

**KyPSC Case No. 2024-00152**  
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VERIFICATION

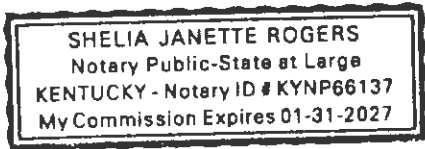
STATE OF OHIO                                    )  
  )  
COUNTY OF HAMILTON                        )        SS:

The undersigned, J. Michael Geers, Manager Environmental Services, being duly sworn deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information, and belief.

  
\_\_\_\_\_  
J. Michael Geers, Affiant

Subscribed and sworn to before me by J. Michael Geers on this 30<sup>th</sup> day of September, 2024.

  
\_\_\_\_\_  
NOTARY PUBLIC



My Commission Expires: 1-31-2027

VERIFICATION

STATE OF NORTH CAROLINA )  
 )  
COUNTY OF ~~MECKLENBURG~~ <sup>81</sup> ) SS:  
 Lincoln )

The undersigned, Matt Kalemba, Vice President Integrated Resource Planning, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

*Matt Kalemba*  
Matt Kalemba Affiant

Subscribed and sworn to before me by Matt Kalemba on this 2 day of October 2024.

SHEILA LEMOINE  
Notary Public, North Carolina  
Lincoln County  
My Commission Expires  
July 21, 2029

*Sheila Lemoine*  
NOTARY PUBLIC

My Commission Expires: July 21, 2029



VERIFICATION


STATE OF Kentucky )  
 )  
COUNTY OF Pendleton )

SS: **MADISON BRADIE WYATT**  
Notary Public, Kentucky State at Large  
My Commission Expires Aug. 8, 2026  
Notary ID# KYNP56797

The undersigned, Brett Riggins, GM III Reg Stations, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

  
Brett Riggins, Affiant

Subscribed and sworn to before me by Brett Riggins on this 6<sup>th</sup> day of September, 2024.

  
NOTARY PUBLIC

My Commission Expires:

VERIFICATION

STATE OF NORTH CAROLINA        )  
  )  
COUNTY OF MECKLENBURG        )        SS:

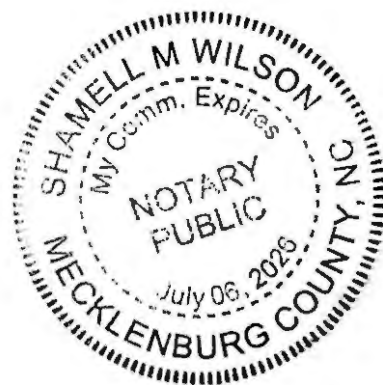
The undersigned, John Verderame, VP Fuels & Systems Optimization, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

John Verderame  
John Verderame, Affiant

Subscribed and sworn to before me by John Verderame on this 28 day of August, 2024.

[Signature]  
NOTARY PUBLIC

My Commission Expires:



**Duke Energy Kentucky**  
**Case No. 2024-00152**  
**STAFF Second Set of Data Requests**  
**Date Received: September 20, 2024**

**PUBLIC STAFF-DR-02-001**

**REQUEST:**

Refer to Duke Kentucky's response to Commission Staff's First Request for Information (Staff's First Request), Item 2(a).

a. Explain, in detail, the process Duke Kentucky used to calculate the East Bend dispatch cost of a basket of market coals that is optimized to derive a blended product that serves as a least-cost market dispatch coal, inclusive of coal cost, reagent costs, and transportation.

b. Provide the calculation for quicklime that resulted in a blended coal that had a #5.62 SO<sub>2</sub> content and a heat content of 11703 Btu/lb. Include in the response any associated work papers or sources used for the calculation.

c. Provide the derivation of the dispatch cost and the escalation from \$3.83/MMBtu to \$4.19/MMBtu over the model horizon. Include in the response any associated work papers or sources used for the calculation.

d. Provide the calculation for the limestone scenario that resulted in the modeled coal of #6 SO<sub>2</sub> product at 11782 Btu/lb. Include in the response any associated work papers or sources used for the calculation.

e. Provide the derivation of the dispatch cost escalating from \$2.77/MMBtu to \$2.97/MMBtu over the model horizon from the limestone scenario. Include in the response any workpapers or sources used for the calculation.



**CONFIDENTIAL PROPRIETARY TRADE SECRET**

a. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

b. Please see STAFF-DR-02-001 Confidential Attachment 1. Optimized blend data can be found in columns J through M of the “East Bend Optimizer.” Additional information on price inputs and assumptions can be seen on the “Placeholder” tab.

c. Please see STAFF-DR-02-001 Confidential Attachment 1. Optimized blend data can be found in columns J through M of the “East Bend Optimizer.” Additional information on price inputs and assumptions can be seen on the “Placeholder” tab.

d. Please see STAFF-DR-02-001 Confidential Attachment 2. Optimized blend data can be found in columns J through M of the “East Bend Optimizer.” Additional information on price inputs and assumptions can be seen on the “Placeholder” tab.

e. Please see STAFF-DR-02-001 Confidential Attachment 2. Optimized blend data can be found in columns J through M of the “East Bend Optimizer.” Additional information on price inputs and assumptions can be seen on the “Placeholder” tab.

**PERSON RESPONSIBLE:** Ryan Trogstad

**CONFIDENTIAL PROPRIETARY TRADE  
SECRET**

**STAFF-DR-02-001  
CONFIDENTIAL ATTACHMENTS 1 & 2**

**FILED UNDER SEAL**

**Duke Energy Kentucky**  
**Case No. 2024-00152**  
**STAFF Second Set of Data Requests**  
**Date Received: September 20, 2024**

**STAFF-DR-02-002**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 23. Confirm Duke Kentucky believes there is no beneficial reuse of the new wet flue gas desulfurization (WFGD) byproduct. If confirmed, explain why. If not confirmed, explain what beneficial uses Duke Kentucky foresees for the WFGD byproduct.

**RESPONSE:**

Duke Energy Kentucky believes there is no beneficial reuse of the new wet flue gas desulfurization (WFGD) byproduct. The East Bend FGD system operates under inhibited oxidation conditions which means that it does not produce saleable gypsum which requires a forced oxidation process. The byproducts produced by the WFGD system are combined with a small amount of fixation lime to produce a solid stabilized product that landfill.

**PERSON RESPONSIBLE:** J. Michael Geers

**Duke Energy Kentucky**  
**Case No. 2024-00152**  
**STAFF Second Set of Data Requests**  
**Date Received: September 20, 2024**

**STAFF-DR-02-003**

**REQUEST:**

Refer to the Direct Testimony of J. Michael Geers (Geers Direct Testimony), page 13, lines 18-19.

- a. Provide the latest status of the filed application.
- b. Provide a monthly update on the status of this application during the pendency of this case.

**RESPONSE:**

As stated in direct testimony, the project only requires minor air source permitting. The Company filed the necessary application on July 17, 2024. The permit application's 60-day review window has expired, and from a permitting standpoint, the Company is authorized to begin construction. No further status updates are necessary.

**PERSON RESPONSIBLE:** J. Michael Geers

**Duke Energy Kentucky  
Case No. 2024-00152  
STAFF Second Set of Data Requests  
Date Received: September 20, 2024**

**STAFF-DR-02-004**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 13. This response was unresponsive. Provide clarification of the planned retirement date of the East Bend facility. Include in the clarification a specific year.

**RESPONSE:**

Based on current laws and regulations, including the EPA CAA Section 111 Update, the 2024 IRP plans for an East Bend Station retirement date of 12/31/2038.

**PERSON RESPONSIBLE:** Matthew Kalemba

**Duke Energy Kentucky**  
**Case No. 2024-00152**  
**STAFF Second Set of Data Requests**  
**Date Received: September 20, 2024**

**STAFF-DR-02-005**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 14 and the Engineering, Procurement, and Construction (EPC) contract with AECOM. Provide:

- a. All additional cost data, including any additional estimates;
- b. The response to the Request for Proposal (RFP) AECOM provided, including projections for expenses associated with the EPC contract such as the cost for front end design and engineering and the development of a construction bid package already provided.

**RESPONSE:**

Please see STAFF-DR-02-005 Attachments 1, 2, and 3.

**PERSON RESPONSIBLE:** Troy Wilhelm



AECOM  
13640 Briarwick Drive, Suite 200  
Austin, TX 78729  
aecom.com

**Project name:**  
East Bend LS Conversion Project

**To:**  
Troy Wilhelm  
Duke Energy

**From:**  
Julie Harkin

**Date:**  
May 31, 2024

Letter: AECOM-0001

**Subject: East Bend Limestone Conversion Pricing Update Rev 1**

Dear Mr. Wilhelm,

The following is an update to the letter submitted on May 15, 2024.

### **Background**

AECOM completed the Limestone Conversion Phase I Study for Duke Energy in August 2022. The estimate was developed based on a combination of vendor quotes, estimating tools and reference data. The estimate was reflective of current day pricing as of the issue date of the study and did not include escalation (other than labor on engineering and construction management services), taxes, elevated insurance requirements or any Owner's costs. Contingency was included, but it was stated that the contingency was for cost estimate inaccuracies caused by uncertainties in the project definition but did not include costs for equipment and material escalation.

### **May 2024 Pricing Update**

As AECOM was nearing completion of the CPCN study, Duke Energy requested a pricing update to support the CPCN cost submittal. It was agreed that new equipment quotes would be obtained for major equipment, and construction commodity pricing and material costs would be updated by the AECOM estimating team. Any changes in scope, execution approach or assumptions from the 2022 study are not included in this pricing, as these items are covered in a subsequent section. The following table shows the results of this pricing update.



Category	Aug-22 Estimate Costs	May-24 Estimate Costs	Delta \$	Delta %
Engineering (includes travel)	\$5,375,000	\$5,740,000	\$365,000	7%
Procurement	\$15,195,000	\$15,205,000	\$10,000	0%
Construction/Subs	\$13,860,000	\$15,200,000	\$1,340,000	10%
Construction Management	\$3,170,000	\$3,250,000	\$80,000	3%
Contingency	\$4,120,000	\$4,390,000	\$270,000	7%
Fee	\$3,350,000	\$3,515,000	\$165,000	5%
<b>Total</b>	<b>\$45,070,000</b>	<b>\$47,300,000</b>	<b>\$2,230,000</b>	<b>4.9%</b>

In summary the pricing increase over an approximate 2-year period is below 5%, which comes out to about 2.5% per year. The costs for the procurement of the engineered equipment changed very little from the previous estimate, while the construction costs increased around 10% due to inflation in labor costs and certain materials.

**Modifications From Study Estimate Basis**

Changes to the 2022 estimate basis were identified during the execution of the CPCN study and the FEED kickoff meeting. These include changes in scope and execution approach as compared to the 2022 study. For the sake of clarity AECOM is presenting the pricing for scope and execution changes separately from the pricing update. The following table shows the total installed pricing (engineering, materials, construction, contingency and fee) associated with these changes, along with a brief description of the change.

Please note that some of these potential changes were only recently identified during the FEED kickoff. As such, the scope of some items is not well defined, and the estimating approach is related to a feasibility estimate, and therefore should only be considered preliminary or indicative. For the estimating methodology, some costs were derived from factored historical equipment costs, while others are based on budgetary quotes. For commodities, quantities were factored based on changes from the original scope. As the FEED progresses, the scope and costs of these items will be further refined.

### Clarifications and Assumptions

- Changes to the limestone pre-crusher technology are not included.
- Changes to the limestone storage silo for increased loading are not included. Currently the scope includes derating the volumetric capacity of the silo.
- Changes from use of vertimills to horizontal ball mills are not included.
- Ductwork repairs for higher air leakage are not included.
- The schedule duration begins with detailed design starting in May 2024, construction mobilization in the fall of 2025 and completion in December 2026.
- This estimate is non-binding and developed for use in budgeting, any continued work will be subject to mutually agreeable terms, conditions, scope and schedule.
- Assumes warranty requirements will be passed through to vendors and subcontractors.
- No costs are included for bonds, taxes or licenses.
- No permitting or permitting support is included.
- Assumes schedule liquidated damages will be included in subcontractor and critical vendor contracts but are not included in the prime agreement.
- Mutually agreeable performance guarantees to be provided for SO<sub>2</sub> emissions.
- Pricing for a modification to the thickener rake is not included.
- Pricing for ductwork repairs is not included.

Attachment 1

#	Item	Cost	Description
1	Conveyor Walkway	\$ 159,000	The estimate basis in the 2022 study included two conveyors with walkways on one side. During the CPCN development, Duke Energy requested the scope be modified for walkways on both sides of these two conveyors.
2	Weighbelt Feeder	\$ 205,000	Cost includes 4 Merrick weigh belt feeders rather than a generic brand.
3	Material Unloading	\$ 116,000	During the site walkdown, it was identified that the unloading hopper needed to be evaluated for the material change, the flowability study of the hopper is included for 3 limestone options. The profile plate has been deducted since this already exists, the cost provided is the net increase. The wear plates are included in the base scope with an estimate of \$95k.
4	Vertimill Enclosure	\$ 3,477,000	Duke Energy requested that the Vertimill Enclosure be a separate structure and include a maintenance bay. The size of the new enclosure is assumed to be 81'x83' and 77' tall which is a 120% increase in volume when compared to the study layout. This estimate increases the steel tonnage based on historical volumetric indices and the foundation is factored by the new footprint dimensions. Additional detail can be found in Attachment 2.
5	Reagent Prep	\$ 264,000	Duke Energy requested that a second Vertimill screw stand assembly be included as well as 11 ball storage bins. The pricing does not include a spare grinding auger.
6	Dust collector	\$ 325,000	With the new vertimill enclosure location, an additional dust collector has been added for the material handling system in that area along with 4-8" outage tie-points including associated duct work.
7	Crossover Tie	\$ 425,000	A new FRP crossover piping tie is included for each absorber module and a total of 6 new manual isolation valves are included to provide flexibility for 4 or 3 pump operation.
8	ME Filters	\$ 80,000	This cost includes a new Gravity Filter Bank for the ME system.
9	Thickener Underflow	\$ -	The costs for the thickener underflow flush modifications was included included in the CO2 estimate performed during the CPCN.
10	Agitator Analysis	\$ -	Duke has determined that the agitator orientation is correct. Costs have been removed.
11	Tank Coating	\$ 441,000	During the site walkdown, Duke Energy indicated that the Limestone Tank and the Sludge Tank needed to be relined. This estimate is an allowance for an abrasion resistant flake glass type liner.
12	CRW System Recommendations	\$ 810,000	Cost includes eight automated valves at \$40K each and allowances for: piping, cabling, raceways, and I/O. Pump impeller trimming is assumed to be by Duke prior to LSIO construction activities.
13	Construction productivity	\$ 685,000	Duke Energy explained that the forthcoming specifications will include robust construction execution requirements, a factor of 5% of construction labor has been added for this requirement for the subcontractor and construction management time has been included for this additional effort.
14	Engineering	\$ 304,000	The original engineering execution plan included a more streamlined approach, obtain procurement bids and proceed directly with placing orders, vendor engineering and fabrication. The current plan is a hold point to wait for the CPCN approval and then refresh quotes that have exceeded the bid validity period.
15	Escalation	\$ 1,558,000	The estimate basis in the 2022 study was that the pricing was in current day pricing, due to market volatility, escalation was not included for the timing of the procurement and construction award dates. This cost escalates procurements by 3% (based on May 24 to May 25 award) and construction by 4.5% (based on on May 24 to Aug 25 award).
16	FFP Execution	\$ 2,800,000	The estimate basis in the 2022 study was an open book contracting approach. This fixed price adder applies to the entire scope, original plus new scope items. An additional 5% of the project total estimate was included for risks associated with firm fixed price delivery.
<b>Total Changes</b>		<b>\$ 11,649,000</b>	

Attachment 2

The following table shows the changes to the Enclosure and Foundation costs for the Reagent Prep Grinding System as the estimate has progressed. The second table shows the breakout of the items included in the estimate for the enclosure and the foundations.

<b>Reagent Prep Grinding System</b>	<b>Materials</b>	<b>Construction</b>	<b>Total</b>
2022 Study			
Enclosure	\$ 1,715,000	\$ 2,066,000	\$ 3,781,000
Foundations	\$ 172,000	\$ 640,000	\$ 812,000
2022 Study Total			\$ 4,593,000

2022 Study Escalated to 2024			
Enclosure	\$ 1,725,000	\$ 2,178,000	\$ 3,903,000
Foundations	\$ 267,000	\$ 980,000	\$ 1,247,000
2022 Study Escalated to 2024 Total			\$ 5,150,000

2024 Updated Scope			
Enclosure	\$ 2,327,000	\$ 2,952,000	\$ 5,279,000
Foundations	\$ 481,000	\$ 1,721,000	\$ 2,202,000
2024 Update Total			\$ 7,481,000

Change (Updated Scope - 2022 Study Escalated to 2024)			\$ 2,331,000
Sub Markups, Freight			\$ 173,000
Engineering			\$ 350,000
Contingency			\$ 339,000
Fee			\$ 284,000
Total Change			\$ 3,477,000

The following details the items and quantities for the 2024 Updated Scope total.

**Enclosure**

WBS-Level 4	WBS-Level 5	Construction	WBS-Level 6	User Description	User Details	Qty	UM
Grinding System	Enclosure	01 - Civil	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof (ID:20)	READY-MIX CONC. - TYPE B	59	CY
Grinding System	Enclosure	01 - Civil	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof (ID:20)	Rebar	4	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	0-20 # per ft	119	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	100 # and > per ft	95	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	20-40 # per ft	58	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	40-100 # per ft	104	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	BEAMS W14X34	7	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	Galv Grate	2,363	SOFT
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	Hand rail	683	FEET
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	INSULATED ROOFING	4,874	SOFT
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	INSULATED SIDING & DOORS	27,338	SOFT
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Ladders	LADDER AND CAGE	54	VLF
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	Ventilation	Louvers 4'X4'	27	EACH
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	Mandoors	4	EACH
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	METAL DECKING	2,770	SOFT
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	Roll Up Door-15'x15'	3	EACH
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCL Side & Roof	Sag Rods	4	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	Stair rail	500	TONS
Grinding System	Enclosure	02 - Structural	Vertimill Enclosure Steel	S-VTM ENCLOSURE	Stair treads	108	FEET
Grinding System	Enclosure	04 - Mech Equipment	AECOM	Bridge Crane	50 ton bridge crane - 44' span	1	EACH
Grinding System	Enclosure	04 - Mech Equipment		Heaters	Heaters	10	EACH
Grinding System	Enclosure	04 - Mech Equipment		Ventilation	Vent fans - 2' x 2'	54	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(357) NON-METAL PIPE ERECTION	BOLT UP CONNECTIONS 3 IN	11	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(357) NON-METAL PIPE ERECTION	BOLT UP CONNECTIONS 4 IN	14	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(345) LINED VALVES	CHECK V 4 IN 150 CLASS	3	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	ELBOW 3 IN	4	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(351) NON-METAL FIELD MATERIAL	ELBOW 4 IN	7	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(366) PIPE HANGERS, SHOES ETC	ERECT PREFAB PIPE SUPP. 4 IN	27	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(366) PIPE HANGERS, SHOES ETC	ERECT PREFAB PIPE SUPP. 3 IN	22	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	FLANGE 3 IN	11	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(351) NON-METAL FIELD MATERIAL	FLANGE 4 IN	14	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(345) LINED VALVES	GATE V 3 IN 150 CLASS	3	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(345) LINED VALVES	GATE V 4 IN 150 CLASS	3	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(351) NON-METAL FIELD MATERIAL	JOINT KIT	43	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	JOINT KIT	46	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	PIPE 3 IN	162	FEET
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(351) NON-METAL FIELD MATERIAL	PIPE 4 IN	216	FEET
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	REDUCR 3 IN	3	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-3" FRP PIPE	(351) NON-METAL FIELD MATERIAL	TEE 3 IN	3	EACH
Grinding System	Enclosure	05 - Piping	Piping to and From Enclosure Sump-4" FRP PIPE	(351) NON-METAL FIELD MATERIAL	TEE 4 IN	1	EACH
Grinding System	Enclosure	06 - Electrical Equipment	VTM Building & PDC Building	Lighting - Fixtures	1" Pendant Mount Light Fixture Hanger	36	EACH
Grinding System	Enclosure	06 - Electrical Equipment	VTM Building & PDC Building	Receptacle Pow er	120V Receptacles (20A)	22	EACH
Grinding System	Enclosure	06 - Electrical Equipment	VTM Building & PDC Building	Lighting - Fixtures	Pendant Mount Light Fixture	22	EACH
Grinding System	Enclosure	06 - Electrical Equipment	VTM Building & PDC Building	Lighting - Fixtures	Pendant Mount Light Fixture Emergency w/ Battery Pack	15	EACH
Grinding System	Enclosure	07 - Instrumentation		VTM Fire Detection	Fire detection monitors and cabling	1	LOT

**Foundations**

WBS-Level 4	WBS-Level 5	Construction	WBS-Level 6	User Description	User Details	Qty	UM
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	ANCHORS AND EMBEDMENTS	3266	LBS
Grinding System	Foundations	01 - Civil	Vertimill and Sump Tank Foundation	C-VTM	ANCHORS AND EMBEDMENTS	520	LBS
Grinding System	Foundations	01 - Civil	Mill Product Tank Foundations	C-MPT FDN	ANCHORS AND EMBEDMENTS	180	LBS
Grinding System	Foundations	01 - Civil	Classifier Pump Foundations	C-CP FDN	ANCHORS AND EMBEDMENTS	120	LBS
Grinding System	Foundations	01 - Civil	Recycle Pump Foundations	C-RP FDN	ANCHORS AND EMBEDMENTS	90	LBS
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	FORMWORK FABRICATION & INSTALLATION	4480	SOFT
Grinding System	Foundations	01 - Civil	Vertimill and Sump Tank Foundation	C-VTM	FORMWORK FABRICATION & INSTALLATION	670	SOFT
Grinding System	Foundations	01 - Civil	Mill Product Tank Foundations	C-MPT FDN	FORMWORK FABRICATION & INSTALLATION	88	SOFT
Grinding System	Foundations	01 - Civil	Recycle Pump Foundations	C-RP FDN	FORMWORK FABRICATION & INSTALLATION	40	SOFT
Grinding System	Foundations	01 - Civil	Classifier Pump Foundations	C-CP FDN	FORMWORK FABRICATION & INSTALLATION	30	SOFT
Grinding System	Foundations	01 - Civil	Vertimill and Sump Tank Foundation	C-VTM	GROUT	3	CY
Grinding System	Foundations	01 - Civil	Mill Product Tank Foundations	C-MPT FDN	GROUT	2	CY
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	HAND EXCAVATION	26	CY
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	IMPORTED FILL	586	CY
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	MACHINE EXCAVATION	1247	CY
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	READY-MIX CONC. - TYPE B	1112	CY
Grinding System	Foundations	01 - Civil	Vertimill and Sump Tank Foundation	C-VTM	READY-MIX CONC. - TYPE B	73	CY
Grinding System	Foundations	01 - Civil	Mill Product Tank Foundations	C-MPT FDN	READY-MIX CONC. - TYPE B	12	CY
Grinding System	Foundations	01 - Civil	Recycle Pump Foundations	C-RP FDN	READY-MIX CONC. - TYPE B	2	CY
Grinding System	Foundations	01 - Civil	Classifier Pump Foundations	C-CP FDN	READY-MIX CONC. - TYPE B	1	CY
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	REBAR INSTALL.- TYPE S	112	TONS
Grinding System	Foundations	01 - Civil	Vertimill and Sump Tank Foundation	C-VTM	REBAR INSTALL.- TYPE S	5	TONS
Grinding System	Foundations	01 - Civil	Mill Product Tank Foundations	C-MPT FDN	REBAR INSTALL.- TYPE S	1	TONS
Grinding System	Foundations	01 - Civil	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	SEAL SLAB - TYPE A CONC.	44	CY
Grinding System	Foundations	02 - Structural	Vertimill Enclosure Foundation	C-VTM ENCLOSURE	1INx3/16IN MBG	800	SOFT

<b>CLIENT:</b>	Duke Energy	<b>AECOM</b>			<b>DATE:</b>	11-Apr-24
<b>PROJECT:</b>	CPCN CO-002				<b>PREPARED BY:</b>	MLH/TML
<b>LOCATION:</b>	East Bend					
<b>JOB NO.:</b>						
<b>REV NO.:</b>	A					
<b>TOTAL SUMMARY by WBS</b>						
<b>WBS</b>	<b>DESCRIPTION</b>	<b>FIELD WORKHOURS</b>	<b>FIELD LABOR TOTAL COST</b>	<b>MATERIAL</b>	<b>TOTAL DIRECT</b>	<b>NOTES</b>
1	30 Day Silo Mods	29	\$ 2,448	\$ 25,457	\$ 27,905	
2	Pump Refurbishment	406	\$ 34,476	\$ 1,114,792	\$ 1,149,268	Duke quote
4	Sulfur Feed System	2,874	\$ 244,290	\$ 453,361	\$ 697,651	AECOM quote (similar)
5	Rotate Agitator	239	\$ 20,318	\$ -	\$ 20,318	
6	Nuclear Density Meter	216	\$ 18,360	\$ 68,037	\$ 86,397	AECOM quote
7	Lakos Filter Piping	164	\$ 13,909	\$ 15,565	\$ 29,474	
8	Clamshell	96	\$ 8,160	\$ 104,000	\$ 112,160	
9	ME Wash Valves	440	\$ 37,365	\$ 49,681	\$ 87,046	
10	Pugmill	1,440	\$ 122,400	\$ 325,899	\$ 448,299	Duke quote
11	Automated Flush	5,229	\$ 458,028	\$ 422,328	\$ 880,356	
13	4160 Breakers	19	\$ 1,632	\$ 100,000	\$ 101,632	Duke quote
14	Mag Separator	86	\$ 7,344	\$ 50,173	\$ 57,517	AECOM quote
	<b>SUBTOTAL DIRECT COST</b>	<b>11,237</b>	<b>\$ 968,730</b>	<b>\$ 2,729,293</b>	<b>\$ 3,698,023</b>	<b>Sum of WBS total directs</b>
	<b>SUBTOTAL INDIRECT FIELD COST</b>				<b>\$ 1,065,945</b>	<b>Factored</b>
	<b>SUBTOTAL ENGINEERING</b>				<b>\$ 829,054</b>	<b>Factored</b>
	<b>TOTAL</b>				<b>\$ 5,593,022</b>	<b>Sum of Direct + Indirect + Engineering</b>

The estimate does not include owner's costs, insurance, taxes, bonds, permits, contingency, escalation, schedule, equipment delivery, or process performance guarantees

## Duke Energy

### East Bend Limestone Conversion Project

### Front End Engineering & Design (FEED) Proposal

#### **1. Background**

AECOM completed a study for the East Bend Station to convert the FGD system reagent from magnesium enhanced lime to limestone in 2022. The scope of the study included technical feasibility assessment, capital cost estimate for the conversion, and operating costs based on the reagent conversion. As a follow up to the study, AECOM developed a report to support Duke's Certificate of Public Convenience and Necessity (CPCN) application in April 2024. References to the CPCN report (CPCN Report) are included in this scope document.

In an effort to advance the design development and increase confidence in expected project costs, Duke has requested AECOM perform front end engineering and design tasks. The scope of work, schedule and pricing for these tasks are further defined below.

#### **2. Scope of Work**

AECOM is proposing the following scope of work.

##### **2.1 Engineering**

1. Design Basis – The Project Design Basis will be updated and issued to Duke for review and approval. Fundamental process conditions, such as air ingress impacts, will be confirmed as part of the review.
2. Process Flow Diagram – The Process Flow Diagram (PFD) will be updated and issued to Duke for review and approval. After review, the PFD will be updated and issued for design.
3. P&IDs – Existing P&IDs will be updated and new preliminary P&IDs will be developed for new systems. The P&IDs will be issued to Duke for review and approval.
4. Design Model – A 3D design model of the FGD area modifications, limestone material handling system, and the reagent preparation area will be developed in AutoCAD. Two virtual model reviews will be conducted with Duke.
5. General Arrangements - A new preliminary overall site plan will be developed for the FGD Area, material handling system, and reagent preparation area. Preliminary Area General Arrangements (including plans and elevations) will be developed.
6. Load List – A preliminary load list will be developed to capture new and abandoned electrical power users.
7. Single Line Diagrams (SLDs) – New SLDs will be developed for the material handling system and reagent preparation area.
8. Absorber Recycle (AR) Hydraulic Analysis – The AR system hydraulics will be finalized based on vendor nozzle data.
9. AR Piping – Preliminary piping drawings of the new external FRP piping will be developed.
10. AR Spray Headers – Drawings of the new 316SS recycle spray headers and supports will be developed.
11. I/O List – A preliminary net I/O list will be developed to support the RFP for the control system modifications.
12. Construction Lists – The following preliminary lists will be developed to support obtaining budgetary construction pricing.
  - 12.1 Process equipment list
  - 12.2 Manual valve list



- 12.3 Line list
- 12.4 Specialty item list
- 12.5 Instrument and automated valve list(s)
- 12.6 Cable schedule
- 12.7 Material take-offs for commodity items

## 2.2 Procurement

1. Supplier List - A recommended equipment supplier list will be developed for the engineered procurement packages identified in Table 2-1 for Duke's review and input.
2. Requests for Quotations (RFQs) - AECOM technical and commercial specifications will be developed to create an RFQ package. RFQs will be issued for the equipment packages identified in Table 2-1. The intent is that firm quotes will be received and used as the basis for awarding the equipment packages during the next phase of the project. Packages in Table 2-1 identified with an asterisk (\*) will be awarded during this phase. The 81.010 General Construction package listed in table 2-1 will be issued to obtain budgetary construction pricing.
3. Equipment Evaluations - Review and clarify equipment proposals for compliance with technical specifications. Develop a bid tabulation of compliant proposals. The technical bid tabulation will be provided for Duke's review.

**Table 2-1: Procurement WBS**

WBS Area	Package Number	Description
Common	81.112	Site Laser Scan*
Common	81.010	General Construction
Common	81.110	Site Survey*
Common	81.115	Geotechnical Investigation*
Material Handling	63.000	Flowability Study*
Material Handling	72.252	Material Handling System
Limestone Prep	71.114	Cranes and Hoists
Limestone Prep	72.250	Limestone Grinding System
Limestone Prep	72.257	Pre-Crusher
Limestone Prep	72.272	Dust Collector
Limestone Prep	73.300	Power Distribution Center (PDC) and Transformers
FGD	72.229	Mist Eliminator Wash Filters (Lakos and Pods)
FGD	72.214	Recycle Piping, FRP (External)
FGD	72.233	Recycle Pumps (Sheaves)
FGD	72.202	Recycle Spray Nozzles
FGD	72.212	Alloy Material (Absorber Internals)
FGD	72.216	Recycle Pipe Supports (External)
FGD	72.264	Sodium Formate System
Dewatering	72.246	Agitators

\* - Indicates packages to be awarded during FEED



## **2.3 Subcontracted Services**

The subcontracts listed below will be executed to support engineering and design activities. An AECOM project team member will be on site during the onsite activities.

1. Flowability Studies - Limestone Flowability Studies will be performed on the Storage Silo, modified Day Bin, and the pre-crusher outlet chute. The primary objective of the studies is to confirm the assumption that no geometry modifications are required on the Storage Silo, guide the detail design on the Day Bin outlet modifications, and provide design parameters for the pre-crusher outlet chute.
2. Geotechnical Investigation - A Geotechnical investigation will be performed in the area of the new vertical milling system to identify the foundation design requirements for this area.
3. Area Survey – A topographical survey will be performed. Major landmarks and structures will be identified. The survey will be tied back to plant benchmarks which are assumed to be part of the Kentucky State Plane coordinate system.
4. Laser Scan - A laser scan will be performed of selected project areas to optimize pipe routing and equipment arrangements.

## **2.4 General Activities**

In addition to the engineering and procurement scope of work outlined above, the following services will be provided:

1. Review Owner's Engineer technical specifications.
2. Prepare, issue, and evaluate construction budgetary bid package.
3. Project management and controls including development and maintenance of a project schedule for the FEED. A preliminary overall project schedule will also be developed in Primavera.
4. Participation in kickoff meeting and field investigation at East Bend Station with Duke personnel. Up to 7 AECOM personnel will attend the one-day meeting.
5. Participation in one conference call per week to review and discuss the project status. Meeting agendas will be prepared and meeting notes will be issued after meetings.
6. A project Action Item List will be maintained.
7. A change log will be developed to communicate and document additional requests beyond the contracted scope.

## **4. Schedule and Pricing**

This FEED is planned to extend for six months from the date of approval.

AECOM is proposing to execute the services work on a time and material basis in accordance with the terms and conditions established under the existing Master Environmental Alliance Partnership (MEAP) Agreement (Duke Maximo Master Contract #27545) between Duke Energy and AECOM with the exceptions noted in Section 5.

The T&M rate table is included in Attachment 1 and the anticipated monthly spend is as follows:



	Monthly Spend
May-24	\$ 250,000
Jun-24	\$ 350,000
Jul-24	\$ 500,000
Aug-24	\$ 500,000
Sep-24	\$ 350,000
Oct-24	\$ 287,000
Total	\$ 2,237,000

Invoices will be issued monthly and payments will be made 45 days after the invoice is issued.

### **5. Assumptions, Clarifications and Exceptions:**

The following is a list of key assumptions and clarifications as they relate to the scope of work for the proposed study:

1. One review cycle is planned for each deliverable issued for review via AECOM Document Control. Duke will consolidate all comments before returning. Documents will be reviewed, and comments returned by Duke, within five business days. If no comments are received, it will be assumed that there are no comments and AECOM will proceed as such.
2. Documents that will be issued for Client / Owner's Engineer review include: Design Basis, PFDs, P&IDs, General Arrangements, Load List and Single Line Diagrams.
3. A single PFD will be developed for the LSIO modifications.
4. It is assumed that twenty existing P&IDs will be updated and six preliminary P&IDs will be developed for new systems.
5. Engineering sketches will supplement drawings and construction lists in the construction bid package.
6. AECOM standard practices will be used for the security, storage, and sharing of project documents while in progress.
7. One site visit will be planned for the kick-off meeting.
8. Revision control of existing Duke drawings will utilize [complete revisions (e.g., Rev 2 to Rev 3) or partial revisions (e.g., Rev 2 to Rev 3A)]. (Duke to indicate preferred revision method). New AECOM drawings and documents will utilize letter revisions while drawings are in progress and under initial review. After documents and drawings have completed their review cycle, they utilize number revisions for working documents (IFC, IFD, etc.).
9. Computational Fluid Dynamics (CFD) analysis to help mitigate solids accumulation in the FGD inlet duct is currently not included in the scope. This CFD analysis can be added to the scope upon Duke's request.
10. AECOM technical and commercial specifications will be utilized for the Equipment and Construction procurements.
11. Duke will provide limestone samples to flowability study provider.
12. AECOM will electronically edit existing Duke drawings utilizing CAD software compatible with existing Duke drawings and develop new scope drawings in AutoCAD with an AECOM title block.
13. Any work subsequent to the FEED will be subject to mutually agreeable terms, conditions, scope and schedule.
14. Travel expenses and subcontracts will be marked up 10% of the actual costs.



**Attachment 1**

Duke Energy Role Name	T&M Rate	Hours
CAD Staff I	\$ 71.00	0
CAD Staff II	\$ 95.00	0
Designer I	\$ 143.00	852
Designer II	\$ 165.00	962
Engineer/Scientist I	\$ 90.00	478
Engineer/Scientist II	\$ 125.00	0
Engineer/Scientist III	\$ 143.00	1,631
Engineer/Scientist IV	\$ 165.00	1,797
Engineer/Scientist V	\$ 174.00	766
Engineer/Scientist VI	\$ 185.00	831
Principal Engineer/Scientist I	\$ 225.00	0
Principal Engineer/Scientist II	\$ 250.00	823
Project Professional I	\$ 79.00	56
Project Professional II	\$ 137.00	184
Project Professional III	\$ 188.00	84
Project Professional IV	\$ 225.00	27
Project Administrator	\$ 65.00	122
Project Controls I	\$ 99.00	290
Project Controls II	\$ 154.00	554
Project Manager	\$ 250.00	882
Subject Matter Expert	\$ 225.00	88
Total Hours		10,426
Total Labor		\$ 1,759,679
Travel Expenses		\$ 17,380
Subcontracts		
Flowability Study		\$ 302,148
Laser Scan		\$ 57,200
Geotech		\$ 28,600
Survey		\$ 28,600
10% Markup on Subs and Expenses		\$ 43,393
TOTAL FEED		\$ 2,237,000
*Duke Discount 1.5%	\$ 26,395	
** Rates are valid through September 30, 2024		

**Duke Energy Kentucky  
Case No. 2024-00152  
STAFF Second Set of Data Requests  
Date Received: September 20, 2024**

**STAFF-DR-02-006**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 15. Provide a summary from 2019 through the current year of the forced outages or derates by cause code and description for East Bend Station.

**RESPONSE:**

Please see STAFF-DR-02-006 Attachment.

**PERSON RESPONSIBLE:** John D. Swez

Duke Energy Kentucky  
 2024 Case 2024-00152  
 STAFF DR 2.06

Unit	Event Type	Event Start	Event End	Event Duration Hours	Equip MWh Lost	Outside Mgmt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	1/2/19 12:30 PM	1/2/19 5:00 PM	4.50	180		340	Other pulverizer problems	Wet coal
East Bend Steam-2	D1	1/21/19 7:25 AM	1/22/19 8:43 PM	37.30	962.34		340	Other pulverizer problems	MILL ISSUE
East Bend Steam-2	D4	1/23/19 3:01 AM	1/23/19 9:00 AM	5.98	338.66		1488	Air heater (regenerative)	2-1 Air Heater Air Drive Coupling
East Bend Steam-2	D4	1/24/19 5:01 AM	1/24/19 9:00 AM	3.98	1347.56		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D4	1/25/19 5:00 AM	1/25/19 9:27 AM	4.45	1561.99		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D4	1/27/19 5:00 AM	1/27/19 10:15 AM	5.25	1748.25		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D1	3/6/19 3:24 PM	3/6/19 4:55 PM	1.52	148		3811	Service water piping	FGD Service Water Line Leak
East Bend Steam-2	D1	3/8/19 10:04 PM	3/8/19 10:44 PM	0.67	23.99		250	Pulverizer feeders	2-5 Coal Feeder Issue
East Bend Steam-2	U1	3/30/19 3:00 PM	4/3/19 4:00 AM	85.00	51000		3110	Condenser tube leaks	Condenser Tube Leak
East Bend Steam-2	D1	5/6/19 12:00 AM	5/8/19 12:00 AM	48.00	10463.04		8250	Dampers other than bypass	A Module Dampers
East Bend Steam-2	D4	5/8/19 2:05 PM	5/8/19 9:00 PM	6.92	345.83		9656	Other stack or exhaust emissions testing - fossil	Stack Linearity Testing
East Bend Steam-2	D1	5/9/19 8:37 PM	5/9/19 10:57 PM	2.33	108.99		250	Pulverizer feeders	feeder issues
East Bend Steam-2	D1	5/15/19 2:42 PM	5/15/19 3:37 PM	0.92	50.99		310	Pulverizer mills	Loss of Mill
East Bend Steam-2	D4	5/15/19 4:01 PM	5/15/19 10:56 PM	6.92	775.01		3414	Feedwater pump local controls	2-2 BFP I/H Repairs
East Bend Steam-2	D4	5/28/19 4:00 AM	5/30/19 11:48 PM	67.80	13560		8230	Ducting	C Module Ductwork Repairs
East Bend Steam-2	U1	5/31/19 8:29 PM	6/1/19 1:22 PM	16.88	10130		4299	Other hydraulic system problems	#4 Throttle Valve Actuator Failure
East Bend Steam-2	D4	7/11/19 5:00 PM	7/11/19 10:00 PM	5.00	250		344	Pulverizer inspection	2-3 Pulverizer Inspection/Repairs
East Bend Steam-2	D1	7/20/19 3:33 AM	7/20/19 4:19 AM	0.77	79.99		250	Pulverizer feeders	2-1 Feeder Trips
East Bend Steam-2	D4	8/3/19 2:00 PM	8/3/19 8:15 PM	6.25	1250		8140	Reaction tanks including agitators	C Module Return to Service Issues
East Bend Steam-2	D1	9/3/19 1:30 PM	9/4/19 3:00 AM	13.50	3213		30	Coal conveyors and feeders	F Conv Fluid Drive
East Bend Steam-2	D1	9/9/19 3:20 PM	9/9/19 8:32 PM	5.20	254.8		250	Pulverizer feeders	2-1 Feeder Belt
East Bend Steam-2	U1	10/1/19 7:10 PM	10/4/19 2:00 AM	54.83	32900		3110	Condenser tube leaks	Condenser leak - chemistry issues
East Bend Steam-2	U1	11/24/19 10:12 PM	11/25/19 7:46 AM	9.57	5740		4300	Turbine supervisory system (use codes 4290 to 4299 for hyd	Unit trip due to vibration indication
East Bend Steam-2	U1	11/26/19 2:50 PM	11/26/19 6:40 PM	3.83	2300		4300	Turbine supervisory system (use codes 4290 to 4299 for hyd	#1 Bearing vibration indication
East Bend Steam-2	D1	12/3/19 12:14 PM	12/3/19 1:57 PM	1.72	249.36		250	Pulverizer feeders	2-2 No coal on belt
East Bend Steam-2	D1	12/6/19 7:48 PM	12/6/19 8:50 PM	1.03	140.12		250	Pulverizer feeders	2-3 No coal on belt
East Bend Steam-2	D4	12/14/19 5:00 AM	12/14/19 8:10 AM	3.17	475		1980	Boiler safety valve test	Setting safety valves
East Bend Steam-2	D4	12/16/19 5:00 PM	12/19/19 1:20 AM	56.33	1126.67		344	Pulverizer inspection	2-3 Pulverizer inspection and repairs
East Bend Steam-2	D1	12/18/19 8:39 PM	12/18/19 10:28 PM	1.82	282.87		250	Pulverizer feeders	2-1 and 2-4 No coal on belt
East Bend Steam-2	D1	12/21/19 7:41 PM	12/21/19 7:54 PM	0.22	5		3819	Other service water problems	Service water pressure issues
East Bend Steam-2	D4	12/26/19 12:00 PM	12/26/19 7:50 PM	7.83	783.33		920	Other slag and ash removal problems	Boiler DeSlag
East Bend Steam-2	D1	1/7/20 10:23 AM	1/7/20 10:51 AM	0.47	122		250	Pulverizer feeders	2-1 mill lost coal
East Bend Steam-2	D1	1/20/20 7:05 AM	1/20/20 7:08 AM	0.05	3		250	Pulverizer feeders	2-6 mill lost coal
East Bend Steam-2	D1	1/20/20 11:29 PM	1/21/20 12:07 AM	0.63	28.99		250	Pulverizer feeders	2-6 mill lost coal
East Bend Steam-2	D1	1/21/20 8:23 AM	1/21/20 9:04 AM	0.68	30		250	Pulverizer feeders	2-6 mill lost coal
East Bend Steam-2	D1	1/24/20 6:18 PM	1/24/20 6:33 PM	0.25	48		250	Pulverizer feeders	2-6 mill lost coal
East Bend Steam-2	D1	2/15/20 9:42 PM	2/15/20 10:03 PM	0.35	108		250	Pulverizer feeders	2-6 Feeder Plugged
East Bend Steam-2	D4	2/18/20 6:39 PM	2/19/20 1:30 AM	6.85	1164.5		310	Pulverizer mills	2-3 Pulverizer Plugged Feed Tube
East Bend Steam-2	D1	2/20/20 3:01 PM	2/20/20 3:23 PM	0.37	16		250	Pulverizer feeders	2-2 Lighter Trip
East Bend Steam-2	U1	3/2/20 3:20 PM	3/3/20 7:02 AM	15.70	9420		3420	Feedwater piping and supports	2-1 BFP Recirc. Flange Leak
East Bend Steam-2	D1	3/5/20 12:09 PM	3/5/20 12:14 PM	0.08	5		310	Pulverizer mills	2-1 Pulverizer Loss of Coal Flow
East Bend Steam-2	U1	6/1/20 9:45 PM	6/3/20 1:00 AM	27.25	16350		8261	Scrubber booster I.D. fan drive	2-2 IDBF VIV

Duke Energy Kentucky  
 2024 Case 2024-00152  
 STAFF DR 2.06

Unit	Event Type	Event Start	Event End	Event Duration Hours	Equiv MWh Lost	Outside Mgmt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	6/6/20 12:33 AM	6/6/20 11:00 PM	22.45	5941.17		8010	Crushers/mills	Vertimill Cleaning and 2-2 IDBF VIV
East Bend Steam-2	D1	6/6/20 11:00 PM	6/11/20 3:48 PM	112.80	4536.82		8261	Scrubber booster I.D. fan drive	IDBF VIV
East Bend Steam-2	D4	6/11/20 9:00 AM	6/11/20 5:20 PM	8.33	1120.83		8261	Scrubber booster I.D. fan drive	IDBF VIV
East Bend Steam-2	D4	6/24/20 10:00 AM	6/24/20 5:05 PM	7.08	1062.5		1471	Induced draft fan motors - variable speed	2-2 ID Fan Coolant Leak
East Bend Steam-2	D1	7/1/20 3:40 PM	7/1/20 4:55 PM	1.25	154		250	Pulverizer feeders	2-6 Coal Feeder Tripped
East Bend Steam-2	D1	7/9/20 6:05 PM	7/10/20 1:44 AM	7.65	951.28		8399	Solids conveying and mixing system problems	Lime Feed Conveyor Power
East Bend Steam-2	D1	7/22/20 11:56 AM	7/22/20 4:20 PM	4.40	1047.07		3410	Feedwater pump	2-2 BFPT Replace MOOG and duplex filters
East Bend Steam-2	D1	7/22/20 6:29 PM	7/23/20 1:30 AM	7.02	576.56		360	Burners	2-1 Mill 12R Burner Line Fire
East Bend Steam-2	D4	7/25/20 9:00 AM	7/25/20 12:00 PM	3.00	750		3410	Feedwater pump	2-2 BFPT MOOG Replacement
East Bend Steam-2	U1	7/25/20 11:18 PM	7/26/20 6:02 AM	6.73	4040		1450	Other air supply problems	High furnace pressure swing from slag fall.
East Bend Steam-2	D4	8/8/20 5:29 AM	8/8/20 11:15 AM	5.77	1037.65		8210	Valves	C Module Repairs - Replace CRW Makeup Bypass Valve
East Bend Steam-2	D1	8/14/20 11:27 PM	8/14/20 11:33 PM	0.10	2		250	Pulverizer feeders	Lost coal on 2-4
East Bend Steam-2	D4	8/15/20 1:53 AM	8/15/20 8:25 AM	6.53	1140.39		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D4	8/15/20 10:00 AM	8/15/20 11:20 AM	1.33	66.67		250	Pulverizer feeders	Replacement of 2-1 Feed Cleanout Conveyor
East Bend Steam-2	D1	8/20/20 1:30 PM	8/20/20 3:35 PM	2.08	41.67		3499	Other feedwater system problems	Feedwater Pressure Transmitter - Sent flow into bad quality
East Bend Steam-2	D4	8/29/20 8:00 AM	8/29/20 7:30 PM	11.50	550.05		250	Pulverizer feeders	2-3 Feeder Belt Replacement
East Bend Steam-2	D1	9/14/20 5:42 PM	9/14/20 6:08 PM	0.43	16		250	Pulverizer feeders	Pulverizer feeder 480V breaker would not close.
East Bend Steam-2	D1	9/17/20 2:13 PM	9/17/20 5:38 PM	3.42	872.34		360	Burners	Burner Fire
East Bend Steam-2	D1	9/18/20 10:10 AM	9/18/20 10:46 AM	0.60	182		250	Pulverizer feeders	Bunker rundown for outage
East Bend Steam-2	D4	9/18/20 4:50 PM	9/18/20 9:11 PM	4.35	1327.66		250	Pulverizer feeders	Bunker rundown for outage
East Bend Steam-2	D1	11/24/20 1:00 AM	11/25/20 4:15 AM	27.25	4802.27		1850	Boiler water condition (not feedwater water quality)	Startup Chemistry Issues
East Bend Steam-2	D1	11/25/20 4:15 AM	11/28/20 5:44 AM	73.48	2939.33		260	Primary air fan	2-4 Mill Trip on Low PA Flow
East Bend Steam-2	D4	11/28/20 4:33 AM	11/28/20 5:44 AM	1.18	456.79		4040	Bearings	High Vibration on HP Turbine
East Bend Steam-2	D1	12/2/20 8:16 PM	12/2/20 10:27 PM	2.18	109.17		253	Pulverizer feeder motor	2-4 Pulverizer Issues
East Bend Steam-2	D1	12/6/20 2:12 PM	12/6/20 4:22 PM	2.17	201		253	Pulverizer feeder motor	2-4 Feeder Motor Stopped
East Bend Steam-2	D4	12/10/20 4:00 AM	12/10/20 11:00 AM	7.00	1820		8010	Crushers/mills	Vertimill Heat Exchanger Tuning
East Bend Steam-2	D4	12/11/20 3:40 AM	12/11/20 11:00 AM	7.33	194.99		8010	Crushers/mills	Vertimill Heat Exchanger Tuning
East Bend Steam-2	D1	12/24/20 4:20 PM	12/24/20 4:35 PM	0.25	7.5		310	Pulverizer mills	2-4 Pulverizer Mill
East Bend Steam-2	D4	12/31/20 2:50 AM	12/31/20 10:53 AM	8.05	1610		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D1	1/1/21 7:49 PM	1/1/21 8:00 PM	0.18	2		310	Pulverizer mills	Starting 2-2 Pulv. Needed 6 mills in service to maintain load.
East Bend Steam-2	D1	1/8/21 1:00 PM	1/8/21 4:05 PM	3.08	418.99		8010	Crushers/mills	2-1 Vertimill Cleaning, 2-2 Vertimill Lime Slurry Transfer Pump Belt Replacement
East Bend Steam-2	D1	1/18/21 6:43 PM	1/20/21 6:22 AM	35.65	10435.47		1150	Second superheater	Boiler Slag, could not pull enough air
East Bend Steam-2	U1	1/25/21 8:38 PM	1/26/21 12:18 AM	3.67	2200		800	Drums and drum internals (single drum only)	Tripped due to drum level
East Bend Steam-2	U1	1/26/21 12:19 AM	1/26/21 1:42 AM	1.38	830		800	Drums and drum internals (single drum only)	Tripped due to drum level
East Bend Steam-2	D1	1/26/21 4:00 AM	1/27/21 8:20 AM	28.33	9281.72		3352	Feedwater chemistry (not specific to condenser, polishers,	Startup Chemistry Issues
East Bend Steam-2	U1	1/27/21 8:20 AM	1/29/21 4:44 PM	56.40	33840		3110	Condenser tube leaks	Condenser Tube Leak
East Bend Steam-2	D1	2/5/21 10:25 AM	2/5/21 1:17 PM	2.87	544.67		8010	Crushers/mills	Vertimill Screw Failure
East Bend Steam-2	D4	2/6/21 5:01 AM	2/6/21 9:00 AM	3.98	1195		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D4	2/6/21 11:30 AM	2/6/21 8:38 PM	9.13	456.67		335	Pulverizer lube oil system	Pulverizer Lube Oil Pump Replacement
East Bend Steam-2	D4	2/7/21 3:00 AM	2/7/21 8:15 AM	5.25	1575		920	Other slag and ash removal problems	DESLAG
East Bend Steam-2	D1	2/11/21 5:00 PM	2/11/21 6:14 PM	1.23	44.01		250	Pulverizer feeders	2-1 Feeder Lost Coal
East Bend Steam-2	D4	2/27/21 4:00 AM	3/1/21 4:59 AM	48.98	9796.67		8230	Ducting	FGD C Module Ductwork Leak Repairs

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Unit	Event Type	Event Start	Event End	Event Duration Hours	Equip MWh Lost	Outside Mgmt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	3/8/21 8:03 AM	3/8/21 8:08 AM	0.08	23		250	Pulverizer feeders	Lost coal on 2-3 Pulverizer
East Bend Steam-2	D4	3/9/21 5:01 AM	3/9/21 7:08 AM	2.12	635		8499	Other miscellaneous wet scrubber problems	FGD Chemistry
East Bend Steam-2	D1	3/16/21 1:51 PM	3/16/21 10:46 PM	8.92	2896.04		30	Coal conveyors and feeders	F Conv. Fluid Drive
East Bend Steam-2	D1	3/17/21 3:49 PM	3/17/21 3:57 PM	0.13	40.52		264	Other primary air fan problems	2-4 PA Damper
East Bend Steam-2	D1	3/18/21 11:03 AM	3/18/21 11:04 AM	0.02	4		264	Other primary air fan problems	2-4 PA Damper
East Bend Steam-2	D1	3/19/21 5:43 PM	3/19/21 5:52 PM	0.15	3		264	Other primary air fan problems	2-4 PA Damper
East Bend Steam-2	D1	3/19/21 6:20 PM	3/19/21 9:00 PM	2.67	26.67		264	Other primary air fan problems	2-4 PA Damper
East Bend Steam-2	D4	3/20/21 6:46 AM	3/20/21 7:00 PM	12.23	2327.88		8230	Ducting	C Module Outage to Repair Duct Leaks
East Bend Steam-2	D1	4/3/21 8:55 AM	4/3/21 12:18 PM	3.38	284		1480	Other induced draft fan problems	2-4 ID Fan Conductivity High
East Bend Steam-2	D1	4/18/21 8:19 PM	4/18/21 8:55 PM	0.60	25		335	Pulverizer lube oil system	2-1 Pulv. Oil Leak, Removed From Service
East Bend Steam-2	D1	4/19/21 7:56 PM	4/24/21 3:14 AM	103.30	24334.38		260	Primary air fan	2-2 PA Fan Shaft and Bearings
East Bend Steam-2	D1	4/20/21 10:00 AM	4/21/21 2:45 PM	28.75	1597.35		1489	Air heater (heat pipe, plate-type)	Secondary Air Heater Baskets
East Bend Steam-2	D1	4/21/21 5:20 PM	4/21/21 7:30 PM	2.17	182.93		310	Pulverizer mills	2-2 Mill out for Flame Scanner Tuning
East Bend Steam-2	D1	5/11/21 11:10 PM	5/12/21 4:01 AM	4.85	834.01		1457	Induced draft fan lubrication systems	2-1 ID Fan Tripped, No Coolant
East Bend Steam-2	D1	5/15/21 3:12 PM	5/15/21 9:10 PM	5.97	1283.31		1480	Other induced draft fan problems	ID Fan Maintenance
East Bend Steam-2	D4	5/22/21 9:30 AM	5/22/21 3:02 PM	5.53	553.33		1457	Induced draft fan lubrication systems	2-4 ID Fan, Replace Molded Case Breaker for Coolant Pump #1
East Bend Steam-2	D4	5/29/21 6:00 AM	5/29/21 5:52 PM	11.87	2590.37		260	Primary air fan	2-2 PA Fan Vibration - Replace Outboard Bearing
East Bend Steam-2	D1	5/30/21 12:53 AM	5/30/21 2:26 AM	1.55	471.99		1455	Induced draft fans	2-4 ID Fan Spinning Backwards
East Bend Steam-2	D1	6/8/21 9:47 AM	6/8/21 10:13 AM	0.43	138	OMC	9270	Wet coal (OMC)	OMC - Lost 2-6 Mill - High Pulv. Outlet Temp - Plugged with Wet Coal
East Bend Steam-2	D1	6/8/21 12:30 PM	6/9/21 2:54 AM	14.40	792	OMC	9270	Wet coal (OMC)	OMC - Cleaning wet coal out of 2-6 Mill
East Bend Steam-2	D1	6/8/21 4:37 PM	6/8/21 5:48 PM	1.18	42.9		310	Pulverizer mills	Lost 2-3 Mill
East Bend Steam-2	D1	6/8/21 6:26 PM	6/8/21 6:55 PM	0.48	9		310	Pulverizer mills	Lost 2-5 Mill
East Bend Steam-2	D1	6/11/21 2:05 PM	6/11/21 2:47 PM	0.70	21		250	Pulverizer feeders	Lost coal on 2-3 Feeder
East Bend Steam-2	D4	6/13/21 2:01 AM	6/13/21 10:30 AM	8.48	2088.68		260	Primary air fan	2-2 PA Fan Bearing Work
East Bend Steam-2	D1	6/21/21 2:35 PM	6/21/21 10:17 PM	7.70	2082		260	Primary air fan	2-2 PA Fan Inboard Bearing Cooler Line Leak Repair
East Bend Steam-2	D4	6/26/21 2:00 AM	6/26/21 8:30 AM	6.50	1950		1480	Other induced draft fan problems	2-4 ID Fan #1 Coolant Pump Repairs and Test
East Bend Steam-2	D4	7/1/21 4:01 AM	7/1/21 10:15 AM	6.23	1904.6		260	Primary air fan	Remove 2-2 PA Fan from Service to Tighten Bearing Bolts
East Bend Steam-2	D1	7/18/21 3:45 AM	7/18/21 4:19 AM	0.57	185		335	Pulverizer lube oil system	2-4 Pulv. Trip - Lost Lube Oil Pump
East Bend Steam-2	D4	7/18/21 8:00 AM	7/18/21 12:00 PM	4.00	800		8210	Valves	Replace C Module Slurry Feed Control Valve
East Bend Steam-2	D1	7/24/21 6:05 PM	7/24/21 6:44 PM	0.65	122		340	Other pulverizer problems	2-4 Pulv. Trip
East Bend Steam-2	D1	7/24/21 8:52 PM	7/24/21 9:21 PM	0.48	17		340	Other pulverizer problems	2-4 Pulv Unavailable - Fans Maxed
East Bend Steam-2	D1	7/25/21 12:39 AM	7/25/21 2:00 AM	1.35	10		340	Other pulverizer problems	2-4 Pulv Unavailable
East Bend Steam-2	D1	7/25/21 7:20 PM	7/26/21 4:40 PM	21.33	866.13		338	Pulverizer control systems (temperature and pressure)	2-4 Pulv Trip due to PA Damper
East Bend Steam-2	D1	7/27/21 1:53 PM	7/27/21 5:16 PM	3.38	796		340	Other pulverizer problems	2-4 Mill Unavailable - Swapping Mills
East Bend Steam-2	D1	7/27/21 7:20 PM	7/27/21 9:15 PM	1.92	38.33		340	Other pulverizer problems	2-4 Mill Unavailable - Bad Fuel Quality
East Bend Steam-2	D1	7/29/21 1:30 AM	7/29/21 7:14 AM	5.73	1560.04		920	Other slag and ash removal problems	SFC Unable to Pull Ash
East Bend Steam-2	U1	7/29/21 7:14 AM	7/30/21 11:50 PM	40.60	24360		890	Bottom ash systems (wet or dry)	SFC Unable to Pull Ash
East Bend Steam-2	D1	8/1/21 2:10 PM	8/2/21 10:07 PM	31.95	11182.5		8030	Classifiers	FGD - Thickener Upsets
East Bend Steam-2	U1	8/2/21 11:06 PM	8/5/21 2:14 PM	63.13	37880		3416	Other feedwater pump problems	2-1 BFPT Manual Valve Leaking
East Bend Steam-2	D1	8/8/21 6:52 PM	8/8/21 9:00 PM	2.13	21.33		1400	Forced draft fans	Ran Out of FD Fan
East Bend Steam-2	D1	8/10/21 10:40 PM	8/11/21 3:00 AM	4.33	43.33		1400	Forced draft fans	2-2 FD Fan Maxed Out
East Bend Steam-2	D4	8/17/21 10:00 AM	8/17/21 10:01 AM	0.02	3.5		8399	Solids conveying and mixing system problems	Replace Radial Stacker Belt

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Unit	Event Type	Event Start	Event End	Event Duration Hours	Equip MWh Lost	Outside Mgmt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	8/26/21 6:34 AM	8/26/21 7:58 AM	1.40	171.99		340	Other pulverizer problems	Dropped Load to Swap Mills
East Bend Steam-2	D1	8/28/21 7:43 PM	8/28/21 11:00 PM	3.28	775		4520	Stator windings, bushings, and terminals	Generator Flex Links and A-phase Bushing
East Bend Steam-2	U1	8/28/21 11:00 PM	9/5/21 2:30 PM	183.50	110100		4520	Stator windings, bushings, and terminals	Generator Flex Links and A-phase Bushing
East Bend Steam-2	U1	9/5/21 3:14 PM	9/5/21 4:58 PM	1.73	1040		1740	Boiler drum gage glasses / level indicator	Trip on boiler drum level.
East Bend Steam-2	U1	9/5/21 5:06 PM	9/5/21 6:42 PM	1.60	960		1740	Boiler drum gage glasses / level indicator	Trip on boiler drum level.
East Bend Steam-2	D1	9/8/21 10:40 AM	9/11/21 3:03 AM	64.38	643.67		1700	Feedwater controls (report local controls - feedwater pump,	Governor Valve
East Bend Steam-2	D1	9/9/21 1:42 AM	9/9/21 2:28 AM	0.77	126.66		310	Pulverizer mills	Lost coal on 2-4 mill
East Bend Steam-2	D1	9/9/21 7:53 AM	9/9/21 9:42 AM	1.82	372.67		310	Pulverizer mills	Swapping mills
East Bend Steam-2	D1	9/10/21 2:16 PM	9/11/21 3:03 AM	12.78	2402.18		95	Bunker flow problems	Bunker Rundown for Fall 2021 Planned Outage
East Bend Steam-2	U1	12/19/21 2:28 AM	12/26/21 2:40 AM	168.20	100920		4609	Other exciter problems	Exciter repairs
East Bend Steam-2	U1	12/26/21 2:54 PM	12/27/21 4:08 AM	13.23	7940		1700	Feedwater controls (report local controls - feedwater pump,	Lost drop 25/75 Feedwater Controls
East Bend Steam-2	U1	12/27/21 8:46 AM	12/27/21 7:00 PM	10.23	6140		4420	Vibration of the turbine generator unit that cannot be attribut	turbine vibration trip
East Bend Steam-2	D1	12/29/21 8:00 PM	12/31/21 2:14 AM	30.23	6514.68		4560	Generator vibration (excluding vibration due to failed bearin	Generator Vibration
East Bend Steam-2	D1	1/2/22 10:00 PM	1/3/22 3:01 AM	5.02	1265		4560	Generator vibration (excluding vibration due to failed bearin	Derate due to #9 bearing vibration
East Bend Steam-2	D1	1/8/22 12:13 AM	1/8/22 1:08 AM	0.92	32		250	Pulverizer feeders	2-6 chute pluggage
East Bend Steam-2	D1	1/8/22 11:30 AM	1/8/22 12:54 PM	1.40	61.99		310	Pulverizer mills	5 mill runback
East Bend Steam-2	D1	1/9/22 11:54 PM	1/10/22 3:00 AM	3.10	298		250	Pulverizer feeders	2-2 feeder loss of coal
East Bend Steam-2	D1	1/10/22 3:00 AM	1/10/22 11:45 PM	20.75	1062.81		1424	Secondary air fan/blower controls	Secondary Air control issue
East Bend Steam-2	D1	1/11/22 9:16 PM	1/13/22 12:30 AM	27.23	2236.67		310	Pulverizer mills	2-6 mill trip
East Bend Steam-2	D1	1/12/22 7:57 PM	1/12/22 8:25 PM	0.47	0		310	Pulverizer mills	swapping mills 2-6 pulverizer
East Bend Steam-2	D1	1/12/22 11:54 PM	1/13/22 12:07 AM	0.22	0		310	Pulverizer mills	swapping mills, 2-6 pulverizer
East Bend Steam-2	D1	1/13/22 7:55 AM	1/15/22 7:10 PM	59.25	4394.57	OMC	9270	Wet coal (OMC)	2-6 pulverizer pluggage- Wet Coal
East Bend Steam-2	D1	1/13/22 11:52 PM	1/14/22 4:55 AM	5.05	0		3630	400-700 volt transformers	2A-2 transformer failure
East Bend Steam-2	U1	1/18/22 9:59 PM	1/20/22 4:59 AM	31.00	18600		4293	Hydraulic system pipes and valves	Loss of EH due to pipe failure on Governor valves
East Bend Steam-2	U1	1/20/22 5:04 AM	1/20/22 5:40 AM	0.60	360		3401	Startup feedwater pump	Feedwater trip
East Bend Steam-2	D1	1/21/22 8:22 PM	2/1/22 4:23 AM	248.02	6044.17		4301	Turbine governing system	#5 Governor valve
East Bend Steam-2	D1	1/25/22 8:10 PM	1/25/22 8:58 PM	0.80	10.5		8010	Crushers/mills	Lost vertimill
East Bend Steam-2	D4	2/4/22 10:09 PM	2/8/22 7:29 AM	81.33	1588.11		4301	Turbine governing system	Governor Valves 5&8
East Bend Steam-2	D1	2/5/22 7:12 PM	2/5/22 8:09 PM	0.95	17.44		1440	Air supply dampers	2-5 pulverizer secondary air damper flow
East Bend Steam-2	D1	2/6/22 8:49 PM	2/8/22 7:29 AM	34.67	3774.42		1470	Induced draft fan motors and drives	2-3 ID fan VFD trip
East Bend Steam-2	D4	2/8/22 4:00 AM	2/8/22 7:29 AM	3.48	373.74		1470	Induced draft fan motors and drives	load drop to start 2-3 ID fan VFD
East Bend Steam-2	U1	2/8/22 7:28 AM	2/8/22 5:36 PM	10.13	6080		250	Pulverizer feeders	2-2 preheat coil pump failure caused low voltage and tripped 2 out of 3 feeders
East Bend Steam-2	D1	2/9/22 6:32 AM	2/10/22 9:20 AM	26.80	1340		350	Pulverized fuel and air piping (from pulverizer to wind box) (s	2-4 pulv damper issue
East Bend Steam-2	D1	2/10/22 3:00 AM	2/10/22 3:11 AM	0.18	0		350	Pulverized fuel and air piping (from pulverizer to wind box) (s	2-4 pulv swing valve
East Bend Steam-2	D4	2/10/22 3:00 AM	2/10/22 9:20 AM	6.33	253.33		350	Pulverized fuel and air piping (from pulverizer to wind box) (s	Maintenance derate to replace 2-4 pulv damper beckdrive
East Bend Steam-2	D1	2/11/22 12:30 PM	2/14/22 2:06 PM	73.60	2447.2	OMC	9250	Low BTU coal (OMC)	Coal Quality
East Bend Steam-2	D1	2/12/22 5:08 AM	2/12/22 5:32 AM	0.40	54.7		250	Pulverizer feeders	Lost 2-4 coal feeder
East Bend Steam-2	D1	2/12/22 9:49 AM	2/12/22 11:13 AM	1.40	177.45		250	Pulverizer feeders	2 Lost 2-3 coal feeder
East Bend Steam-2	D1	2/15/22 1:18 AM	2/16/22 12:11 AM	22.88	686.5	OMC	9250	Low BTU coal (OMC)	Coal Quality
East Bend Steam-2	D4	2/15/22 4:41 AM	2/16/22 12:18 AM	19.62	4832.57		260	Primary air fan	PA fan issue/inspection
East Bend Steam-2	D1	2/17/22 3:14 AM	2/17/22 4:06 AM	0.87	167.99		250	Pulverizer feeders	2-2 Pulverizer feeder trip
East Bend Steam-2	D4	2/18/22 3:00 AM	2/18/22 5:34 AM	2.57	282.33		550	Reheat steam relief/safety valves	Setting safety valves



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East Bend Steam-2	D4	2/19/22 4:04 AM	2/23/22 1:30 AM	93.43	28030		260	Primary air fan	2-2 PA fan motor and inspect bearings
East Bend Steam-2	D1	2/26/22 12:12 AM	2/26/22 12:40 AM	0.47	12	OMC	9270	Wet coal (OMC)	2-6 pulverizer-wet coal
East Bend Steam-2	D4	3/5/22 8:00 AM	3/5/22 3:00 PM	7.00	2100		270	Primary air duct and dampers	PA fan inlet vanes
East Bend Steam-2	D4	3/12/22 9:00 AM	3/12/22 9:00 PM	12.00	600		898	Bottom ash pyrite hopper (pulverizer reject) system	Planned derate- pyrite hopper knife gate
East Bend Steam-2	U1	5/7/22 4:20 AM	5/7/22 6:00 AM	1.67	1000		260	Primary air fan	PA fan vibration
East Bend Steam-2	U1	5/8/22 3:24 AM	5/9/22 5:28 PM	38.07	22840		3410	Feedwater pump	Unit Trip-Boiler Feed Pump recirc line repairs
East Bend Steam-2	D1	5/11/22 9:00 AM	5/11/22 11:00 AM	2.00	97		8020	Mill slurry tanks supply problems	Vertimill loss of grinding water
East Bend Steam-2	D4	5/16/22 10:00 AM	5/16/22 4:00 PM	6.00	1200		1990	Boiler performance testing (use code 9999 for total unit per	Boiler optimization tuning, mid-load off AGC
East Bend Steam-2	U1	5/31/22 2:16 AM	6/1/22 6:33 AM	28.28	16970		4700	Generator voltage control	Voltage regulator
East Bend Steam-2	U1	6/1/22 7:16 AM	6/2/22 8:34 AM	25.30	15180		3410	Feedwater pump	2-2 BFPT Trip - Unit trip on Low Drum Level
East Bend Steam-2	D1	6/22/22 6:17 PM	6/22/22 9:35 PM	3.30	52.11		1470	Induced draft fan motors and drives	2-1, 2-2 and 2-4 ID Fan VFDs temperature high
East Bend Steam-2	D1	6/24/22 10:47 AM	6/24/22 11:03 AM	0.27	44		370	Burner instruments and controls (except light off)	2-5 Pulverizer tripped due to burner flames not detected
East Bend Steam-2	D1	7/1/22 7:53 PM	7/1/22 9:26 PM	1.55	21.28		1400	Forced draft fans	FD Fans Max Capability
East Bend Steam-2	D1	7/2/22 7:20 PM	7/3/22 10:49 AM	15.48	154.83		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/4/22 9:00 PM	7/4/22 9:30 PM	0.50	6		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/5/22 12:00 AM	7/5/22 6:20 AM	6.33	107.98		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/5/22 5:25 PM	7/5/22 7:43 PM	2.30	136.99		1470	Induced draft fan motors and drives	ID Fan VFDs at maximum temperature
East Bend Steam-2	D1	7/5/22 9:00 PM	7/6/22 3:00 AM	6.00	144		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/6/22 4:00 PM	7/8/22 1:55 AM	33.92	747.52		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/7/22 10:52 PM	7/7/22 11:35 PM	0.72	6.2		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/8/22 1:55 AM	7/9/22 4:00 PM	38.08	761.67		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/11/22 7:30 PM	7/14/22 11:35 AM	64.08	15658.12		8330	Dewatering equipment (thickener, centrifuge, etc.)	FGD Thickener Chemistry
East Bend Steam-2	D1	7/19/22 7:00 PM	7/21/22 3:21 AM	32.35	942.36		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/20/22 7:21 PM	7/20/22 7:37 PM	0.27	0		4240	Bearings	LP Turbine #7 Bearing Vibration
East Bend Steam-2	D1	7/21/22 3:21 AM	7/24/22 1:20 AM	69.98	2068.01		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/23/22 4:23 AM	7/23/22 5:10 AM	0.78	35.85		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/24/22 3:20 PM	7/26/22 3:28 PM	48.13	1404.53		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/26/22 8:50 PM	7/27/22 3:30 AM	6.67	66.67		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/27/22 5:29 AM	7/27/22 5:42 AM	0.22	8		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/27/22 6:30 PM	7/27/22 8:00 PM	1.50	75		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	7/27/22 8:00 PM	7/29/22 5:47 AM	33.78	959.78		1400	Forced draft fans	FD Fan Max Capacity
East Bend Steam-2	D1	8/1/22 5:00 PM	8/2/22 2:15 PM	21.25	784.13		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	ID Booster Fan Breaker Single Phase
East Bend Steam-2	D1	8/2/22 4:00 AM	8/4/22 12:50 PM	56.83	1000.14		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	ID Booster Fan Breaker Single Phase
East Bend Steam-2	D1	8/4/22 2:20 PM	8/5/22 5:58 PM	27.63	552.67		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	ID Booster Fan Breaker Single Phase
East Bend Steam-2	D1	8/5/22 5:55 PM	8/5/22 5:58 PM	0.05	7		3844	Soot blowing air compressor and system	SBAC Trip
East Bend Steam-2	U1	8/5/22 5:58 PM	8/6/22 3:36 AM	9.63	5780		3844	Soot blowing air compressor and system	Station air compressor tripped due to damaged seal air piping.
East Bend Steam-2	U1	8/6/22 3:41 AM	8/6/22 4:55 AM	1.23	740		3414	Feedwater pump local controls	Drum Level trip
East Bend Steam-2	D1	8/6/22 8:00 PM	8/6/22 10:30 PM	2.50	12.5		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	ID Booster Fan Breaker Single Phase
East Bend Steam-2	U1	8/7/22 12:21 AM	8/7/22 10:22 AM	10.02	6010		3970	Distributive Control System (DCS) - process computer	DCS Drop 25 Failure - MFT
East Bend Steam-2	U1	8/7/22 10:28 AM	8/7/22 12:01 PM	1.55	930		3414	Feedwater pump local controls	Drum Level trip
East Bend Steam-2	D1	8/10/22 3:40 PM	8/12/22 4:50 AM	37.17	11369.28	OMC	9130	Lack of fuel: Physical failures of fuel supply or delivery/trans	Reclaim System flooding and coal supply delayed due to heavy rain and river conditions
East Bend Steam-2	D4	9/14/22 4:01 AM	9/17/22 12:15 PM	80.23	23978.53		260	Primary air fan	PA Fan Motor oil Leak

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Unit	Event Type	Event Start	Event End	Event Duration Hours	Equiv MWh Lost	Outside Mgmnt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	9/21/22 11:10 AM	9/21/22 12:20 PM	1.17	211.17		350	Pulverized fuel and air piping (from pulverizer to wind box) (s	2-2 Pulverizer 8R Burner Line Hot Spot
East Bend Steam-2	D1	9/21/22 8:25 PM	9/21/22 9:41 PM	1.27	12.67		1470	Induced draft fan motors and drives	2-2 ID Fan VFD Cooling Fan failed limiting cooling
East Bend Steam-2	D1	9/22/22 6:43 AM	9/22/22 7:38 AM	0.92	167.67		350	Pulverized fuel and air piping (from pulverizer to wind box) (s	2-2 Pulverizer 1R burner line hot spot.
East Bend Steam-2	D4	9/22/22 11:26 PM	9/23/22 1:47 AM	2.35	907.99		95	Bunker flow problems	Bunker Rundown to empty prior to outage.
East Bend Steam-2	D1	11/4/22 7:00 AM	11/5/22 1:06 AM	18.10	4206.08		3620	Main transformer	Main power transformer cooling
East Bend Steam-2	D1	11/16/22 2:10 PM	11/18/22 6:00 PM	51.83	9848.33		1510	Flue gas ducts (except recirculation)	FGD Ductwork
East Bend Steam-2	D4	11/18/22 9:00 PM	11/18/22 9:46 PM	0.77	76.67		1510	Flue gas ducts (except recirculation)	FGD Ductwork
East Bend Steam-2	D4	11/23/22 5:00 AM	11/23/22 10:32 PM	17.53	3331.33		1510	Flue gas ducts (except recirculation)	FGD Ductwork
East Bend Steam-2	D1	12/3/22 1:11 AM	12/3/22 2:37 AM	1.43	414.99		250	Pulverizer feeders	Lost coal on 2-4 Feeder
East Bend Steam-2	D1	12/5/22 3:44 PM	12/8/22 4:56 AM	61.20	11646.97		8100	Scrubber/absorber tower or module	C Module Mixer Failure
East Bend Steam-2	U1	12/9/22 6:10 AM	12/9/22 8:34 AM	2.40	1440		1700	Feedwater controls (report local controls - feedwater pump,	Drum Level control trip
East Bend Steam-2	U1	12/9/22 10:30 AM	12/10/22 2:08 AM	15.63	9380		1700	Feedwater controls (report local controls - feedwater pump,	Feedwater control trip
East Bend Steam-2	U1	12/10/22 3:08 AM	12/10/22 4:22 AM	1.23	740		1700	Feedwater controls (report local controls - feedwater pump,	Feedwater control trip
East Bend Steam-2	D1	12/10/22 3:23 PM	12/14/22 9:18 PM	101.92	22358.48		260	Primary air fan	2-1 Primary air fan motor failure
East Bend Steam-2	D1	12/16/22 2:22 PM	12/16/22 5:00 PM	2.63	184.41		250	Pulverizer feeders	Lost coal on 2-3 Feeder
East Bend Steam-2	D1	12/21/22 11:27 AM	12/21/22 11:00 PM	11.55	2889.58		1470	Induced draft fan motors and drives	2-1 ID Fan VFD Trip
East Bend Steam-2	D1	12/26/22 12:34 AM	12/26/22 10:00 PM	21.43	3921.87		1470	Induced draft fan motors and drives	2-1 ID Fan VFD
East Bend Steam-2	D4	1/19/23 11:00 AM	1/19/23 11:00 PM	12.00	2160		270	Primary air duct and dampers	2-4 Pulverizer PA Damper Control
East Bend Steam-2	U1	3/15/23 8:32 AM	3/15/23 11:18 AM	2.77	1660		1700	Feedwater controls (report local controls - feedwater pump,	Feedwater drum level control trip
East Bend Steam-2	D1	3/16/23 10:20 AM	3/16/23 7:00 PM	8.67	1213.33		250	Pulverizer feeders	2-3 Coal Feeder Belt Failure
East Bend Steam-2	D1	3/17/23 12:45 AM	3/18/23 1:10 AM	24.42	4395		250	Pulverizer feeders	2-5 Coal Feeder Belt Failure
East Bend Steam-2	D1	3/22/23 4:01 AM	4/1/23 4:00 AM	239.98	45596.83		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	2-1 IDBF Coupling Failure
East Bend Steam-2	D1	3/27/23 10:05 AM	3/27/23 11:00 AM	0.92	0		95	Bunker flow problems	2-5 Coal feed plugged.
East Bend Steam-2	D1	3/27/23 3:01 PM	3/27/23 8:00 PM	4.98	645.54		95	Bunker flow problems	2-6 Coal flow plugged
East Bend Steam-2	D4	4/1/23 4:01 AM	4/15/23 11:59 PM	355.97	40368.67		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	2-1 IDBF Sole Plate Repairs
East Bend Steam-2	U1	4/5/23 7:30 AM	4/11/23 7:00 AM	143.50	86100		3662	4000-7000 volt conductors and buses	24SR1 & 24SR2 Bus Failure
East Bend Steam-2	D4	4/16/23 12:00 AM	4/20/23 3:39 AM	99.65	18933.5		8260	Scrubber booster I.D. fan (fan specific to the scrubber)	2-1 IDBF Sole Plate Repairs
East Bend Steam-2	D1	5/8/23 12:00 PM	5/15/23 4:21 AM	160.35	29664.75		1480	Other induced draft fan problems	Vibration on motor IB bearing, cause found to be coupling issue
East Bend Steam-2	D1	5/29/23 10:50 PM	6/7/23 6:05 AM	199.25	5578.53		4301	Turbine governing system	Govenor valve number 8
East Bend Steam-2	D1	6/2/23 6:56 AM	6/2/23 7:00 AM	0.07	1.56		95	Bunker flow problems	2-3 pulv coal flow issues
East Bend Steam-2	D4	6/8/23 4:00 AM	6/10/23 3:50 AM	47.83	14924		260	Primary air fan	Motor Replacement
East Bend Steam-2	D1	6/19/23 6:01 PM	6/19/23 7:00 PM	0.98	53.81		95	Bunker flow problems	2-3 pulv coal flow issues
East Bend Steam-2	D1	7/28/23 7:30 PM	7/28/23 11:20 PM	3.83	76.67	OMC	9270	Wet coal (OMC)	2-6 Pulverizer Plugged
East Bend Steam-2	D1	7/31/23 4:35 PM	7/31/23 8:47 PM	4.20	756		280	Pulverizer fires	2-2 Burner Line Fire
East Bend Steam-2	D1	8/23/23 7:57 AM	8/23/23 8:00 AM	0.05	1.06		250	Pulverizer feeders	2-5 Pulverizer Coal Plugged
East Bend Steam-2	D1	8/25/23 5:19 PM	8/26/23 7:28 AM	14.15	367.48		1400	Forced draft fans	FD Fan MAXED
East Bend Steam-2	D1	9/5/23 5:30 PM	9/6/23 9:37 PM	28.12	281.17		4301	Turbine governing system	Turbine Governor Valve Control
East Bend Steam-2	D1	11/16/23 10:28 PM	11/16/23 11:00 PM	0.53	86.63		250	Pulverizer feeders	Loss of coal on 2-6 pulverizer
East Bend Steam-2	D1	11/17/23 10:31 AM	11/17/23 11:00 AM	0.48	70.7		250	Pulverizer feeders	Loss of coal on 2-6 pulverizer
East Bend Steam-2	D1	11/17/23 8:38 PM	11/17/23 10:00 PM	1.37	206.82		250	Pulverizer feeders	Loss of coal on 2-6 pulverizer
East Bend Steam-2	D1	11/22/23 12:39 PM	11/22/23 1:00 PM	0.35	23.04		250	Pulverizer feeders	Loss of coal on top mills (2-2 and 2-4)
East Bend Steam-2	D1	11/23/23 3:03 PM	11/23/23 4:00 PM	0.95	279.43		250	Pulverizer feeders	Loss of coal on 2-6 pulverizer

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Unit	Event Type	Event Start	Event End	Event Duration Hours	Equiv MWh Lost	Outside Mgmnt	Cause Code	Cause Description	Event Description
East Bend Steam-2	D1	12/1/23 5:11 PM	12/2/23 7:56 AM	14.75	3017.26		891	Bottom ash hoppers (including gates)	Economizer ash hoppers and submerged flight conveyor, too much slag at once
East Bend Steam-2	D4	12/2/23 7:57 AM	12/2/23 10:37 PM	14.67	3813.33		1510	Flue gas ducts (except recirculation)	A Module Ductwork Repairs
East Bend Steam-2	D1	12/5/23 12:26 AM	12/5/23 3:00 AM	2.57	252.48		250	Pulverizer feeders	Lost coal on 2-6 pulverizer
East Bend Steam-2	D4	12/9/23 6:00 AM	12/10/23 12:15 AM	18.25	4562.5		1510	Flue gas ducts (except recirculation)	A Module Ductwork Repairs
East Bend Steam-2	D1	12/15/23 2:00 PM	12/15/23 6:57 PM	4.95	123.75		95	Bunker flow problems	2-6 bunker to coal chute clogged
East Bend Steam-2	D4	12/16/23 5:01 AM	12/18/23 3:00 AM	45.98	11495.83		1510	Flue gas ducts (except recirculation)	C Module Ductwork Repairs
East Bend Steam-2	D1	12/27/23 10:01 AM	12/28/23 8:50 PM	34.82	8060.06		260	Primary air fan	2-1 PA Fan Outboard Bearing Wiped
East Bend Steam-2	D1	1/13/24 5:37 AM	1/13/24 6:00 AM	0.38	45.98	OMC	9270	Wet coal (OMC)	2-6 mill, wet coal causing feeder plugging
East Bend Steam-2	D1	1/14/24 6:01 PM	1/14/24 9:00 PM	2.98	581.33	OMC	9270	Wet coal (OMC)	2-5 mill, wet coal causing feeder and burner line plugging
East Bend Steam-2	D1	1/15/24 5:09 AM	1/15/24 7:00 AM	1.85	97.75		360	Burners	23R burner line fire
East Bend Steam-2	D1	1/16/24 8:28 AM	1/16/24 9:00 AM	0.53	53.91	OMC	9270	Wet coal (OMC)	2-2 mill, wet coal causing feeder plugging
East Bend Steam-2	D1	1/16/24 9:40 AM	1/16/24 2:00 PM	4.33	801.67	OMC	9270	Wet coal (OMC)	2-2 mill, wet coal causing belt tracking
East Bend Steam-2	D1	1/16/24 2:01 PM	1/16/24 4:00 PM	1.98	617.51	OMC	9270	Wet coal (OMC)	2-2 mill, wet coal causing belt tracking
East Bend Steam-2	D1	1/16/24 4:01 PM	1/16/24 5:45 PM	1.73	320.67	OMC	9270	Wet coal (OMC)	2-2 mill, wet coal causing belt tracking
East Bend Steam-2	D1	1/16/24 7:41 PM	1/17/24 1:37 AM	5.93	433.9	OMC	9270	Wet coal (OMC)	2-6 mill, wet coal causing feeder and chute plugging
East Bend Steam-2	D1	1/17/24 10:28 AM	1/17/24 2:00 PM	3.53	493.82	OMC	9270	Wet coal (OMC)	2-3 and 2-6 mill, wet coal causing feeder build up and belt tracking
East Bend Steam-2	D1	1/17/24 8:19 PM	1/18/24 12:00 AM	3.68	556.22	OMC	9270	Wet coal (OMC)	2-6 mill, wet coal causing feeder plugging
East Bend Steam-2	D1	1/19/24 12:12 AM	1/19/24 1:00 AM	0.80	115.82	OMC	9270	Wet coal (OMC)	2-3 mill, wet coal causing chute plugging
East Bend Steam-2	D1	1/20/24 3:05 PM	1/20/24 6:00 PM	2.92	373.57		3295	Other waste water (zero discharge) problems	FGD Chemistry
East Bend Steam-2	U1	1/31/24 5:32 AM	1/31/24 9:16 AM	3.73	2240	OMC	9270	Wet coal (OMC)	2-1 mill, wet coal causing feeder plugging and drum level to trip
East Bend Steam-2	D1	2/1/24 5:01 AM	2/5/24 11:40 PM	114.65	27302.75	OMC	9270	Wet coal (OMC)	Start-up ran long due to wet coal causing mill runbacks and could not stabilize Unit
East Bend Steam-2	D1	2/9/24 6:43 AM	2/9/24 7:00 AM	0.28	26.38	OMC	9270	Wet coal (OMC)	2-4 Pulverizer feeder tripped from wet coal
East Bend Steam-2	D1	2/11/24 11:56 PM	2/12/24 1:00 AM	1.07	280.23	OMC	9270	Wet coal (OMC)	2-1 pulverizer mill tripped twice on wet coal
East Bend Steam-2	D1	2/13/24 12:01 AM	2/13/24 1:00 AM	0.98	297.23		270	Primary air duct and dampers	2-1 PA Fan tripped out, causing runback on 2-1 mill.
East Bend Steam-2	D1	2/13/24 1:00 AM	2/15/24 12:02 AM	47.03	10347.33		270	Primary air duct and dampers	2-1 PA Fan IB VIVs found broken, made repairs
East Bend Steam-2	D1	2/20/24 5:54 PM	2/20/24 6:00 PM	0.10	3.58		250	Pulverizer feeders	2-1 Pulverizer plugged
East Bend Steam-2	D4	2/27/24 11:00 AM	2/27/24 10:00 PM	11.00	2530		270	Primary air duct and dampers	2-2 PA Fan VIVs inspected to verify condition, all looked good
East Bend Steam-2	D1	3/8/24 10:58 PM	3/8/24 11:00 PM	0.03	0.36		1999	Boiler, miscellaneous	SH temps high due to spray valve regulator stuck at 13%
East Bend Steam-2	D1	3/19/24 4:01 AM	3/19/24 6:24 AM	2.38	429		8710	SO2 analyzer problems	Troubleshooting transmitter issues on SO2
East Bend Steam-2	D1	3/19/24 6:25 AM	3/19/24 5:25 PM	11.00	2200		8710	SO2 analyzer problems	Working through transmitter issues and repairs
East Bend Steam-2	D1	4/2/24 10:45 PM	4/3/24 3:10 AM	4.42	44.17		4301	Turbine governing system	Turbine Valves opened at 100% and back pressure spiked
East Bend Steam-2	D4	4/3/24 11:00 AM	4/3/24 6:35 PM	7.58	2275		590	Desuperheater/attemperator valves	PSH Valve Repumping
East Bend Steam-2	D1	4/10/24 1:15 AM	4/10/24 1:45 AM	0.50	2.5		4301	Turbine governing system	Governor valves maxed out
East Bend Steam-2	D1	4/12/24 4:01 PM	4/12/24 5:00 PM	0.98	204.1		400	Burner wind box fires	2-6 14R Burner Line
East Bend Steam-2	D4	5/7/24 8:21 PM	5/9/24 12:00 AM	27.65	9636.3		4300	Turbine supervisory system (use codes 4290 to 4299 for hyd	Tuning
East Bend Steam-2	D1	5/9/24 5:01 PM	5/9/24 7:00 PM	1.98	460.65		340	Other pulverizer problems	Received alarm for not normal fuel block, took 2-4 mill out of service to investigate
East Bend Steam-2	D4	5/23/24 6:21 PM	5/27/24 8:00 PM	97.65	23289.53		4300	Turbine supervisory system (use codes 4290 to 4299 for hyd	Tuning
East Bend Steam-2	D1	6/3/24 11:50 PM	6/4/24 4:00 AM	4.17	41.67		8265	Scrubber booster I.D. fan dampers	ID Booster Fan VIVs sticking
East Bend Steam-2	D1	6/14/24 6:01 PM	6/14/24 8:00 PM	1.98	16.38		8265	Scrubber booster I.D. fan dampers	ID Booster Fan VIVs sticking
East Bend Steam-2	D1	6/17/24 6:38 PM	6/17/24 9:00 PM	2.37	207.56		400	Burner wind box fires	2-2 8R burner line, had to switch pulverizers
East Bend Steam-2	D4	6/27/24 10:00 AM	6/27/24 9:00 PM	11.00	2860		8261	Scrubber booster I.D. fan drive	Repaired beck drive, which caused for VIVs sticking
East Bend Steam-2	D1	8/29/24 12:05 AM	8/29/24 7:00 PM	18.92	4161.67		8506	Slurry pipelines	Slurry line plugged, dropped load until issue was resolved so as to not impact PH and

**Duke Energy Kentucky**  
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**STAFF-DR-02-007**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First, Item 20. Provide cost and schedule estimates for each item identified in the response.

**RESPONSE:**

The information does not exist in the format requested and is unavailable. As part of planned maintenance outages, East Bend Station schedules WFGD inspections to perform equipment condition assessments to support current and future outage scope. The findings of each inspection are prioritized by the station engineering team and operations group to support reliable and efficient operation of the WFGD. Inspection findings are anticipated and typically consist of absorber module vessel cleaning and slurry header cleaning within the three absorber modules. In addition, repair of external leaks, valves, mist eliminators and pump maintenance vary each outage based on operating hours and unit capacity factor. For O&M outage repairs and cleaning ~\$400,000 – \$850,000 is budgeted every two years for planned maintenance activities which includes addressing prioritized findings from equipment inspections. In addition, to the aforementioned O&M maintenance activities, the East Bend Station capital plan includes WFGD component replacement and equipment modifications to improve reliability and reduce O&M operating expense. The multi-year capital strategy is developed based on inspections results, equipment performance and the design life cycle of the equipment. The Capital budget typically ranges from 2-7 million for planned outages greater than 3 weeks in duration.

**PERSON RESPONSIBLE:**           Brett Riggins

**Duke Energy Kentucky  
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**CONFIDENTIAL STAFF-DR-02-008  
(As to Attachment only)**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 21 and refer to Application at page 6, paragraph 14. Confirm Duke Kentucky did no further analysis to support the impact the higher cost of lime-based reagent has on the unit's capacity factor and dispatch ranking. If not confirmed, provide in the response any work papers or documents supporting the estimates and cost of the lime.

**RESPONSE:**

**CONFIDENTIAL PROPRIETARY TRADE SECRET (As to Attachment only)**

In August 2023 Duke Energy evaluated the Limestone Conversion project through the Encompass model. This is the same Encompass model software that is used for IRP filings. Please see STAFF-DR-02-008 Confidential Attachment.

**PERSON RESPONSIBLE:** Matthew Kalemba

**CONFIDENTIAL PROPRIETARY TRADE  
SECRET**

**STAFF-DR-02-008  
CONFIDENTIAL ATTACHMENT**

**FILED UNDER SEAL**

**Duke Energy Kentucky**  
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**Date Received: September 20, 2024**

**STAFF-DR-02-009**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 22 and refer to the Application at page 6, paragraph 15. Provide a more detailed financial and benefit/cost analysis for each of the three alternatives that were considered for the Limestone Conversion Project. Include in the response any estimates of expenses, any cost benefit analysis performed, and any supporting documentation for each of the three alternatives.

**RESPONSE:**

Please see the following Company responses for additional information relating to the analysis of the alternatives.

- STAFF-DR-02-001
- SIERRA-DR-01-007(a), (b), and (c)
- SIERRA-DR-01-047(a)
- SIERRA-DR-01-048(a) – (j)
- SIERRA-DR-01-49 (a) – (d)
- SIERRA-DR-01-051
- SIERRA-DR-01-053(a) and (b)
- AG-DR-02-009

**PERSON RESPONSIBLE:** John A. Verderame

**Duke Energy Kentucky**  
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**Date Received: September 20, 2024**

**STAFF-DR-02-010**

**REQUEST:**

Refer to Application, Exhibit 3 Duke Kentucky East Bend Station Title V Minor Permit Revision Table on Page 3. Provide the actual application and permit for the “Baseline,” “Future W-Limestone,” and “Future W/O- Quicklime” operating modes.

**RESPONSE:**

There are no “actual application and permit” for the Baseline, Future W-Limestone, and Future W/O- Quicklime operating modes. The current permit in force is the East Bend’s Title V permit. The table on page 3 describes the actual emissions from the facility emitted during the baseline period before the project (Baseline) and the projected emissions under either the “Future W-Limestone” or the “Future W/O- Quicklime” scenarios. When determining the need for any air permit modification, the amount of emissions during the baseline period before the project is implemented are compared to the projected future emissions after the project was implemented and the projected future emissions if the project was not implemented. The magnitude of any emission changes dictates the type of permitting required.

**PERSON RESPONSIBLE:** J. Michael Geers



**Duke Energy Kentucky**  
**Case No. 2024-00152**  
**STAFF Second Set of Data Requests**  
**Date Received: September 20, 2024**

**STAFF-DR-02-011**

**REQUEST:**

Refer to Duke Kentucky's response to Staff's First Request, Item 28.

a. Elaborate, in detail, why moving the Duke Kentucky generation fleet from Fixed Resource Requirement (FRR) to a Reliability Pricing Model (RPM) after 14 years will benefit Kentucky customers. Provide any supporting documentation for the explanation including any calculations performed for the benefit analysis.

b. Provide a copy of any internal or other studies or analyses Duke Kentucky relied upon to justify the September 6, 2024, filing it made in Case No. 2024-00285.<sup>1</sup>

c. Discuss whether the decision for Duke Kentucky to move to RPM has any impact on the rationale provided in this case in support of the approval of the certificate for public convenience and necessity (CPCN) for the East Bend Station rather than for Duke Kentucky to rely upon the Pennsylvania New Jersey Maryland Interconnection RPM markets to provide sufficient capacity for customers.

**RESPONSE:**

a. In reference to part a., the question states "moving the Duke Kentucky generation fleet from Fixed Resource Requirement (FRR) to a Reliability Pricing Model (RPM)." It should be noted that if Duke Energy Kentucky moves to RPM, both the

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<sup>1</sup> Case No. 2024-00285, *Electronic Application of Duke Energy Kentucky, Inc. to Become a Full Participant in the PJM Interconnection LLC, Base Residual, and Incremental Auction Construct for the 2027/2028 Delivery Year and for Necessary Accounting and Tariff Changes* (filed Sept. 6, 2024), Application.

generation and load move to the RPM, not only the Duke Energy Kentucky generation fleet. Since first entering PJM, Duke Energy Kentucky has participated as an FRR capacity construct member. With PJM capacity market structural changes, the potential for customer load growth, especially those loads that can be added quicker than generation supply, projected increases in PJM market clearing prices, and changes to the PJM supply/demand balance, the Company has determined through analysis that a move to a full RPM auction participant is now in the customer's best interest.<sup>2</sup>

Please refer to the financial analysis contained in STAFF-DR-02-011 Attachment for supporting documentation. Note that in three of the four corners of the "Heat Map," the benefit of participation in RPM exceeds that of FRR by between \$4 to \$5 million annually. Thus, the Duke Energy Kentucky customer will save between \$4 to \$5 million annually, assuming the move to RPM is made and the Commission accepts the Company's proposal to modify PSM sharing with respect to capacity participation such that the customer receives 100 percent of any net benefit or net cost of RPM participation.

b. Please see STAFF-DR-02-011 Attachment referenced in the response above.

c. The decision in this case regarding conversion of East Bend to a limestone scrubber is independent of the decision to move from the PJM FRR to RPM capacity construct. Note that since at the time this limestone conversion CPCN testimony was submitted, the Company had not filed with the Commission requesting to move to the RPM capacity construct. Thus, the penalty calculations in the limestone CPCN on testimony of

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<sup>2</sup> See generally, *the Company's Application and Supporting Testimony in Case No. 2024-00285, Electronic Application of Duke Energy Kentucky, Inc. to Become a Full Participant in the PJM Interconnection LLC, Base Residual, and Incremental Auction Construct for the 2027/2028 Delivery Year and for Necessary Accounting and Tariff Changes* (filed Sept. 6, 2024), Application.

Mr. Verderame assumed that the Company was participating as a PJM FRR capacity construct member. These calculations were further updated for new market prices in the response to STAFF-DR-01-007.

The penalty calculations in Mr. Verderame's direct testimony and response to STAFF-DR-01-007 have been re-calculated below with the assumption that the Company is under the RPM construct at the time that East Bend were to become unavailable due to lime supply, as opposed to being an FRR PJM capacity member:

- Using a replacement price equal to the current bilateral market price of \$300/MW-Day, the costs for the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> years replacement are \$55.2 million per year, or a total of \$165.6 million, which is less than the updated penalty cost of \$192.4 million from the response to STAFF-DR-01-007 that would be incurred as a penalty if participating as a FRR PJM capacity member.

Calculation: 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Years Replacement Capacity = 600 MW x .84 (ELCC Class Rating) x \$300/MW-Day x 365 days x 3 years = \$165.6 million.

Thus, the current 3-year total impact from the East Bend unit unavailability is a range of between \$192.4 million (assumes FRR Capacity market participation) and \$165.6 million (assumes RPM Capacity market participation).

Finally, note that the decision for Duke Energy Kentucky to move from a FRR to RPM does not mean that the Company has chosen to "rely upon the Pennsylvania New Jersey Maryland Interconnection RPM markets to provide sufficient capacity for customers." Although under RPM, the Company will both buy its capacity obligation for customer load and sell generation in the RPM, Duke Energy Kentucky will continue to own the resources necessary to serve the Company's customers, just as it does now under

the FRR construct. The Company's analysis shows that the RPM capacity construct reduces the costs needed to serve the capacity needs of its customers and better monetizes excess capacity, again for the benefit of customers.

**PERSON RESPONSIBLE:** John Swez

# DEK FRR vs. RPM Capacity Impact Analysis

All inputs are shown in Yellow

**Inputs:**

Low BRA Clearing Price	50	\$/MW-Day
Mid BRA Clearing Price	225	\$/MW-Day
	300	\$/MW-Day
High BRA Clearing Price	525	\$/MW-Day
Low BRA Price RPM Reserve Margin	22.5%	
Mid BRA Price RPM Reserve Margin	19.5%	
High BRA Price RPM Reserve Margin	18%	
Max Price RPM Reserve Margin	17%	
Generation Capacity	1300	MW
FRR Reserve Margin	17.8%	
3rd Incremental Auction Clearing Price	50%	As Percentage of BRA
NET CONE	300	\$/MW-Day
Long Scenario DEK Load	1000	MW (Must be less than 1,100 MW)
Flat Scenario DEK Load	1100	MW
Short Scenario DEK Load	1200	MW (Must be greater than 1,100 MW)

LONG defined as percentage of Load plus Reserve Margin Before Holdback

Generation	1300	MW
Load + Reserve Margin	1178	MW
Length before holdback	122	MW
Percentage difference	10.4%	

FLAT defined as percentage of Load plus Reserve Margin Before Holdback

Generation	1300	MW
Load + Reserve Margin	1296	MW
Length before holdback	4	MW
Percentage difference	0.3%	

SHORT defined as percentage of Load plus Reserve Margin Before Holdback

Generation	1300	MW
Load + Reserve Margin	1414	MW
Length before holdback	-114	MW
Percentage difference	-8.0%	

# DEK FRR vs. RPM Capacity Impact Analysis

BRA Clearing Price

50

225

525

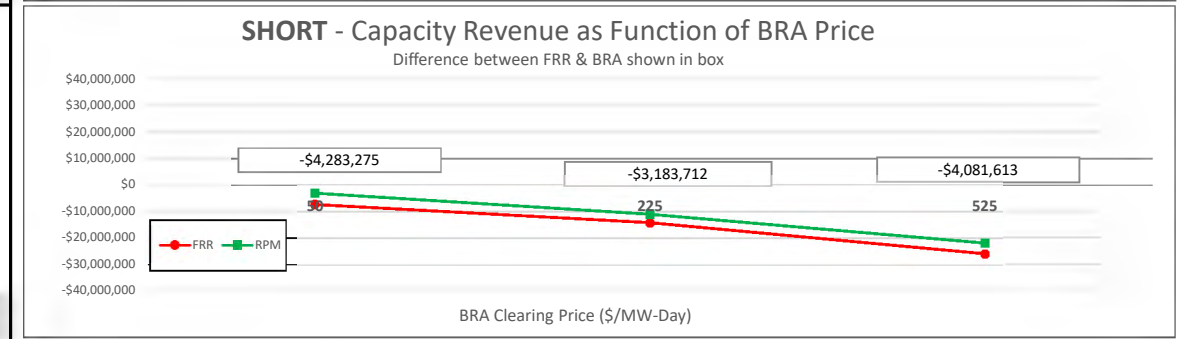
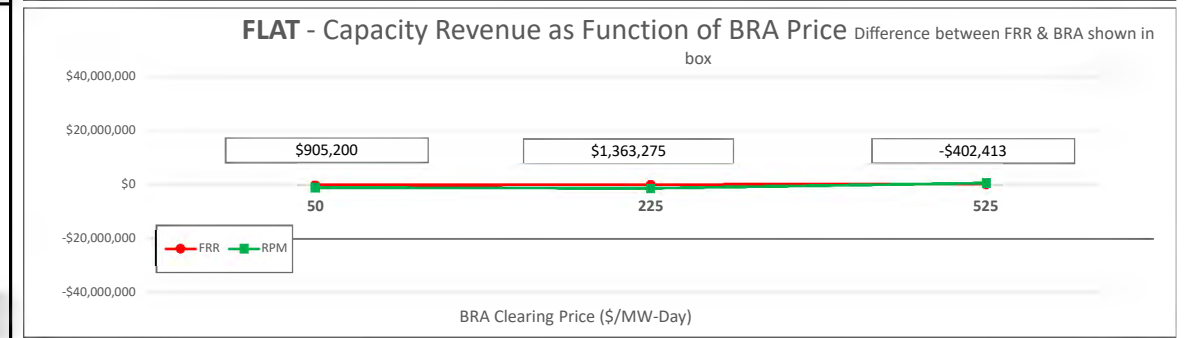
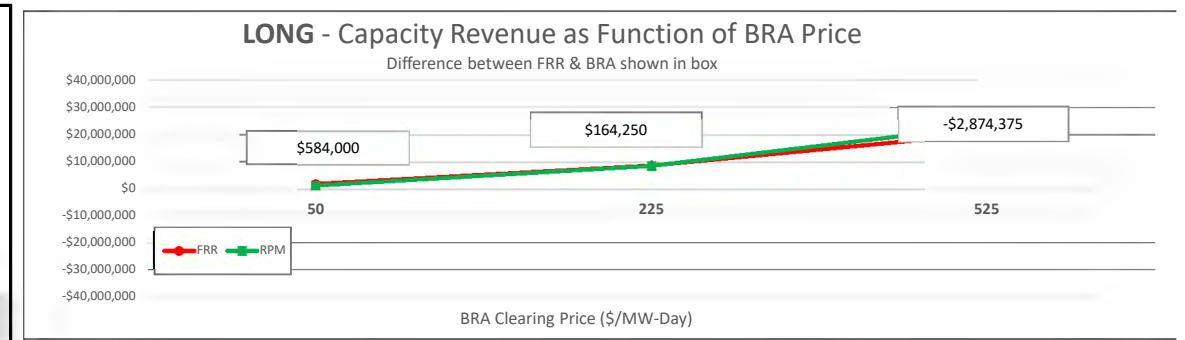
Scenario #1 - 10% LONG DEK Portfolio	50		225		525	
	FRR	RPM	FRR	RPM	FRR	RPM
BRA Clearing Price	50 \$/MW-Day	50 \$/MW-Day	225	225 \$/MW-Day	525 \$/MW-Day	525 \$/MW-Day
Generation Capacity	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW
Load	1000 MW	1000 MW	1000 MW	1000 MW	1000 MW	1000 MW
Reserve Margin	18%	23%	18%	20%	18%	18%
Load + Reserve Margin	1178 MW	1225 MW	1178 MW	1195 MW	1178 MW	1178 MW
Position before Holdback	122 MW	75 MW	122 MW	105 MW	122 MW	122 MW
FRR 3% Holdback Amount	30 MW	30 MW	30 MW	30 MW	30 MW	30 MW
Final BRA Position	92 MW	75 MW	92 MW	105 MW	92 MW	122 MW
BRA Capacity Revenue	\$1,679,000	\$1,368,750	\$7,555,500	\$8,623,125	\$17,629,500	\$23,378,250
3rd Incremental Auction Clearing Price	\$25 \$/MW-Day	\$25 \$/MW-Day	\$113 \$/MW-Day	\$113 \$/MW-Day	\$263 \$/MW-Day	\$263 \$/MW-Day
3rd Incremental Auction Revenue	\$273,750		\$1,231,875		\$2,874,375	
FRR Penalty (1.75 x CONE)	\$0		\$0		\$0	
<b>Total Capacity Revenue</b>	<b>\$1,952,750</b>	<b>\$1,368,750</b>	<b>\$8,787,375</b>	<b>\$8,623,125</b>	<b>\$20,503,875</b>	<b>\$23,378,250</b>
Difference	<b>FRR Better by \$584,000 per year</b>		<b>FRR Better by \$164,250 per year</b>		<b>FRR Worse by -\$2,874,375 per year</b>	

Scenario #2 - FLAT DEK Portfolio	50		225		525	
	FRR	RPM	FRR	RPM	FRR	RPM
BRA Clearing Price	50	50 \$/MW-Day	225	225 \$/MW-Day	525 \$/MW-Day	525 \$/MW-Day
Generation Capacity	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW
Load	1100 MW	1100 MW	1100 MW	1100 MW	1100 MW	1100 MW
Reserve Margin	18%	23%	18%	20%	18%	18%
Load + Reserve Margin	1296 MW	1348 MW	1296 MW	1315 MW	1296 MW	1296 MW
Position before Holdback	4 MW	-48 MW	4 MW	-15 MW	4 MW	4 MW
FRR 3% Holdback Amount	33 MW	33 MW	33 MW	33 MW	33 MW	33 MW
Final BRA Position	0 MW	-48 MW	0 MW	-15 MW	0 MW	4 MW
BRA Capacity Revenue	\$0	-\$866,875	\$0	-\$1,190,813	\$0	\$804,825
3rd Incremental Auction Clearing Price	\$25 \$/MW-Day	\$25 \$/MW-Day	\$113 \$/MW-Day	\$113 \$/MW-Day	\$263 \$/MW-Day	\$263 \$/MW-Day
3rd Incremental Auction Revenue	\$38,325		\$172,463		\$402,413	
FRR Penalty (1.75 x CONE)	\$0		\$0		\$0	
<b>Total Capacity Revenue</b>	<b>\$38,325</b>	<b>-\$866,875</b>	<b>\$172,463</b>	<b>-\$1,190,813</b>	<b>\$402,413</b>	<b>\$804,825</b>
Difference	<b>FRR Better by \$905,200 per year</b>		<b>FRR Better by \$1,363,275 per year</b>		<b>FRR Worse by -\$402,413 per year</b>	


  

Scenario #3 - 10% SHORT DEK Portfolio	50		225		525	
	FRR	RPM	FRR	RPM	FRR	RPM
BRA Clearing Price	50	50 \$/MW-Day	225	225 \$/MW-Day	525 \$/MW-Day	525 \$/MW-Day
Generation Capacity	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW	1300 MW
Load	1200 MW	1200 MW	1200 MW	1200 MW	1200 MW	1200 MW
Reserve Margin	18%	23%	18%	20%	18%	18%
Load + Reserve Margin	1414 MW	1470 MW	1414 MW	1434 MW	1414 MW	1414 MW
Position before Holdback	-114 MW	-170 MW	-114 MW	-134 MW	-114 MW	-114 MW
FRR 3% Holdback Amount	36 MW	36 MW	36 MW	36 MW	36 MW	36 MW
Final BRA Position	0 MW	-170 MW	0 MW	-134 MW	0 MW	-114 MW
BRA Capacity Revenue	\$0	-\$3,102,500	\$0	-\$11,004,750	\$0	-\$21,768,600
3rd Incremental Auction Clearing Price	\$25 \$/MW-Day	\$25 \$/MW-Day	\$113 \$/MW-Day	\$113 \$/MW-Day	\$263 \$/MW-Day	\$263 \$/MW-Day
3rd Incremental Auction Revenue	\$0		\$0		\$0	
FRR Penalty (1.75 x CONE)	\$7,385,775		\$14,188,463		\$25,850,213	
<b>Total Capacity Revenue</b>	<b>-\$7,385,775</b>	<b>-\$3,102,500</b>	<b>-\$14,188,463</b>	<b>-\$11,004,750</b>	<b>-\$25,850,213</b>	<b>-\$21,768,600</b>
Difference	<b>FRR Worse by -\$4,283,275 per year</b>		<b>FRR Worse by -\$3,183,712 per year</b>		<b>FRR Worse by -\$4,081,613 per year</b>	



FRR Penalty assumes that 75% of the FRR Plan Shortfall is purchased at a premium of 1.25 x BRA Clearing Price and remaining 25% FRR Plan Shortfall is subject to penalty due to lack of available generation in DEOK zone

## Annual Financial Impact of Duke Energy Kentucky Capacity Construct: Initial FRR Plan vs. RPM

FRR - RPM		BRA Clearing Price, \$/MW-Day 										
		Length	50	100	150	200	250	300	350	400	450	500
DEK Portfolio Length	Long (Positive) or Short (Negative) Position	9%	\$ 584,584	\$ 855,998	\$ 814,242	\$ 459,316	\$ (334,918)	\$ (1,644,143)	\$ (2,145,504)	\$ (2,711,820)	\$ (3,343,090)	\$ (4,039,313)
		8%	\$ 591,008	\$ 865,405	\$ 823,190	\$ 464,363	\$ (338,598)	\$ (1,662,210)	\$ (2,169,081)	\$ (2,741,620)	\$ (3,379,827)	\$ (4,083,701)
		7%	\$ 597,432	\$ 874,811	\$ 832,137	\$ 469,411	\$ (342,279)	\$ (1,680,278)	\$ (2,192,658)	\$ (2,771,421)	\$ (3,416,564)	\$ (4,128,089)
		6%	\$ 603,856	\$ 884,218	\$ 841,085	\$ 474,458	\$ (345,959)	\$ (1,698,345)	\$ (2,216,235)	\$ (2,801,221)	\$ (3,453,301)	\$ (4,172,477)
		5%	\$ 610,280	\$ 893,624	\$ 850,033	\$ 479,506	\$ (349,640)	\$ (1,716,413)	\$ (2,239,812)	\$ (2,831,021)	\$ (3,490,039)	\$ (4,216,865)
		4%	\$ 616,704	\$ 903,031	\$ 858,981	\$ 484,553	\$ (353,320)	\$ (1,734,480)	\$ (2,263,389)	\$ (2,860,821)	\$ (3,526,776)	\$ (4,261,253)
		3%	\$ 623,128	\$ 912,437	\$ 867,928	\$ 489,601	\$ (357,000)	\$ (1,752,548)	\$ (2,286,966)	\$ (2,890,622)	\$ (3,563,513)	\$ (4,305,641)
		2%	\$ 649,846	\$ 962,432	\$ 937,758	\$ 575,824	\$ (259,211)	\$ (1,648,851)	\$ (2,168,485)	\$ (2,758,070)	\$ (3,417,604)	\$ (4,147,089)
		1%	\$ 777,523	\$ 1,214,345	\$ 1,310,465	\$ 1,065,883	\$ 343,374	\$ (939,401)	\$ (1,343,291)	\$ (1,817,846)	\$ (2,363,065)	\$ (2,978,948)
		0%	\$ 905,200	\$ 1,466,257	\$ 1,683,171	\$ 1,555,943	\$ 945,958	\$ (229,950)	\$ (518,097)	\$ (877,622)	\$ (1,308,525)	\$ (1,810,806)
		-1%	\$ 543,387	\$ 1,158,752	\$ 1,426,534	\$ 1,346,731	\$ 779,344	\$ (359,625)	\$ (601,956)	\$ (916,379)	\$ (1,302,893)	\$ (1,761,498)
	-2%	\$ (53,167)	\$ 582,973	\$ 868,087	\$ 802,175	\$ 243,852	\$ (891,713)	\$ (1,121,762)	\$ (1,424,616)	\$ (1,800,276)	\$ (2,248,741)	
	-3%	\$ (649,721)	\$ 7,193	\$ 309,640	\$ 257,619	\$ (291,640)	\$ (1,423,801)	\$ (1,641,568)	\$ (1,932,854)	\$ (2,297,659)	\$ (2,735,983)	
	-4%	\$ (1,246,274)	\$ (568,587)	\$ (248,807)	\$ (286,937)	\$ (827,133)	\$ (1,955,889)	\$ (2,161,374)	\$ (2,441,092)	\$ (2,795,042)	\$ (3,223,226)	
	-5%	\$ (1,842,828)	\$ (1,144,366)	\$ (807,255)	\$ (831,493)	\$ (1,362,625)	\$ (2,487,977)	\$ (2,681,180)	\$ (2,949,329)	\$ (3,292,425)	\$ (3,710,468)	
	-6%	\$ (2,439,382)	\$ (1,720,146)	\$ (1,365,702)	\$ (1,376,049)	\$ (1,898,117)	\$ (3,020,065)	\$ (3,200,986)	\$ (3,457,567)	\$ (3,789,809)	\$ (4,197,711)	
	-7%	\$ (3,035,935)	\$ (2,295,926)	\$ (1,924,149)	\$ (1,920,605)	\$ (2,433,609)	\$ (3,552,153)	\$ (3,720,791)	\$ (3,965,805)	\$ (4,287,192)	\$ (4,684,953)	
	-8%	\$ (3,632,489)	\$ (2,871,705)	\$ (2,482,596)	\$ (2,465,160)	\$ (2,969,102)	\$ (4,084,241)	\$ (4,240,597)	\$ (4,474,042)	\$ (4,784,575)	\$ (5,172,196)	
	-9%	\$ (4,229,043)	\$ (3,447,485)	\$ (3,041,043)	\$ (3,009,716)	\$ (3,504,594)	\$ (4,616,328)	\$ (4,760,403)	\$ (4,982,280)	\$ (5,281,958)	\$ (5,659,439)	

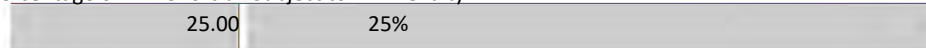
**Positive** value means FRR is a **better** financial outcome than RPM Capacity Construct annually for the amount shown.

**Negative** value means FRR is a **worse** financial outcome than RPM Capacity Construct annually for the amount shown.

*Bi-lateral capacity to fulfill FRR shortfall assumed purchased at a premium of 1.25 x Auction Clearing Price*

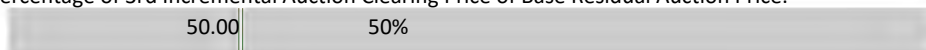
(Capacity owners have general reluctance to sell bi-lateral capacity)

Percentage of FRR Shortfall Subject to FRR Penalty:



25%

Percentage of 3rd Incremental Auction Clearing Price of Base Residual Auction Price:



50%

2025/2026 FRR Positon Portfolio Length = 77 MW/800.6 MW = ~9%; Bi-lateral Market Trading \$85/MW-Day @ \$92/MW-Day as of 7-19-2024; 2025/2026 BRA ultimately cleared \$269.92/MW-Day

## DEK FRR vs. RPM Capacity Impact Analysis

### BRA Clearing Price (\$/MW-Day)

	50		225		525	
Scenario #1 - DEK is LONG 10%	FRR	RPM	FRR	RPM	FRR	RPM
Total Capacity Revenue	\$1,952,750	\$1,368,750	\$8,787,375	\$8,623,125	\$20,503,875	\$23,378,250
	<b>FRR Better by</b>	<b>\$584,000</b>	<b>per year</b>	<b>FRR Better by</b>	<b>\$164,250</b>	<b>per year</b>
	<b>FRR Worse by</b>	<b>-\$2,874,375</b>	<b>per year</b>	<b>FRR Worse by</b>	<b>-\$2,874,375</b>	<b>per year</b>
Scenario #2 - DEK is FLAT						
Total Capacity Revenue	\$38,325	-\$866,875	\$172,463	-\$1,190,813	\$402,413	\$804,825
	<b>FRR Better by</b>	<b>\$905,200</b>	<b>per year</b>	<b>FRR Better by</b>	<b>\$1,363,275</b>	<b>per year</b>
	<b>FRR Worse by</b>	<b>-\$402,413</b>	<b>per year</b>	<b>FRR Worse by</b>	<b>-\$402,413</b>	<b>per year</b>
Scenario #3 - DEK is SHORT -8%						
Total Capacity Revenue	-\$7,385,775	-\$3,102,500	-\$14,188,463	-\$11,004,750	-\$25,850,213	-\$21,768,600
	<b>FRR Worse by</b>	<b>-\$4,283,275</b>	<b>per year</b>	<b>FRR Worse by</b>	<b>-\$3,183,712</b>	<b>per year</b>
	<b>FRR Worse by</b>	<b>-\$4,081,613</b>	<b>per year</b>	<b>FRR Worse by</b>	<b>-\$4,081,613</b>	<b>per year</b>

*FRR Penalty assumes that 75% of the FRR Plan Shortfall is purchased at a premium of 1.25 x BRA Clearing Price and remaining 25% FRR Plan Shortfall is subject to penalty due to lack of available generation in DEOK zone*