the dielectric strength of the winding insulation and the insulating oil due to external faults, contamination, or other causes can lead to the formation of arcing inside the tank of the transformer.

Thermal faults are evidenced by assessing the levels of carbon monoxide, carbon dioxide, ethane, and ethylene in the insulating oil inside the transformer. Carbon monoxide and carbon dioxide result from overheating of the paper insulation of the windings while ethane and ethylene result from degradation of the transformer insulating oil.

System conditions that can contribute to the above events include tree or other vegetation contact with the conductors, high winds blowing the conductors together, failures of line and station equipment, heavy ice and snow loading, animals, vandalism, forest fires, vehicle accidents, and lightning strikes.

There have been 36 events where forced outage events on facilities connected to equipment at the Hazard Substation has directly caused the 138/69kV Transformers #1 & #2 to experience through faults (AG 2-1).

b. The failure of Transformer # 4 in May 2017 was a winding failure. A Transformer Turns Ratio (TTR) test confirmed the cause. This test was conducted after a sudden pressure alarm caused Transformer #4 to trip out of service.

Transformer #4 was manufactured in 1990. Based on the life expectancy of similar transformers, Transformer # 4 would have been expected to have 20 or more years of remaining life expectancy at the time of its failure.

January 29, 2020 Supplement

The response is supplemented to identify Mr. Lasslo as the witness.

Witness: Michael G. Lasslo

VERIFICATION

The undersigned, Michael G. Lasslo, being duly sworn, deposes and says he is the Reliability Manager for Kentucky Power, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Michael G. Lasslo

Commonwealth of Kentucky)
) Case No. 2019-00154
County of Perry)

Subscribed and sworn before me, a Notary Public, by Michael G. Lasslo this 22 day of January, 2020.

Notary Public

My Commission Expires JUNE 21, 2022

VERIFICATION

The undersigned, Kamran Ali, being duly sworn, deposes and says he is the Managing Director of Transmission Planning, American Electric Power Service Corporation, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Kamran Ali (signature)

Kamran Ali

State of Ohio)
) Case No. 2019-00154
County of Franklin)

Subscribed and sworn before me, a Notary Public, by Kamran Ali this 27th day of January, 2020.

Ronda K. Megger (signature)

Notary Public

My Commission Expires

NOTARY PUBLIC STATE OF OHIO

RONDA K. MEGGER
Notary Public, State of Ohio
My Commission Expires
April 20, 2023