Selection Report

Fairport to Denny to IA/MO State Border 345 kV Competitive Transmission Project

October 27, 2023

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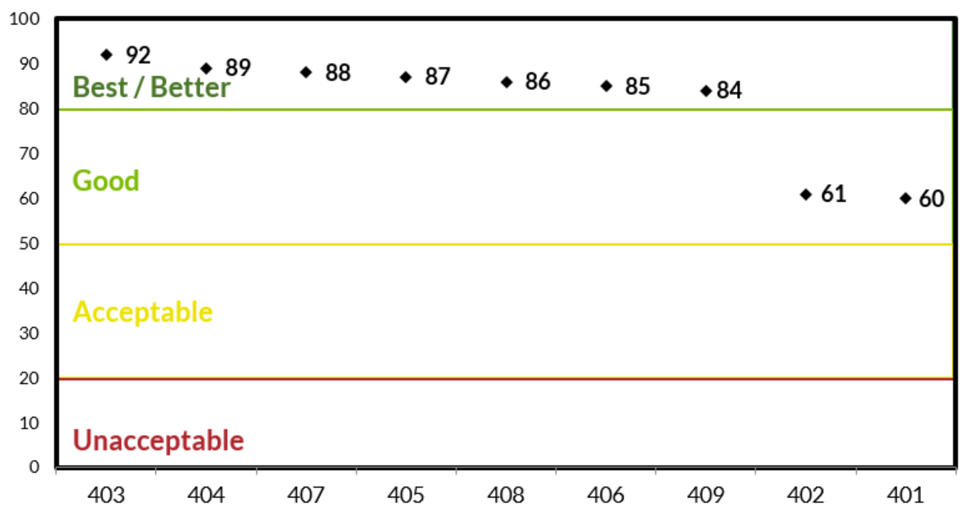
Executive Summary

MISO has chosen Ameren Transmission Company of Illinois (ATXI) to be the Selected Developer for the Fairport to Denny to IA/MO State Border (FDIM) 345 kV Competitive Transmission Project.

ATXI was one of four developers to submit a competitive proposal in response to the FDIM Request for Proposals (RFP), which MISO issued on December 5, 2022. ATXI partnered with Missouri Joint Municipal Electric Utility Commission (MJMEUC) on FDIM and will sell 49% of the project to MJMEUC shortly before the project is placed into service. ATXI submitted Proposal 403.

This report explains the competitive developer selection process and the FDIM project, summarizes the proposals MISO received from transmission developers to construct, own, operate, and maintain FDIM, and explains why MISO chose ATXI to be the Selected Developer. Figure 1 identifies each proposal's score.

Figure 1. Evaluation Scores for FDIM Proposals



On July 25, 2022, MISO's Board of Directors approved the Long-Range Transmission Planning Tranche 1 portfolio for inclusion in the 2021 MISO Transmission Expansion Plan (MTEP21). Tranche 1 included Project 9, which consists of upgrades to Associated Electric Cooperative Incorporated's (AECI) existing Fairport substation in Missouri and MidAmerican Electric Company's (MEC) existing Orient substation in Iowa, a new substation in Missouri named Denny, and two new 345 kV transmission lines from Denny, one to Fairport and one to Orient.

The new facilities located in Missouri are eligible for MISO's Competitive Developer Selection Process. This portion consists of three 345 kV facilities: (1) a four-position ring bus substation to be named Denny and located in northwest Missouri, (2) a single-circuit transmission line from Denny to AECI's existing Fairport substation in DeKalb, Missouri, and (3) a single-circuit transmission line from Denny north to the Iowa border. The portion of Project 9 in Iowa is not eligible for the Competitive Developer Selection Process and will be built by MEC.

In December 2022, MISO issued an RFP for FDIM. In May 2023, Ameren Transmission Company of Illinois, LS Power Midcontinent, NextEra Energy Transmission Midwest, and Transource Energy submitted a total of nine valid proposals in response to the RFP. These four developers are referred to in this report as Developers A, B, C, and D, although not necessarily in that order.

The point on the Iowa/Missouri state border where the new transmission line from Denny will interconnect with MEC's line is not yet known. The RFP required all proposed routes to interconnect at the state border within a certain number of miles east or west of a point identified by MEC as a possible point of interconnection (POI). In this report, the resulting section of the state border is referred to as the "POI window" or "Border."

All proposals met the minimum requirements of the RFP. All developers explained how they would procure materials and what contractors they would use to build the project. All developers demonstrated they have the capital to build and maintain the project and substantial experience operating and maintaining extra-high voltage transmission facilities. The proposals included either Drake, Cardinal, or Pheasant conductors, monopole structures made of galvanized or weathering steel, and either ring bus or double-breaker, double-bus (DBDB) substations.

MISO's cost estimate for FDIM was $161 million, in 2022 dollars. The project implementation (PI) cost of the proposals ranged from $74 million to $134 million, in 2022 dollars. The present value of the proposed revenue requirements (PVRR) over forty years ranged from $62 million to $154 million. The differences between the proposals were principally due to conductor size, substation design, and tax liabilities.

Developer A proposed to build a ring bus substation on a site east of Fairport. It would use Cardinal conductor and galvanized steel structures. Its nominal PI cost estimate was $154 million and its PVRR was also $154 million. Both estimates were the highest submitted. The most competitive aspect of its proposal was its construction access plan.

Developer B proposed to build a DBDB substation on a site northeast of Fairport. It would use Cardinal conductor and galvanized steel structures. Its nominal PI cost estimate without AFUDC was $125 million and its PVRR was $131 million. Both estimates were the second highest submitted. The most competitive aspects of its proposal were its annual revenue caps for the first 40 years and substation design, which included a spare shunt reactor stored onsite.

Developer C proposed to build a ring bus substation on a site northwest of Fairport. It would use Cardinal conductor and weathering steel structures. Its nominal PI cost estimate without AFUDC was $84 million and its PVRR was $62 million. Both amounts were the lowest submitted. The most competitive aspects of its proposal were its PI cost and revenue requirement, a PI cost cap, and its project partnership with a municipal agency exempt from property and income taxes, which reduced its estimated taxes by 49%.

Developer D submitted six proposals that contained different combinations of conductors, substation configurations, and transmission structure features. Because MISO determined Developer D's most competitive proposal was Proposal 404, the rest of this summary will refer to Proposal 404 as Developer D.

Developer D proposed to build a ring bus substation on a site north of Fairport. It would use Drake conductor, which is smaller than Cardinal, and weathering steel structures. Its nominal PI cost estimate was

$89 million and its PVRR was $84 million. The most competitive aspects of its proposal were its annual revenue requirement caps, substation design, transmission routes, and pre-construction studies.

MISO determined Developer C (Proposal 403) and Developer D (Proposal 404) submitted the best and second-best proposals, respectively. The difference between these two proposals was smaller than those of MISO's previous competitive projects.

Developer C's Cost and Design was significantly better than that of Developer D. This criteria accounted for 35% of MISO's Selected Developer decision and is the highest weighted criteria in MISO's Competitive Transmission Process for projects that include both a transmission line and a substation.

Developer C's estimated cost for FDIM (PVRR) was substantially less than that of Developer D, which was $22 million (36%) higher. This was partially due to Developer C's agreement to transfer 49% of FDIM via a joint operating agreement after the facilities are constructed to its project partner, a local municipal agency exempt from income and property taxes. Although Developer C did not include annual revenue caps for 40 years like Developer D, Developer C's PI cost cap, 40-year weighted cost of equity cap, and 10-year O&M cap enabled its PVRR to remain superior under all scenarios modeled by MISO.

Developer D's design for FDIM was more optimized than that of Developer C, principally in bus location and layout. Its substation design would simplify maintenance and would require less investment if additional bays and transmission lines were needed. Its transmission structure design carries slightly less project risk than that proposed by Developer C due to its advanced transmission route planning.

Developer D's Project Implementation plans for FDIM were better than those of Developer C. Developer D conducted extensive route research and proposed a substation site and transmission routes that carried less project risk than those proposed by Developer C due to the proposed locations of the facilities relative to existing transmission lines and an airport in the project area. Project Implementation accounted for 30% of MISO's Selected Developer decision.

Developer D's Operations and Maintenance plans for FDIM were marginally better than those of Developer C. Developer D explained in greater detail its capabilities such as live wire maintenance and its spare parts inventory. Developer C's transmission routes and substation layout result in smaller clearances for maintenance and could result in longer or additional maintenance outages. Operations and Maintenance accounted for 30% of MISO's Selected Developer decision.

All developers earned the full 5% for Project Participation.

The project implementation process will begin immediately with execution of the Selected Developer Agreement. MISO will collaborate with ATXI to successfully execute a project that will benefit MISO's stakeholders.

Fairport to Denny to IA/MO State Border Selection Report

I. Competitive Project and Process

This report explains the basis for MISO's determination of the Selected Developer for the FDIM Competitive Transmission Project and explains the selection process MISO used to reach its decision.

Competitive Project

On July 25, 2022, MISO's Board of Directors approved the Tranche 1 Long-Range Transmission Planning portfolio for inclusion in the 2021 MISO Transmission Expansion Plan (MTEP21). Tranche 1 included MTEP21 Project 9, which includes two new single-circuit 345 kV transmission lines, a new substation named Denny, and additions to two existing substations.

The first transmission line will run from Associated Electric Cooperative Incorporated's (AECI) existing Fairport substation in DeKalb County, Missouri to the Denny substation, which MISO planned to be built within two miles of the Fairport substation. The second transmission line will run north from Denny, cross into Iowa, and interconnect with MidAmerican Electric Company's (MEC) Orient substation in Adair County, Iowa.

Denny substation, the Fairport to Denny (F-D) line, and the Denny to Border (D-B) line, which is the Missouri portion of the Denny to Orient line, are eligible for the competitive transmission process. MISO titled this portion of Project 9 the "Fairport to Denny to IA/MO State Border 345 kV Competitive Project," and this project is referred to as FDIM in this report.

AECI and MEC will complete the required additions to Fairport substation and Orient substation, respectively. MEC will build the portion of the Denny to Orient line that is in Iowa.

Request for Proposals

MISO issued a Request for Proposals (RFP) for FDIM on December 5, 2022. It issued a revision to the RFP on February 13, 2023. MISO held a public meeting on January 12, 2023 to provide information and answer questions about the project and the RFP. Full details about the RFP and a register of questions asked, along with the answers provided by MISO, are available on MISO's Competitive Transmission Administration webpage.[1]

[1] https://www.misoenergy.org/planning/competitive-transmission-administration/

MISO's goal is to select a proposal that provides the greatest overall value while meeting all project requirements and ensuring the highest likelihood of project success. Cost is an important component of value and a comparative advantage, but it is not the sole consideration. MISO listed five aspects and elements of the project it anticipates may be particularly important for the success of the project. MISO encouraged developers to consider the following in formulating their proposals:

1. **Point of Interconnection Flexibility:** The point of interconnection is defined as a range of possible locations along the Iowa/Missouri state border. An important element of project success is to plan for cost certainty, design flexibility, and schedule impact mitigation given possible regulatory requirements or coordination with transmission owners that will influence and ultimately define the geographic location of the point of interconnection.
2. **Denny Substation Location and Design:** The planning analysis modeled the Denny substation about two miles from the Fairport substation. An important aspect of the project will be how the location was determined in relation to the Fairport substation and how this and other design features will translate into flexibility in both operation and maintenance of facilities over the planning horizon.
3. **Coordination with Interconnecting Transmission Owners:** The project connects to facilities owned and operated by three other transmission owners. Of particular importance to project success will be the planned coordination with AECI, MEC, and Ameren on various regulatory, permitting, design, construction, and operations and maintenance activities.
4. **In-Service Date Flexibility:** To place this project into service as planned will require time-sensitive coordination for regulatory, construction, commissioning, and outage coordination activities. An important element of the project is flexibility in the proposal to achieve an earlier in-service date if such an opportunity is identified in cooperation with other involved parties after selection.
5. **Operations and Maintenance Plan:** The project's Denny to Border transmission line facility is only a portion of the Denny to Orient transmission line. An important aspect of the project after it is placed in service will be the planned coordination of operations and maintenance which may have unique needs and requirements.

Submitted Proposals

On May 19, 2023, four developers submitted to MISO nine total proposals for FDIM. This report identifies those developers as A, B, C, and D and those proposals as 401 through 409.

Developers A, B, and C each submitted a single proposal. Developer D submitted six proposals based on combinations of two conductors, two substation configurations, and a single or double-circuit structure capability of the D-B line.

Proposal Clarification and Validation

MISO validated each developer was certified as a Qualified Transmission Developer on the dates the proposals were submitted and reviewed each proposal for completeness. It gave every developer the opportunity to clarify or cure unclear or incomplete submissions. All developers responded to MISO requests for clarification or cure, and no developer subsequently withdrew a proposal.

In July 2023, MISO announced it had received nine valid and complete proposals from four developers: Ameren Transmission Company of Illinois, LS Power Midcontinent, NextEra Energy Transmission Midwest, and Transource Energy.

Proposal Quality

MISO appreciates the amount and complexity of information competitive developers must organize, summarize, and submit in response to MISO's competitive RFPs.

The FDIM proposals presented information and contained attachments in compliance with the RFP. Most of the tables of contents closely followed multiple levels of the recommended report headings and had page numbers that matched the page number indicated by Adobe Acrobat when the proposal was viewed as a PDF. Some proposals listed relevant attachments, both required and optional, at the end of each section for easy reference. All these practices helped MISO more quickly locate and reference relevant information.

One proposal had several places where information or words were missing and figures were incorrectly referenced. This proposal also had smaller margins than those required by the RFP. Another proposal exceeded the page limit identified in the RFP. MISO required the developers that submitted these proposals to cure these violations. This delayed MISO's evaluation process because MISO took additional time to ensure the cured proposals did not contain any new information.

Although these issues did not result in a change in any proposal's comparative ranking, MISO expects future competitive projects to have closer rankings, and a failure to scrutinize writing or follow the RFP could jeopardize a proposal's success.

MISO recognizes it also has a role to play in facilitating well-written, competitive proposals. It will continue to look for opportunities in future RFPs to ask more specific questions and provide clearer direction.

Confidentiality, Communication Protocols, and Document Control

Confidentiality

MISO recognizes the importance of transparency in every step of its Competitive Transmission Process. However, MISO is obligated to treat the following information as confidential unless a developer consents to its disclosure:

- all detailed breakdowns of costs, including the itemized costs for labor and materials,
- all details of a developer's financing arrangements (as well as those for any project participants),
- all detailed design, routing, siting, or specialty construction techniques, and

- any other information or portions of documents that a developer has clearly designated as confidential (excluding items that are expressly categorized by the MISO Tariff as non-confidential or that MISO has an obligation to make publicly available).

Proposal information the tariff categorizes as not confidential includes:

- the identity of developers,
- the high-level design, estimated cost, and estimated 40-year annual transmission revenue requirement for the project,
- information relating to any cost-containment measures, cost-caps, and rate incentives,
- information about the proposed in-service dates of the project,
- the final evaluation score assigned to each proposal (with the names of the developers masked),
- all timetables and milestones agreed to between the Selected Developer and MISO in the Selected Developer Agreement,
- information that is publicly available, a developer has consented to release, or the tariff requires MISO to make publicly available.

To comply with these requirements, this report describes the developers as A, B, C, and D.

Communication Protocols

MISO adheres to the following self-imposed communication protocols throughout the competitive developer selection process:

- **Project Information Kept Confidential:** Information deemed confidential under the Tariff related to competitive projects will be treated as commercially and competitively sensitive.
- **Communications to Be Coordinated:** MISO aims to coordinate all communications with interested stakeholders regarding RFPs, the evaluation process, selection report, and variance analysis. Please refer all questions to MISO Client Relations at TDQS@misoenergy.org and not to individual MISO personnel.
- **Questions Will Be Answered Transparently:** MISO will publicly post questions it receives and vetted answers at the Competitive Transmission Administration webpage.
- **Project-Specific Questions to Be Directed to MISO:** Once an RFP is issued for a Competitive Project and until the Selection Report is issued, all questions regarding that project / RFP must be directed to MISO and not to interconnecting incumbent transmission owners. MISO will process these questions in accordance with MISO's Business Practices Manual 027.

These communication protocols are posted on MISO's public website, were incorporated in part within the RFP and BPM-027 and were made part of presentations delivered by MISO's evaluation team during public stakeholder meetings.

MISO conducted training for employees and consultants involved with the Competitive Developer Selection Process. MISO emphasized the need for confidentiality and announced the communication protocols at every meeting of MISO staff and the Competitive Transmission Executive Committee where information about the RFP, developers, or their proposals was discussed.

MISO instructed the evaluation team, which was required to protect the confidentiality of all proposals and associated work products, to refrain from discussing any proposal with entities or individuals that were not part of the MISO evaluation team.

All MISO employees and consultants followed the confidentiality and communication protocols established by MISO throughout the competitive developer selection process, and restricted access and discussions about proposals not only as to external parties, but also to other staff members within MISO who were not part of the MISO evaluation team. In addition, to protect the integrity of the evaluation process, MISO has kept the identities of its independent consultants confidential and required those consultants to attest they were free from conflicts of interests with the FDIM developers.

Document Control and Review

MISO restricted access to all electronic versions of proposal-related documents. Only members of the MISO evaluation team were allowed access to proposal materials. In addition, before MISO evaluated the proposals, MISO randomly assigned a number to each proposal (401 to 409) and a letter to each developer (A, B, C, and D) to enable team members to discuss proposals without referring to a developer by name.

To avoid bias during comparative analysis, MISO CTA staff and consultants reviewed proposals in different sequences, and each workstream's review sequence differed from that of other workstreams.

Comparative Analysis

MISO analyzed each proposal in compliance with Attachment FF of MISO's Tariff, Business Practices Manual 027 Competitive Transmission Process, and the FDIM RFP.

MISO studied each of the four evaluation criteria identified in the tariff, as well as the enumerated subcriteria. Within each criteria and subcriteria, it considered the cost, risk, certainty, and specificity of the information in each proposal.

Figure 2 identifies the four evaluation criteria and respective weights identified in the tariff, and MISO's categorizations. All proposals earned the full 5% in Planning Participation. The figure also identifies how each proposal ranked in each criteria.

Figure 2. Proposal Criteria Categorizations and Scores

Proposal	Cost and Design 35%		Project Implementation 30%		Operations and Maintenance 30%		Planning Participation 5%	Evaluation Score
403	Best	1	Good	7	Better	7	✓	92
404	Good	2	Best	1	Best	1	✓	89
407	Good	3	Best	1	Best	1	✓	88
405	Good	4	Best	1	Best	1	✓	87
408	Good	5	Best	1	Best	1	✓	86
406	Good	6	Best	1	Best	1	✓	85
409	Good	7	Best	1	Best	1	✓	84
402	Acceptable	8	Good	9	Good	9	✓	61
401	Acceptable	9	Good	8	Good	8	✓	60

Part III of this report, *Comparative Analysis of Proposals*, explains how MISO arrived at the designations identified in Figure 2. Each section begins with a summary of the requirements for that section. Each summary identifies the source of the requirements in a footnote.

Each section then discusses the areas in which all developers performed equally and the areas in which they performed differently. Similar performance by all developers is discussed summarily, while differences are explored in greater detail.

This report principally discusses the submitted proposals by developer because much of the content provided by the single developer that submitted multiple proposals was the same. Where there were differences between that developer's proposals, such as in conductor size or substation configurations, the report identifies those differences by proposal number.

II. Summary of Proposals

The following three figures represent core components of the FDIM proposals. The information is discussed in greater detail in Part III of this report.

Developer D submitted six proposals based on combinations of three options. The first option was either a Drake or a Pheasant conductor. The second option was either single-circuit capable or double-circuit capable structures supporting the new single-circuit D-B transmission line. The third option was either a ring bus substation or a DBDB substation.

In this report, MISO explains why it valued Developer D's Proposal 404 higher than Developer D's other proposals. Proposal 404 included a Drake conductor, structures capable of only supporting a single-circuit on the D-B line, and a ring bus substation. Because MISO identified Proposal 404 as Developer D's most competitive proposal, and for presentation purposes, the tables in this report represent Proposal 404 in one column and the different options Developer D included in its other proposals in a second column.

The final figure in this section shows the specific options in Developer D's proposals comprehensively.

Figure 3. Design characteristics of FDIM proposals

	401 A	402 B	403 C	404 D	Option (D)
Conductor (ACSS)					
Trade name (winding)	Cardinal	Cardinal(TW)	Cardinal	Drake	Pheasant
Kcmil (Misch alloy core)	2-954	2-954 (MA3)	2-954 (MA3)	2-795 (MA2)	2-1272 (MA2)
Summer emerg. rating > RFP (3000)	125%	115%	130%	115%	150%
Emergency amps (summer)	3713	3444	3880	3452	4495
Max. operating temp. proposed (F°)	382°	392°	482°	410°	410°
Transmission structures					
Structure type	Monopoles	Monopoles	Monopoles	Monopoles	
Steel type	Galvanized	Galvanized	Weathering	Weathering	
Total structures	232	254	286	211	
Tangent / Angle / Deadend	176/35/21	235 / 3/16	255 /11/20	196/ 9/6	
Tangent foundation backfill	Aggregate	Concrete	Concrete	Aggregate	
Circuit capability (F-D line)	Single	Single	Single	Double	
Circuit capability (D-B line)	Single	Single	Single	Single	Double
Substation					
Bus arrangement	Ring	DBDB	Ring	Ring	DBDB
Bus ratings (A)	3000	3000	3000	4000	4000
Expansion capability	BAAH	BAAH	BAAH	BAAH	DBDB
Land / footprint (acres)	15 / 3.2	40 / 4.5	40 / 6.2	116 / 3.4	116 / 4.4
Line side disconnect switch	no	yes	yes	yes	yes

Figure 4. Cost characteristics of FDIM proposals

	401 A	402 B	403 C	404 D	Option (D)
PI Cost ($M, without AFUDC)	$154	$125	$84	$89	$93 - $104
Revenue Requirement ($M, PV)	$154	$131	$62	$84	$87 - $95
Commitments					
Project implementation cost cap ($M)			$97		
Annual revenue caps (years)		(40)		(40)	
POI adjustment		1%/mile			
Annual containment above PTW		0.0%		1.4%	
Return on equity % (years)	10% (10)	9.8% (40)		9.8% (40)	
Weighted cost of equity (years)			5.55% (40)[2]		
Equity/capital % (years)	50% (10)				
Pre-in-service carrying cost election	return on CWIP	AFUDC	AFUDC	return on CWIP	
Annual O&M caps (years)			(10)		
Tax exemption (% of project)			49%		
Forego return on working capital				✓	
Forego pre-commercial costs				✓	

Figure 5. Project Implementation and O&M characteristics of FDIM proposals

	401 A	402 B	403 C	404 D	Option (D)
Project Implementation					
Proposed in-service date	Jun 22, 2029	May 24, 2028	Feb 8, 2028	Jun 1, 2028	
Guaranteed in-service date	Apr 1, 2030	Jun 1, 2028	Jun 1, 2030	Jun 1, 2028	
Penalty for exceeding guarantee	$/day	ROE bp/mo	ROE bp/mo	ROE bp/mo	
Parcels / owners of ROW	125 / 98	152 / 108	153 / 98	130 / 96	
Operations & Maintenance					
Backup CC transfer (avg min)	30	20	45	20	
Station inspection	quarterly	monthly	monthly	monthly	
Spare reactor / onsite	yes / no	yes / yes	yes / no	yes / no	

Figure 6. Developer D proposal options

	404 D	405 D	406 D	407 D	408 D	409 D
Conductor	Drake	Pheasant	Drake	Drake	Pheasant	Drake
Substation	Ring	Ring	Ring	DBDB	DBDB	DBDB
Circuit capability (D-B)	Single	Single	Double	Single	Single	Double

[2] Developer C's municipal partner, which will purchase 49% of FDIM after it is constructed, also committed to limit its weighted cost of equity to 4.87% for forty years.

III. Comparative Analysis of Proposals

This section explains the criteria MISO must evaluate in each proposal, the weights MISO must assign to each of the four principal sections identified in the tariff, the content of the submitted proposals that is responsive to the FDIM RFP, and the nonconfidential items in each proposal that strengthened or weakened each developer's submission.

The organization of this section closely parallels the organization of the FDIM RFP and Section 7. Required Content for Proposal Submissions in MISO's Business Practices Manual No. 027 Competitive Transmission Process.

1. Cost & Design

MISO must evaluate a competitive proposal's Cost and Design plans. Within those plans, it must specifically evaluate each proposal's electrical design, structural design, estimated project implementation cost, and estimated annual transmission revenue requirement.

If the project consists of only a transmission line or only a substation, this review must constitute 30% of MISO's decision. If the project consists of both a transmission line and a substation, as it does in FDIM, this review must constitute 35% of the decision.[3]

For Cost and Design, MISO categorized Proposal 403 as Best, Proposals 404 – 409 as Good, and Proposals 401 and 402 as Acceptable.

Proposals 402 and 407-409 included a DBDB substation. This substation design allows all circuits to continue operating when a circuit breaker trips. This design also allows more circuits to continue operating when maintenance is performed on certain elements. However, DBDB substations are more expensive. MISO ranked the Cost and Design component of proposals with a DBDB substation generally lower than that of proposals with a ring bus substation because MISO determined in this FDIM project the additional cost of a DBDB substation outweighed the benefit of that design.

Proposals 405 and 408 included a Pheasant conductor, which is operationally superior but more expensive than the Drake and Cardinal conductors included in the other proposals. The larger diameter of a Pheasant conductor increases its operating life, increases the power it can transmit, and reduces energy losses compared to conductors with smaller diameters.

MISO ranked the Cost and Design component of proposals with a Pheasant conductor generally lower than that of proposals with Drake or Cardinal conductors because the Denny to Border line is only a section of the transmission line that will connect the Denny and Orient substations. The portion of the line in Iowa will have a lower ampacity and therefore would limit the benefits the Pheasant conductor would create.

Proposals 406 and 409 included transmission structures on the D-B line that would be built to hold a possible second circuit in the future. Although this "second circuit" design would be more expensive than the single-circuit designs of the D-B structures included in all other FDIM proposals, if MISO decided in the future to add a second 345 kV circuit between Denny substation and Orient substation, the cost of the

[3] Attachment FF. Section VIII.E.1. Proposal Evaluation Criteria

addition would be lower. However, MISO determined the additional cost of a second circuit design on the D-B line outweighs the present value of any future cost savings, given the speculative nature of the need.

1A. Transmission Line Design

A competitive proposal must describe the electrical design of each competitive transmission facility specified in an RFP.[4] All proposals met the minimum requirements in the tariff for electrical design.

Electrical Design of Transmission Lines

A competitive proposal that includes a transmission line must describe and explain the estimated length of the line and the characteristics of all proposed conductors, ground wires, and communication wires.[5]

Figure 7 identifies characteristics of the proposed conductors.

Figure 7. Proposed conductors

Design	401 A	402 B	403 C	404 D	Option (D)
Trade name (winding)	Cardinal	Cardinal(TW)	Cardinal	Drake	Pheasant
Kcmil (Misch alloy core)	2-954	2-954 (MA3)	2-954 (MA3)	2-795 (MA2)	2-1272 (MA2)
Summer emerg. rating > RFP (3000)	125%	115%	130%	115%	150%
Emergency summer amps	3713	3444	3880	3452	4495
Max. operating temperature (F°)	382°	392°	482°	410°	410°

All developers proposed double-bundled, ACSS conductors and explained to varying degrees of specificity the method by which they analyzed which conductor was best suited for the project. The ratings and maximum operating temperatures are different for the Cardinal conductors because a developer may use its own method for calculating these measurements. All proposals included shield wires as a part of their design, and communication cables as described in the RFP.

Developer A studied four ACSS conductors (Drake, Cardinal, Grackle-TW, and Pheasant) and one ACSR conductor (Lapwing). It concluded Drake, Cardinal, and Grackle-TW were the best options, and it proposed to use Cardinal, which is a standard on its system.

Developer B studied five conductors and it proposed to use Cardinal ACSS/TW with an MA3 core. It was one of two developers to propose an MA3 core, which is stronger but more expensive and rarer than an MA2 core.

4 MISO BPM-027 Section 7.2.4

5 Attachment FF. Section VIII.D.7.1. Design for Competitive Transmission Line Facilities

Developer C proposed a Cardinal ACSS conductor with an MA3 core. It concluded this conductor, which it uses as a standard in its operations, had the lowest lifecycle costs of qualifying conductors.

Developer D studied thirteen conductors and proposed two options. In Proposals 404, 406, 407, and 409, it proposed a Drake ACSS conductor with an MA2 core. This conductor would have the lowest diameter and weight of those proposed for FDIM, but it would have the highest losses, noise, and vibration, and the lowest ampacity. In Proposals 405 and 408, it proposed a Pheasant ACSS conductor with an MA2 core. This conductor would have the highest cost of those proposed for FDIM, but it would have the lowest losses, noise, and vibration, and the highest ampacity.

Legal and Regulatory Compliance

A competitive proposal that includes a transmission line must describe how the developer will meet local legal and regulatory requirements. Each proposal must include a statement that the developer currently has or reasonably expects to obtain all necessary authority to develop and operate the competitive project as envisioned in the RFP.[6]

Each developer stated it has obtained or reasonably expects to obtain all necessary authority to develop and operate the FDIM project.

Structural Design of Transmission Lines

A competitive proposal that includes a transmission line must describe the design attributes of the tangent, running angle, non-angle dead-end, and angle dead-end structures that will support the conductors. It must also explain all grounding, lightning, galloping, and vibration strategies as well as how the structural design will meet local legal and regulatory requirements.[7]

Figure 8 identifies the general characteristics of the structures proposed by the developers. All designs met the minimum RFP requirements. Each developer included drawings and cutsheets for the structures and equipment.

Figure 8. Proposed transmission structures

	401 A	402 B	403 C	404 D	Option (D)
Structure type	Monopoles	Monopoles	Monopoles	Monopoles	
Steel type	Galvanized	Galvanized	Weathering	Weathering	
Total structures	232	254	286	211	
Tangent / Angle / Deadend	176/35/21	235/ 3/16	255/11/20	196/ 9/ 6	
Tangent foundation backfill	Aggregate	Concrete	Concrete	Aggregate	
Circuit capability (F-D line)	Single	Single	Single	Double	
Circuit capability (D-B line)	Single	Single	Single	Single	Double

6 MISO BPM-027 Section 7.2.4.1

7 Attachment FF. Section VIII.D.5.7.1. Design for Competitive Transmission Line Facilities

Transmission structures

Developer A proposed galvanized steel monopoles with davit arms in a delta pattern for the tangent poles. It will directly embed the tangent structures and backfill them with compacted crushed rock. It will use drilled pier, full length anchor bolt foundations for structures with line angles greater than two degrees and will use silicone rubber polymer insulator assemblies. It expects to encounter a water table depth of 20-40 feet in the project area.

Developer B proposed galvanized steel monopoles with braced-post assemblies in a delta pattern for the tangent poles. It will directly embed the structures and backfill them with concrete.

Developer C proposed weathering steel monopoles for the FDIM lines. It will directly embed the tangent poles and use concrete backfill. It will place running angle and deadend poles on concrete drilled piers. It will use polymer braced-post assemblies in a delta pattern for the tangent poles to minimize insulator contamination. It will use glass bell insulators for the angle and deadend poles because polymer insulators would have increased cost by increasing the length of the davit arms.

The developer stated monopole structures are critical to siting approval and property acquisition in Missouri, and H-frame structures impact farming and allow weeds to grow under them. It cited the opinion of a steel pole supplier that weathering steel saves 10-14% in material cost versus galvanized or painted, while providing equivalent strength and reduced maintenance. It will construct a deadend structure no more than five miles from the nearest similar structure. The average span between structures will be 800 feet.

Developer D proposed weathering steel monopoles for the FDIM transmission lines. It will directly embed the tangent poles and backfill them with aggregate. Its running angle and deadend poles will be a mixture of guyed and self-supporting structures. The D-B line will use a delta configuration design and the F-D line will use a vertical configuration. Although the F-D line will be a single circuit, Developer D designed the line structures in each of its proposals to support a second circuit in the future. In Proposals 406 and 409, it also designed the D-B line structures to support a second circuit in the future.

Grounding and lightning protection

All developers presented grounding methods. They discussed lightning, galloping, and vibration strategies but not in equal amounts. To protect the FDIM lines from lightning, all the developers will install two overhead shield wires on the transmission structures: one will be an OPGW and the other will be a standard shield wire. All structures will have proper grounding systems that matches the recommendations and requirements stated in the RFP. In addition, the developers provided the specifics related to their design and proposed installation.

Galloping and vibration design

The Developers are using common technology in their design to address galloping and vibrations. All the developers' structures, phase conductors, OPGW and static wires will be designed to match the recommendations and requirements stated in the RFP. In addition, the developers provided the specifics related to their design and proposed installation.

All the developers' designs used the appropriate equipment to meet industry standards for addressing galloping and vibrations. In addition to the self-damping aspects of ACSS conductors, all the developers included vibration dampers, conductor spacers and other features on the phase conductors, OPGW and static wires.

Regulatory compliance

Each developer stated it has obtained or reasonably expects to obtain all necessary authority to develop and operate the FDIM facilities.

1B. Substation Design

A competitive proposal that includes a substation must include a detailed one-line diagram and describe the proposed protection schemes, remote monitoring capabilities, communication systems, power transformers, line terminal ratings, and characteristics of various other equipment. It must also describe how the structural design will meet local legal and regulatory requirements.[8]

MISO asked competitive developers to include in their FDIM proposal a new four-position 345 kV substation, which will be called Denny. The four positions would support the new transmission line to Orient, the new transmission line to Fairport, a future transmission line to Ameren's Zachary substation in Missouri, and a new 50 MVAr shunt reactor. The RFP emphasized the importance of Denny's location in relation to the Fairport substation and the effect its location and other design features will have on the operation and maintenance of the FDIM facilities.

Figure 9 identifies electrical and structural design characteristics of the proposed substations.

Figure 9. Substation design components

Design	401 A	402 B	403 C	404 D	Option (D)
Bus arrangement	Ring	DBDB	Ring	Ring	DBDB
Bus ratings (A)	3000	3000	3000	4000	4000
Expansion capability	BAAH	BAAH	BAAH	BAAH	DBDB
Land / footprint	15 / 3.2	40 / 4.5	40 / 6.2	116 / 3.4	116 / 4.4
Line side disconnect switch	no	yes	yes	yes	yes

Electrical Design of Substation

As specified in the RFP, the Denny substation may be either a ring bus arrangement or a DBDB arrangement. It will have four total 345 kV positions (terminals): three 345 kV transmission line terminals and one 345 kV bus-connected reactor position.[9] MISO specifically reviews bus configuration, equipment ratings, protection and control features, and communication design of competitive substation facilities.

All proposals met the minimum requirements in the RFP with respect to the Denny substation design, including the specified protection and control equipment, such as relays, outlined in the RFP.

Developer A has a very compact substation design compared to other developers and may be challenged to implement the ring bus design. Also, the line terminations may be challenging as well.

Developer B elected to propose a DBDB design instead of a ring bus design, both of which are allowable in the RFP. The DBDB design is more reliable and offers greater flexibility for operations, as well as performing maintenance versus the ring bus design. While the design and extra benefits are superior to the ring bus, this design comes with a significantly higher cost to construct.

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8 Attachment FF. Section VIII.D.5.7.2. Design for Competitive Transmission Line Facilities

9 FDIM RFP, Part 1, page 41

Developer C's substation site selection and design will require the relocation of an existing transmission line and its line termination points have the most congestion challenges due to the proximity of multiple existing transmission lines. Also, the electrical location of the shunt reactor may lead to more complexity and outages if the substation is expanded.

Developer D explained how it optimized its substation orientation and layout to provide for the proper bay positions for the takeoff structures associated with the lines to Orient, Fairport, and Zachary. Also, the bay alignments allow for the shunt reactor to be between the Zachary and Orient lines. While the other developers designed their substations to meet the minimum 3000 A capability, Developer D designed its substation to accommodate 4000 A capability for the bus and all equipment in the substation.

Structural Design of Substation

Developer A's site plan presents some civil work challenges, and the fenced footprint of the substation may not have adequate space to allow for possible replacement of damaged equipment or for testing and inspection of equipment without specialized equipment such as heavy-duty cranes, etc.

Developer B's site selection is better than some of the other proposed sites and its layout and design supports the placement of the shunt reactor and the two new transmission lines that are part of this project. In addition, the design is well suited to accommodate the future new Zachary line.

Developer C explained the nature of the 40-acre site it secured for the substation. The highest point of the site is in the southwest corner and the property slopes northeast at a 3% grade. The developer will grade 18 acres for use, and it will center the substation pad on the crest hill to balance the earthwork. This will result in a 2% grade running northeast and southwest. Unlike other proposed substation sites, additional civil work will be required if the substation needs to be expanded in the future.

Developer D's site selection and design layouts for the initial ring bus and DBDB will support future expansion. The location of the substation has been optimized and aligned to support the terminations of both the Fairport and Orient 345 kV lines and the future Zachary line. The shunt reactor was optimally placed to meet the current design and future expansion. The future expansion to a breaker-and-a-half design for its ring bus design and maintenance of its DBDB bus design was accounted for in the initial layout of the substation yard and will minimize outages of the substation and its lines.

1C. Project Implementation Cost

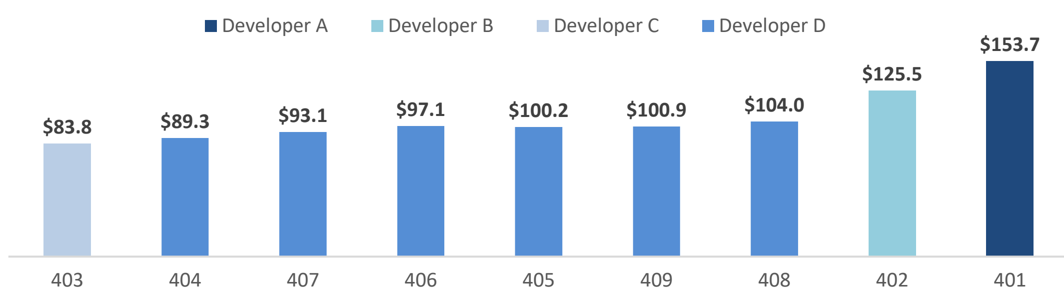
Each proposal included a completed Project Template Workbook (PTW), which allowed MISO to understand the details of a proposal's project implementation (PI) costs during and after construction. Although MISO must evaluate the rigor of each cost estimate and any financial assumptions, it recognizes those estimates are not binding without cost containment measures.[10]

All developers included contingency in their proposals. Contingencies ranged from 1.4% to 5.4% of the estimated costs. MISO views project contingency as an additional cost component that decreases a project's cost risk from an initial level to a subsequent level. It looks at the supporting information in a competitive proposal to better understand how to compare project cost estimates. It has higher confidence in estimates that are paired with project cost containment than estimates that are not.

The estimated PI costs of Proposal 402 and Proposal 403 include Allowance for Funds Used During Construction (AFUDC). The estimated PI costs of the remaining proposals do not include AFUDC, as Developer A and Developer D will request a return on Construction Work in Progress (CWIP). The cash flows related to return on CWIP are accounted for in Section 1D, Annual Transmission Revenue Requirement.

Figure 10 illustrates the estimated PI costs exclusive of AFUDC so they are more comparable.

Figure 10. Estimated FDIM PI cost, exclusive of AFUDC



Developer A estimated a PI cost of $153.7 million, which was based on 42.2 transmission miles and a ring bus substation. It will request a return on CWIP instead of capitalizing AFUDC. It did not propose to cap its PI cost.

Developer B estimated a PI cost exclusive of AFUDC of $125.5 million, which was based on 42.7 transmission miles and a DBDB substation. It forecast AFUDC of $13.6 million for a total PI cost of $139.1 million. It did not propose to cap its PI cost, but it did offer to cap its annual revenue, which will be discussed in the next section.

Developer C estimated a PI cost exclusive of AFUDC of $83.8 million, which was based on 43.7 transmission miles, a ring bus substation, and an in-service date of February 8, 2028. It forecast AFUDC of $5.0 million for a total PI cost of $88.8 million. It proposed to cap its PI cost at $96.9 million, which is $8.1 million greater than its estimate. It developed the cost cap to "address the potential of higher costs, including escalation and

[10] Attachment FF. Section VIII.E.1.1(a)

AFUDC, in the event the parties agree to a project completion date that is later than February 2028." It will adjust its project implementation schedule and cash flow to align with a later, mutually agreeable in-service date and manage project implementation accordingly. It will stop accruing AFUDC at the agreed in-service date if another party causes a delay in project energization.

Developer D estimated a PI cost of $89.3 million for Proposal 404, which was based on 41.4 transmission miles and a ring bus substation. Its other five proposals, the components of which are discussed in Section 1A and 1B of this report, estimated PI costs between $93.1 million and $104.0 million. In each proposal, it will request a return on CWIP instead of capitalizing AFUDC. None of its proposals contain a specific PI cost cap, but they all offer to cap annual revenue, which will be discussed in the next section.

The following two figures illustrate the cost of the transmission lines and substations in the FDIM proposals. Each amount reflects the sum of the direct costs of the facilities and a pro rata allocation of the proposal's indirect costs, exclusive of any AFUDC. Proposals 407-409 and Proposal 402 in Figure 12 are based on DBDB substation designs. The remaining proposals are based on ring substation designs.

Figure 11. Estimated cost per 345 kV transmission line mile ($M)

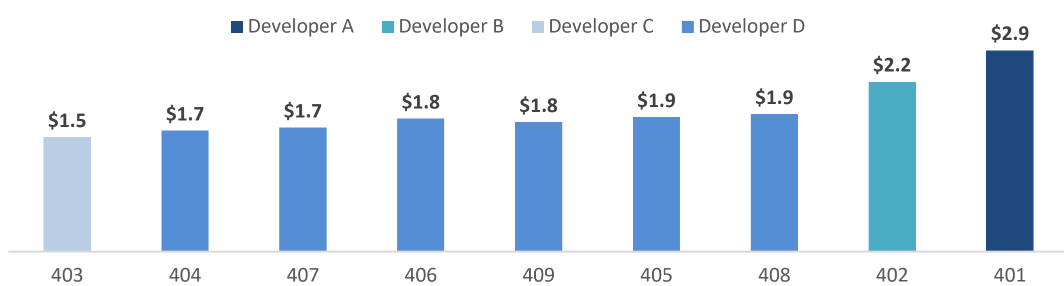
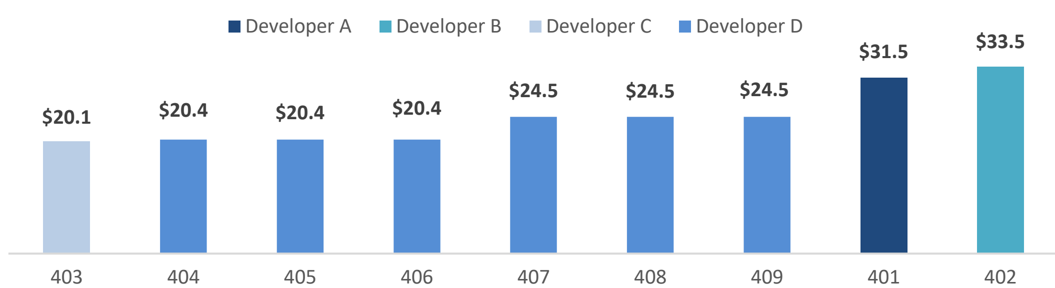


Figure 12. Estimated substation cost ($M)



1D. Annual Transmission Revenue Requirement

MISO calculated the present value of each proposal's 40-year revenue requirement (PVRR) by discounting the annual cash flows by a 6.9% discount rate. Figure 13 illustrates the PVRR of each proposal, and Figure 14 identifies relevant components and commitments related to the PVRR of each proposal.

Figure 13. 40-Year Present Value Revenue Requirement ($M)

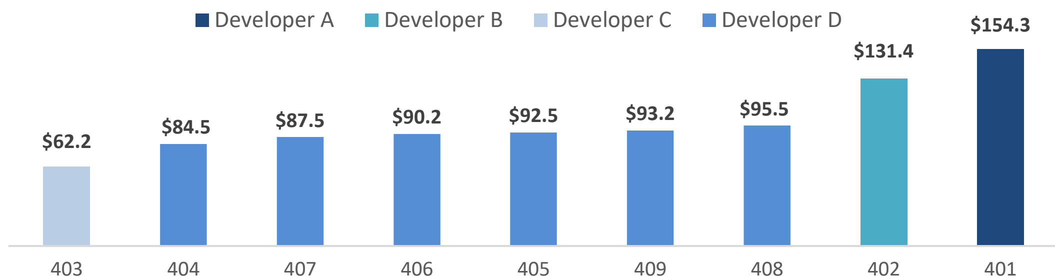


Figure 14. Cost commitments

	Developer A	Developer B	Developer C	Developer D
Project implementation cap			$97 M	
Annual revenue caps (years)[11]		(40)		(40)
Cap increase over PTW amounts		0.0%		~1.4%
Cap adjustment for POI		+1%/mile		
Return on equity % (years)	10% (10)	9.8% (40)		9.8% (40)
Weighted cost of equity % (years)			5.55%/4.87% (40)	
Equity/capital % (years)	50% (10)			
Pre-in-service carrying costs	return on CWIP	AFUDC	AFUDC	return on CWIP
Annual O&M caps (years)			10	
Tax exemption (% of project)			49%	
Forego return on working capital				✓
Forego pre-commercial costs				✓

Return on net plant

Subject to FERC approval, a developer may expense or capitalize carrying costs the developer incurs prior to placing a competitive facility into service. If the developer expenses those costs, it will report them as a "return on construction work-in-progress (CWIP)" and recover them in its revenue requirement prior to placing the asset into service. If the developer capitalizes those costs, it records them as "Allowance for Funds Used During Construction" and then adds them to the facility's gross plant when it places the facility

11 Developer B's cap begins in the first full calendar year of the project. Developer D's cap begins on the in-service date.

into service. It then recovers the capitalized carrying costs through the depreciation and return components of its revenue requirement over the life of the facility.

The developers' proposed revenue requirements reflected returns on equity (ROE) between 9.6% and 10.0% and equity in long-term capital structure between 45% and 55%.[12]

Developer A committed to cap its ROE at 10% and equity percentage for ten years. Developer B and Developer D each committed to cap their ROE at 9.8% for forty years. Developer C and its tax-exempt municipal project partner committed to cap their weighted cost of equity at 5.55% and 4.87% respectively, for forty years.

O&M

Each developer included in its PTW estimated annual O&M expense for the forty-year project period. Developer C was the only developer that proposed to specifically cap its O&M expenses. It proposed to limit annual recoverable O&M through the end of the tenth full project year to the lesser of actual project O&M or stated annual "allowances" plus any cumulative allowance unused in previous years. It stipulated it would not recover in future periods any amounts unable to be recovered in a previous year.

Total Revenue Requirement

Developer A estimated a PVRR of $154.3 million, the highest submitted revenue requirement. It did not offer to cap its annual revenues.

Developer B estimated a PVRR of $131.4 million, the second highest submitted revenue requirement. It offered to cap annual project revenue for forty years at the amounts in its PTW. In any year in which its actual costs are less than its authorized cap, the authorized cap in the following year will increase by the difference. However, in any year in which its actual costs are more than its authorized cap, it may only collect the authorized cap in that year, and it may not collect the "stranded amount" in the following year, even if there is room under the authorized cap in the following year. In this sense, the cap structure is asymmetrical in favor of ratepayers.

Its annual caps will also be subject to a POI adjustment. It will increase its annual caps by 1% for every mile between the actual POI and its proposed POI on the Iowa/Missouri border, which it identified in its proposal. It will round its mileage adjustment to the nearest hundredth of a mile.

Developer C estimated a PVRR of $62.2 million, the lowest submitted revenue requirement. Although it did not offer to cap its annual project revenue, MISO determined its project cost cap, ten-year O&M cap, and ten-year weighted return on equity caps significantly limit the degree to which its actual revenue could deviate from its estimates. Developer C's proposal to partner with a tax-exempt municipal agency significantly reduced the income and property taxes in its PVRR.

Developer D estimated a PVRR of $84.5 million for Proposal 404 and PVRRs between $87.5 and $95.5 million for Proposals 405–409. In each proposal, it offered to cap its annual project revenues for forty years at approximately 1.4% greater than the amounts in its PTW.

[12] These figures include Developer C's weighted project rates, not the individual rates of Developer C and its partner.

Financial Modeling

MISO also calculated proposal PVRRs in different scenarios to understand how those scenarios might change the competitiveness of each proposal. The scenarios included increases in project cost, return on equity, cost of debt, O&M expense, and equity in capital structure, and a six-month energization delay caused by a developer. MISO applied all proposed cost caps and penalties for delay in each scenario.

Although Proposal 404 includes annual revenue caps, Proposal 403 has a lower PVRR and remains superior under various financial scenarios due to its multiple revenue component caps.

2. Project Implementation

MISO must evaluate a competitive proposal's Project Implementation plans. Within those plans, it must specifically evaluate the ability of each developer to manage the project, analyze possible routes and obtain necessary permits, acquire right-of-way and land, construct and finance the project, and ensure safety during the project.[13]

If the project only consists of a transmission line, this evaluation must constitute 35% of MISO's decision. If the project includes a substation, as it does in FDIM, this evaluation must constitute 30% of the decision.[14]

A proposal must identify, for each of the project implementation components, the identities, qualifications, and base of operations of the staff or contractors that will be used to successfully complete the project. Additional requirements are identified in the project implementation subcategories below.

Each of the four developers demonstrated within their proposals they have the ability and experience to complete the project. Because the project implementation content of developers that submitted more than one FDIM proposal was not materially different across those proposals, this report evaluates that content by developer instead of by individual proposal.

For Project Implementation, MISO categorized Developer D as Best and Developers A, B, and C as Good.

2A. Schedule and Management

Project Schedule

A competitive proposal must include a project schedule that highlights a project's critical path and major milestones. It may also include a brief discussion of the project's scheduling risks. A developer should discuss the weather days and float included in its schedule.[15]

The FDIM RFP stated in-service date flexibility is an aspect of FDIM MISO anticipates may be particularly important. The RFP also stated a developer must be able to place FDIM into service by June 1, 2030.

The developers stated they could complete the project two months to two years earlier than MISO's deadline. The developers will still have to coordinate with MEC and AECI, the two interconnecting transmission owners, and Ameren, the owner of the Zachary substation, to place the FDIM facilities into service.

Developer A stated it would be able to energize FDIM by June 22, 2029, but it did not offer any penalty for failure to meet this deadline. Instead, it offered to reduce the project's capital cost by $5,000 for each day it is not ready to energize the line past April 1, 2030. The schedule included 25 weather days, but those days were not identified at the activity level.

13 Attachment FF. Section VIII.D.5.8. Project Implementation

14 Attachment FF. Section VIII.E.1. Proposal Evaluation Criteria

15 FDIM RFP, Page 20

The schedule shows that substation materials will arrive approximately one year before the developer begins to prepare the site. MISO determined this slightly decreases the certainty of the proposed plan because the materials may need to be moved.

Developer B guaranteed to energize FDIM as early as June 1, 2028, if the interconnecting parties and MISO agree on an early energization date by June 1, 2024. It offered to reduce its return on equity by 0.025%, up to a maximum of 0.3%, for every month it is not ready to energize the facilities beyond the in-service date agreed to by the interconnecting parties. It did not identify the routing contractor it will use, which all other developers did. Its schedule includes 30 weather days and twelve months of float.

Developer C stated it could energize FDIM by February 8, 2028, the earliest date suggested in the proposals. It offered schedule delay penalties like Developer B, but different in two ways. First, the penalties will not begin until June 1, 2030, MISO's expected in-service date. Second, the penalty is 0.0125% and applies to both the developer's and its municipal partner's weighted cost of equity. Because Developer C and its municipal partner will own 51% and 49% of FDIM, respectively, after the project is energized, its schedule delay penalty is substantially equal to the 0.025% ROE penalties offered by the two developers that did not define their proposed penalties in weighted terms.

It included 28 months of float in its critical path and 46 weather days in its construction schedule. It also broke the weather days down by major project activities. Its schedule indicates steel pole procurement will overlap ROW and easement acquisition by four months. This increases project risk because the developer may be purchasing its poles before finalizing its route and confirming geological adequacy.

Developer D guaranteed it would be able to energize FDIM as early as June 1, 2028, if the interconnecting parties and MISO agree to a date earlier than June 1, 2030. It offered a schedule delay reduction to ROE exactly like Developer B.

It included 124 days of float in its critical path and added an additional 122 days of float for ROW acquisition and material procurement. It provided historical weather patterns for the area and included 137 days for weather delays.

It plans to build the transmission line in seven months to meet its earliest guaranteed energization date, which is almost twice as fast as the next quickest transmission construction period proposed. This period increases to fifteen months for the 2030 energization date, which is like other proposals.

Project Management Plan

A developer must describe how it will manage the project to meet the proposed schedule. It should describe the qualifications and locations of the management team and the organizational structure of the project's contractors and subcontractors. It must also attach a project management plan that identifies project risks and discusses how the developer will coordinate with all interconnecting transmission owners (ITO).[16]

MISO recognizes that the quality of a risk register is not absolutely related to the number of items identified. One developer may combine similar risks into a single category in its risk register while another may break down risks into more detail. MISO also recognizes that the number of risks identified relates to a developer's implementation strategies. A developer that chooses to comprehensively study a certain

[16] FDIM RFP, Page 21

project component may list less risks related to that component than a developer that does not choose to study that component in as much depth prior to submitting its proposal.

Developer A attached a risk register that described 38 risks to the project. For each risk, the register identified whether the developer or its EPC contractor was responsible for mitigation, the relative financial exposure, the probability of occurrence, and mitigation strategies.

The register categorized financial exposure as minimal, moderate, major, severe, or worst case and explained the minimum and maximum costs related to each category, but it did not identify the individual or total weighted costs of the risks. MISO determined that Developer A's presentation of the weighted cost of each risk was less specific than those of its peers.

Developer B appended a risk register to its project management plan attachment that identified 70 risks to the project. For each risk, the register identified the relative likelihood and consequence, the resulting risk level to the developer (and a related risk level to customers), mitigation strategies, the internal position responsible, and the weighted financial impact. The mitigation strategy for many risks included a statement about cost and schedule guarantees providing risk protection rather than specific risk responses.

Developer C attached a risk register that identified eight risks to the project and explained how those risks informed 85% of the dollar amount of its contingency. The risks related to drilling foundations, easements for ROW, road weight restrictions, and land clearing. The remaining 15% of the contingency was defined as general risk related to the project, and the developer stated, "strategies will be developed…prior to construction when specific risks are defined."

The developer executed and attached to its proposal a master program contract with a general contractor, which incorporates an incentive-based, target pricing structure. It also identified eight other contractors it will use for project implementation.

Developer D attached a risk register that identified 70 risks to the project. For each risk, the register identified a mitigation plan, the probability of occurrence, the estimated maximum and weighted cost of exposure, and the estimated maximum and weighted effect on the project schedule.

All developers satisfactorily explained how they will coordinate with ITOs.

2B. Route and Site Evaluation and Permitting

Route and Site Evaluation

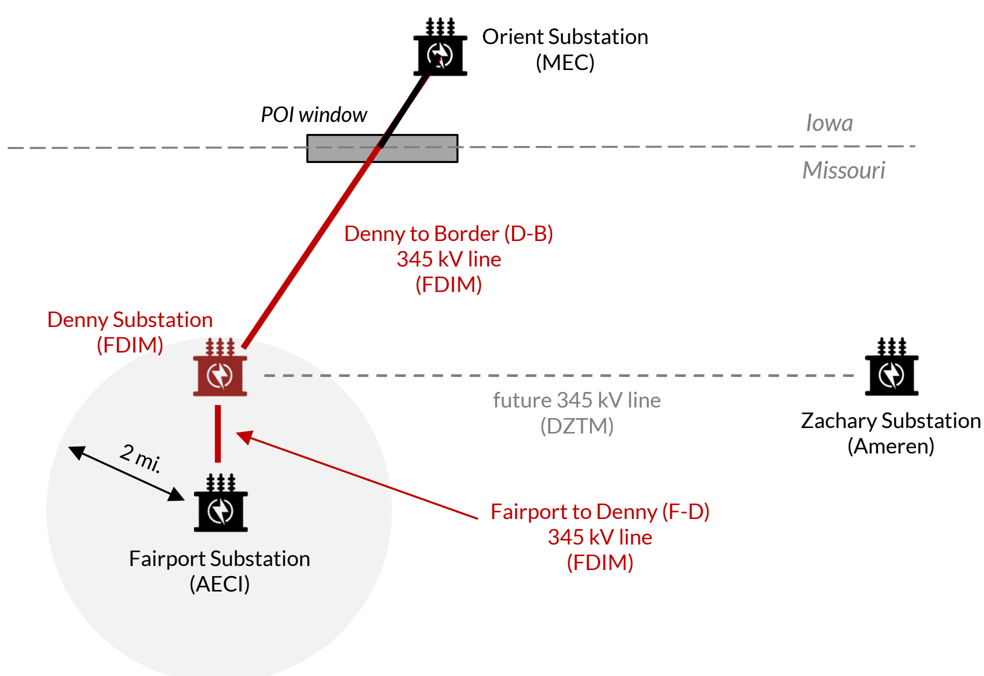
A competitive proposal must describe how the facilities will be routed or sited and the challenges and risks that exist in that plan. It must explain how the developer evaluated and selected all routes and sites and how it will conduct public outreach during the evaluation and selection process.[17]

Figure 15 illustrates the general relationship of the existing and proposed transmission assets relevant to FDIM. The FDIM RFP explained MISO's planning analysis modeled the new Denny substation about two miles from AECI's Fairport substation, which is near Fairport, Missouri.

The RFP directed developers to also propose two 345 kV single-circuit transmission lines out of Denny, one to Fairport (F-D) and one north to the POI at the state border (D-B). The RFP identified this section using GPS coordinates and informed developers the D-B line would interconnect at the state border within the POI window with a similar 345 kV line to be built by MEC that would terminate at MEC's Orient substation in Iowa.

The RFP stated point of interconnection flexibility and the substation's location in relation to the Fairport substation was an aspect of the project MISO anticipates may be particularly important.

Figure 15. FDIM facility map



[17] MISO BPM-27 Section 7.3.3

Developer A proposed to build the Denny substation on a 15-acre site east of Fairport and build a 40-mile line for the D-B line segment. It chose to route east of Albany because it was the shortest, straightest route with fewer parcels and landowners crossed, the least amount of ROW acquisition, and flexibility at the POI window at the Iowa/Missouri state border.

Developer A's route selection process was specific and well-integrated with its design decisions. It extended its route study five miles into Iowa to better inform its POI location. It provided the most specificity in its construction overlay KMZ of all developers, displaying access, clearing, and existing infrastructure. Its proposed route avoids environmentally protected areas, follows parcel edges, and strategically places structures to minimize farm impacts, and avoids or minimizes impacts to environmentally sensitive areas. Its route crosses the fewest number of parcels and impacts the fewest wetlands of all developers.

Developer A does not anticipate triggering FAA requirements for the nearby Albany Municipal Airport but did not provide explicit confirmation of this expectation. Developer A will notify the FAA, after it finalizes engineering design, if any notification criteria are met.

Developer A stated its substation design is still pending internal review, and there are related site issues that create uncertainty. Its substation site is the smallest of all developers, and the compact layout does not appear to provide sufficient area for vehicular traffic during construction or future maintenance. There is an atypical takeoff structure which adds uncertainty to site access. Developer A plans to use its 15-acre site as a laydown yard for substation equipment during construction, which is risky due to its compact size and grading not being explicitly shown to be completed before critical material arrives. Contours do not seem to be taken into consideration for overall site design, with no grade breaks across the site.

Developer B proposed to build the Denny substation on a 40-acre site northeast of Fairport and build a 40-mile line for the D-B line segment. It chose to route the D-B line east of Albany because that would avoid all key routing constraints, have the least angle structures of all routes evaluated to the center of the POI window, and have no overhead line crossings.

Developer B's routing process included a three-category weighting system but provided less detailed comparative analysis of alternatives than other developers. It was the only developer without a dedicated routing contractor. Its route avoids encroaching on the Albany Municipal Airport, but it did not explain why it routed so far east, and it placed some angle structures with guy wires in locations that could seemingly be adjusted slightly to lessen impacts to farms.

Developer B evaluated the most substation sites of all developers but included the least specificity about the chosen substation site and the process that led to choosing it, including descriptions of alternatives that were not chosen.

Developer C proposed to build the Denny substation on a 40-acre site northwest of Fairport and build a 42-mile line for the D-B line segment. It explained how it optimized the D-B line to leverage existing transmission corridors and roads.

Like some of the other developers, Developer C proposed a route that will come within the 20,000-foot radius around the Albany Municipal Airport, which will likely require it to notify the Federal Aviation Administration. However, unlike those other developers, it did not discuss this potential issue. This introduces a small degree of uncertainty around its proposed route. Its proposed Denny substation location results in the most congestion challenges of all developers for both FDIM and the future connection to Zachary Substation.

Developer D proposed to build the Denny substation on a 116-acre site north of Fairport and build a 41-mile line for the D-B line segment. It chose to route through the western corridor due to fewer topographical changes and a shorter overall route.

Developer D had a highly specific routing process, and it completed various activities to provide more certainty in its proposed route than other developers. It performed the most extensive study of Iowa routes from the Iowa/Missouri state border to MEC's Orient substation and studied six micro-routes at the north end of the corridor to better inform its proposed western POI location and provide flexibility for the final POI location. It was the only developer to commission a consultant study which resulted in a minor reroute and assurance that FAA mitigations due to the Albany Municipal Airport will be avoided. Developer D performed a multi-day field visit in early 2023, completed a cultural and tribal interests assessment that found no significant concerns, and included correspondence with various regulatory agencies. It included detailed maps with existing transmission and distribution crossings, underground utility crossings, and other routing constraints.

Developer D provided project-specific benefits in its substation siting such as orienting its substation equipment and F-D structures to mitigate nearby transmission line crossings and proposing a site large enough to use as a laydown yard during construction or maintenance storage location after implementation. It provided a communications log showing government agency outreach which was performed to provide certainty in its proposed site.

Regulatory permitting process

A competitive proposal must describe how the developer will obtain regulatory permits necessary for the project. This must include activities such as preliminary engineering, preparation of any applications and written testimony, and participation in regulatory hearings. [18] A developer must also discuss recent projects that demonstrate its capabilities to obtain the necessary permits.[19]

MISO identified coordination with interconnecting transmission owners as an aspect of FDIM it anticipates may be particularly important.

The developers described in varying degrees four specific or general regulatory bodies from which the Selected Developer will or may need to receive permits or approvals to execute FDIM.

1. **MPSC CCN.** A developer will have to receive a Certificate of Convenience and Necessity (CCN) and a declaration that it is a public utility from the Missouri Public Service Commission (MPSC). This will allow it to build FDIM and exercise eminent domain if necessary.
2. **County Assents.** A developer will have to receive assents from each county in Missouri in which the developer will need to use or alter public roads.

[18] MISO BPM-27 Section 7.3.4

[19] FDIM RFP, page 23

3. **FERC.** The developer will have to receive approval from the Federal Energy Regulatory Commission to enter into separate Interconnection Agreements with MEC, AECI, and Ameren. These agreements will dictate how the developer will work with the interconnecting parties to successfully build, operate, and maintain FDIM.
4. **Other Permits.** The developer may need to notify or receive approval from various federal and Missouri state agencies for issues related to the environment, airspace, and infrastructure.

   The most notable environmental and airspace issues in the FDIM project area are the Seat Memorial Conservation Area near Siloam Springs, MO, the Elam Bend Conservation Area just northeast of AECI's Fairport substation, and the Albany Municipal Airport, which is directly between Fairport substation and the POI window.

   Other common permitting agencies relevant to this project include the U.S. Army Corps of Engineers (USACE), Missouri Department of Natural Resources (MDNR), U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Missouri State Historic Preservation Office (MSHPO), and Missouri Department of Transportation (MODOT).

Developer A discussed processes for anticipated federal and state regulatory permits, including MPSC CCN and FERC regulatory processes. Its list of anticipated environmental permit requirements lacked timelines and was more generic than those of the other Developers, sometimes assigning permitting responsibilities rather than providing the steps necessary to obtain them. FAA permits are not anticipated but not mitigated to the extent of Developer D. It provided extensive examples of recent, relevant experience.

Developer B discussed processes and timelines for anticipated or mitigated federal and state regulatory permits, including MPSC CCN, FERC regulatory processes, all permits related to common permitting agencies listed above, the Iowa Utilities Board (IUB) Franchise Agreement if the POI is in Iowa, and various county permits for DeKalb, Gentry, and Worth Counties. It provided descriptions and timelines for all anticipated permits. It provided a log of recent and successful projects with relevant regulatory approvals highlighted.

Developer C adequately discussed the regulatory activities necessary to successfully execute FDIM and identified three recent significant transmission projects that demonstrated its abilities in these areas. However, its lack of consideration for a municipal airport in the project area may increase the risk of its proposal.

Developer D discussed processes and timelines for anticipated or mitigated federal, state, and local regulatory permits, including MPSC CCN and FERC regulatory processes, as well as most of those common permits discussed in the beginning of this section. It has conducted activities to provide comparatively high permitting certainty such as initiating correspondence with MPSC, commissioning a consultant to perform an FAA Obstruction-Analytical Airspace Study, and reviewed Missouri bat impacts to provide mitigated land costs. It provided a history of relevant projects for itself and primary consultants.

2C. Right-of-Way and Land Acquisition

A competitive proposal must describe a developer's abilities to acquire right-of-way and land for the project and the processes it will use to negotiate with landowners, prepare and execute contracts, complete land transactions, and when necessary, use eminent domain to condemn right-of-way.[20]

Developer A was the only developer to propose a right-of-way width of 130 feet, which was twenty feet less than that proposed by all other developers. Its proposed route traverses 125 land parcels and 98 landowners. It highlighted a recent project for which it received timely regulatory approvals, and it explained it chose not to contact landowners until after it was awarded that project. It implemented the same strategy for FDIM. It provided a project-specific outreach plan that included public open houses in Worth, Gentry, and DeKalb Counties. It demonstrated knowledge of the Missouri eminent domain process, including the 2022 state law regarding condemnation valuation. It commissioned a study by a public affairs firm that found the socio-political risk level to be medium-high.

Developer B described the significant number of easements it has acquired in the last ten years for new 345+ kV transmission projects, less than 5% of which were obtained through eminent domain. Its proposed route traverses 152 land parcels and 108 landowners. It described its post-award land acquisition plan, which includes landowner outreach. It did not identify a routing contractor and has yet to contract with a right-of-way firm, which creates risk.

Developer C demonstrated it has significant, recent experience in acquiring right-of-way. It also demonstrated it understands the eminent domain process in Missouri. Its proposed routes traverse 153 land parcels and 98 landowners. It chose to not contact landowners until after MISO announces the Selected Developer to present accurate information about the likely route. It will discuss FDIM with commissioners in the three affected counties one month before it hosts open houses in those counties. It believes this will lead to better support for the project. Once MPSC awards it a CCN for the project, it will host an additional open house in each county.

Developer D provided extensive discussion of its recent, relevant experience in acquiring right-of-way, including its familiarity with the Missouri eminent domain process and its 2022 condemnation law. Its proposed route traverses 130 parcels and 96 landowners. It is the only developer that chose to begin landowner outreach and acquisition negotiations to support the information provided in its proposal submission. It has secured Option and Transmission Easement Agreements for 100% of the right-of-way for its F-D route and Denny substation, and 33% of the right-of-way for its D-B route.

[20] MISO BPM-27 Section 7.3.5

2D. Construction

A competitive developer must describe its plans for engineering and surveying, material procurement, construction, and commissioning of the project. It must include a construction plan.

Engineering and Surveying

A competitive proposal must discuss a developer's engineering and surveying plans prior to project construction and the labor it will use.[21]

These plans typically include field wetland delineation, utility mapping, and geotechnical and LiDAR surveys on all easements and acquired land. They also should include identification of all line crossings and coordination with line owners on necessary outages or clearances.

Developer A stated its design is at approximately a 30% level and is pending internal review. Its completed substation and transmission line engineering was less specific than other developers. Upon award it will begin detailed engineering and design. It has not secured LiDAR and geotechnical contractors but has plans to do so after award. Its general contractor will execute survey and design scope including the previously mentioned surveys as well as right-of-way boundary survey, utility locations, staking, environmental and ecological surveys, and as-built verification survey.

Developer B stated it has completed 30% of substation design for FDIM. It attached an engineering task list that summarized the design items that are completed, ongoing, or not yet begun. Its geotechnical contractor has completed a desktop study of the proposed route and preliminary field and laboratory studies of the substation site. It will conduct LiDAR, geotechnical, and environmental surveys after it is selected by MISO and after it receives a CCN from the Missouri PSC. It will perform short-circuit study, grounding analysis, and insulator coordination study after it is selected.

Developer C stated it has completed approximately 90% of the necessary transmission line and substation design for FDIM. It has already collected geotechnical data and soil borings at the substation site, which it will use to finalize the substation foundation design. After selection, it will perform geotechnical and LiDAR surveys on the line routes and substation site. A consultant will perform generic steps for LiDAR, supplemental survey, and staking.

Developer D restated the design work and surveys it has already completed, which MISO determined to be the most comprehensive of all developers. The developer also identified the design work and surveys it will complete if MISO selects it to develop FDIM.

After selection, the developer will finalize the deadend structures outside of Fairport substation and at the Iowa/Missouri border, confirm electrical phase alignment with interconnection partners, and identify proper clearances and construction outage windows with underground and overhead line owners in the project area. It will also complete additional boundary, LiDAR, geotechnical, cultural resource, bat, and subsurface surveys. It will use the same consultants that helped it develop three recent projects comparable in scope and geography to FDIM.

[21] MISO BPM-27 Section 7.3.6

Material Procurement

A competitive proposal must describe a developer's plans for purchasing, transporting, storing, and staging all materials for the project. The developer should discuss its strategies for procuring long-lead time materials, managing staggered deliveries, dealing with material defects, and minimizing project-specific risks.[22] It must describe the competitive project's key materials and equipment and state the lead time for them.[23]

Developer A provided tables of approved vendors and suppliers for key equipment and materials. Its general contractor will determine final material quantities for procurement and evaluate and approve any material substitutions proposed by suppliers. The contractor's procurement and material management team will competitively bid materials and services. Substation equipment delivery will begin in January 2027 and substation site preparation does not begin until October 2028, which introduces a risk of material theft or damage during excessive movement around the site. Developer A identified lead times for key materials.

Developer B will directly purchase structures, conductor, OPGW, and insulators and hardware. Its EPC will procure substation equipment and materials. It named multiple suppliers for key materials, with lead times included based on vendor correspondence. It included schedule float between executing material contracts and beginning fabrication. It plans to utilize pre-stressed spun concrete structures until contracts with the steel manufacturer are finalized, which introduces uncertainty since pre-designed concrete poles may not suffice and the steel structures are not secured. It is the only developer without a defined laydown yard which provides less specificity than the other developers.

Developer C will self-procure large material purchases. It will designate its general contractor as an agent for materials so the contractor can coordinate procurement activities. The developer's affiliate services company will directly procure all remaining materials not identified as the responsibility of the contractor. Most of the employees in that affiliate's sourcing and purchasing groups hold a relevant, professional certification. It adequately explained where materials would be delivered, who would process those deliveries, and how the materials would be moved to the project site for assembly.

It identified the lead times for key equipment and material. MISO determined its proposal has a slight increase in risk due to the uncertainty around its route, which is driven by the proximity to the airport and the need to conduct more comprehensive LiDAR and geotechnical surveys.

Developer D will directly procure long lead-time items, while contractors will purchase and manage other material and equipment. It provided a material procurement plan which outlined procurement personnel, material and equipment lead times, and material delivery and storage processes.

Construction

A competitive proposal must describe a developer's construction abilities and plan for the project. The developer must discuss approved contractor lists in the relevant state, if they exist, its requirements and

[22] MISO BPM-27 Section 7.3.7

[23] FDIM RFP, page 24

standards for contractors, the anticipated staff and contractors it will use for the project, their base of operations during construction, their experience and expertise, and the safety programs to be used.[24]

Developer A will use a general contractor to manage and construct the project. It identified the contractor's office location, the personnel who will be on-site daily and those who will be working out of various offices. It provided a construction plan with project-specific information such as the number of planned wire pulls and the fiber installation sequencing in relation to the transmission line construction. It verified crossings in the field to inform its comprehensive access plan, which includes haul routes and matting locations. Its EPC is ISO 9001.2015 quality standard certified.

Developer B will use a contractor to lead the construction of the transmission lines and has an EPC arrangement in place which will be utilized to construct the Denny substation. It identified the location of its project management team as well as its primary transmission line and substation contractors. It stated that each primary contractor will set up temporary offices near the project. It provided a construction plan that is broken down into work groups and aligns with its schedule. It visited the project location with its primary transmission line contractor to verify that there are no constructability risks that it considers to be unique.

It will share Quality Assurance/Quality Control responsibilities with the transmission line contractor and the substation contractor rather than being the sole responsible party, which provides some uncertainty in its plan.

Developer C will use a general contractor to manage project construction. It identified the contractor's office location, annual revenue, and both total and local personnel.

MISO determined the developer's construction management plan was less specific than that of Developer D. Its Quality Assurance/Quality Control (QA/QC) process and construction management plan lack specificity compared to some other developers and sometimes assigned activities or stated that subcontractors will be determined later.

Developer D, along with contractors, will manage and construct the project. It will begin ROW clearing in January 2027, begin substation construction in May 2027, and begin transmission line construction in September 2027. Line construction will begin at Fairport and proceed north to allow additional time for the point of interconnection with MEC to be finalized. Transmission line construction will take seven months.

Commissioning

A developer must describe how it will commission and energize a competitive facility.[25] It must identify and explain the qualifications of the internal personnel or contractors that will perform the work. It must discuss equipment testing, coordination with ITOs, and final inspection procedures.[26] MISO identified coordination with interconnecting transmission owners as an aspect of FDIM it anticipates may be particularly important.

All developers discussed how they will coordinate with ITOs during commissioning.

24 MISO BPM-27 Section 7.3.8

25 MISO BPM-27 Section 7.3.9

26 FDIM RFP, Part II, page 25

2E. Financing and Capital Resource Plan

All developers submitted financing and capital resource plans that demonstrated their individual ability to fund the construction of the FDIM project. All developers proposed corporate financing through construction by funding the project from cash on hand and the existing credit facilities.

All developers will fund the project operations and maintenance by maintaining cash reserves sufficient to fund immediate needs. If additional major financing needs arise, credit facilities will be available.

2F. Safety

A competitive proposal must describe the general and specific aspects of the project safety plan and include the OSHA/DART reports of the entities that will be constructing the project.[27]

All developers submitted the table of contents of their site-specific safety plans and at least two years of safety data of their primary construction contractor. MISO determined all proposals contained satisfactory safety information.

[27] MISO BPM-27 Section 7.3.17

3. Operations and Maintenance

MISO must evaluate a competitive proposal's Operation and Maintenance plan. Within each plan, it must specifically evaluate each proposal's plan for normal operations, non-normal operations, maintenance, and safety after the competitive project is in-service. This evaluation must constitute 30% of MISO's decision if the project contains a transmission line, as it does in FDIM. If the project only consists of a substation, this evaluation must constitute 35% of its decision.[28]

All four developers that submitted proposals for FDIM demonstrated they have significant experience operating and maintaining high-voltage transmission in many areas of the country. Although MISO is confident all developers could adequately operate and maintain the FDIM facilities, it reviewed each developer's O&M plans and capabilities to determine measurable differences. The FDIM RFP stated operations and maintenance is an aspect of FDIM MISO anticipates may be particularly important.

For Operations and Maintenance, MISO categorized Developer D's proposals as Best, Developer C's proposal as Better, and Developer A's and B's proposals as Good.

3A. Normal Operations

This O&M topic consists of a developer's plans for incorporating the competitive facilities into a Local Balancing Authority, monitoring and control of its real-time operations, switching power on project transmission lines or substations, and coordinating planned outages.

Local Balancing Authority Area

A competitive proposal must describe how the project will be incorporated into a MISO Local Balancing Authority Area (LBAA).[29] The FDIM RFP stated Ameren and MEC, the interconnecting LBAs in this project, were not willing at the time of the RFP to offer LBA services for the FDIM facilities.[30]

Once the RFP was issued, developers were asked to direct all questions related to FDIM and the RFP to MISO.[31] Unless there were existing arrangements among the developers or their affiliates and the Balancing Authority, any new LBAA agreements must take place after the Selected Developer and Alternate Developer is selected.

One developer plans, within 60 days of ISD, to request MEC or Ameren include the FDIM competitive transmission facilities within the boundaries of MEC or Ameren's existing LBAs. When the RFP was issued. MEC and Ameren were unwilling to provide LBA services for the FDIM facilities. This developer's choice for having a very short-term plan to contract for LBAA services is less certain than those in other proposals.

[28] MISO Tariff, Attachment FF. Section VIII.E.1

[29] MISO BPM-027 Section 7.4.1

[30] FDIM RFP, page 45

[31] MISO BPM-027 Section 5.7

Another developer plans to coordinate with MISO to form a new LBA and then self-perform LBA services. The two other developers already have affiliates registered as Local Balancing Authorities in MISO and will incorporate the new facilities into their existing LBA areas.

Real-Time Operations Monitoring and Control

A competitive developer must describe how it will monitor project transmission lines and monitor and control project substations in real-time.

It must identify the location and ownership of the control center that will be used as well as the staffing levels and training programs of the center. It must also state the control center complies with all applicable NERC standards, describe how the center will communicate with MISO, other entities, and project facilities, describe the SCADA system that will be used, and describe how the developer will fulfill all the requirements of the NERC TOP for FDIM.[32]

All developers identified the locations and owners of the primary (PCC) and backup control centers (BUCC) they will use for FDIM. Each BUCC was sufficiently close to the PCC to allow PCC staff to drive to the BUCC. NERC requires a BUCC to be no more than a two-hour drive from a PCC. The developers reported operating transfer periods of 20 to 45 minutes. Two developers stated they will have at least one additional control center that could support FDIM if its PCC and BUCC were both unavailable.

The developers reported they will have between nine and nineteen NERC-certified system operators to monitor FDIM. Each developer identified the SCADA system it will use to monitor and control project facilities.

Switching

A competitive proposal, if the underlying project will require the developer to install a field-mounted switch on a project facility, must describe the switching activities as well as the labor and resources that will be necessary. The switching activities may include writing orders, issuing tags or clearances, and switch execution in the field.[33]

Developer A's transmission system operators (TSO) are certified to complete switching orders and the developer demonstrated relevant experience with the ITOs. It executed 1,800 switching orders in 2022 with an accuracy rate of 99.8%.

Developer B will be responsible for supervising and performing switching for the project. It has completed 400 switching activities between 2018 and 2022 with 100% accuracy, and its field personnel have an average of 14 years of experience. Although the developer stated it will have maintenance staff close to the Denny substation, it did not state whether it considers its "field personnel – switching" staff to be maintenance staff.

Developer C will use internal personnel to perform switching orders. It has executed about 15,000 switching orders since 2012, with an overall switching accuracy of 99.8%. It described the switching coordination process and how it uses a Human Performance Event Learning meeting to investigate

32 FDIM RFP, Part II, page 30

33 MISO BPM-27 Section 7.4.3

switching errors in the rare event they happen. It identified the location and experience of the employees who will coordinate switching activities and perform switching activities in the substation.

Developer D will use internal personnel to perform switching orders. It discussed the tools it will use for these orders. Its affiliate has a switching accuracy of almost 100% over the past five years.

Planned Outage Coordination

A competitive developer must identify and describe the labor, expertise, tools, and base of operations for coordinating planned outages for the competitive facilities. All developers provided sufficient information in this area that demonstrated their abilities to meet this requirement as required in the RFP.

3B. Non-Normal Operations

This O&M topic consists of a developer's plans for responding to forced outages, repairing equipment during emergencies, replacing or rebuilding major facility assets destroyed in a catastrophe, and financing expenses incurred because of a catastrophe.

A competitive proposal must include a non-normal operations plan that contains project-specific considerations, a table of contents of applicable non-normal operations procedures, and the qualifications, certifications, and relevant recent experience of the internal or external personnel who will execute the non-normal activities.

In each non-normal operational function below, a developer must describe the owned and contracted tools, internal and external personnel, operational locations, and response time contemplated by its plans.[34]

In compliance with the RFP, each developer submitted a non-normal operations plan.

Forced Outage Response

A developer must describe how it will respond to a forced outage of each competitive facility.[35] It must discuss how long it will be able to monitor and control a project substation if that substation loses its off-site AC station power source, and it must explain its plans to control the substation using only DC battery power.[36]

All developers are experienced transmission owners and operators and submitted sufficient information to establish they had the resources and experience to respond effectively to a forced outage of FDIM.

Developer A will utilize existing contracts with two contractors for all transmission line maintenance and restoration. It will also use a named helicopter contractor if it needs a live-line crew. It provided a table

[34] FDIM RFP Part II, page 31
[35] MISO BPM-027 Section 7.4.4
[36] FDIM RFP Part II, page 32

showing reasonable response times and mileage to both Denny substation and the POI window from multiple planned operational bases.

The developer identified the individual number of contract linemen, substation crew members, and protection and control technicians it will have available. In the event of a forced outage, the substation's DC batteries will be able to power the control house for ten hours.

Developer B will use a contractor to respond to forced outages. Although it stated the contractor will "have the personnel, tools, and equipment necessary" to respond to forced outages within a few hours, it did not provide more information. It described seven steps of forced outage response, but it did not describe its testing procedures prior to re-energizing equipment.

The developer's local maintenance technician will be able to respond from its local facility to any part of the project within a reasonable time. In the event of a forced outage, the substation's DC batteries will be able to power the control house for twelve hours. The developer also explained that it will be able to use a mobile generator for redundant or longer backup power.

Developer C will use internal resources to respond to forced outages. The nearest responding line crew and the nearest substation crew will be a reasonable distance from the Denny substation. The developer attached plans for emergency vegetation management, drone inspections, and fiber restoration. In the event of a forced outage, the substation's DC batteries will be able to power the control house for eight hours.

Developer D will use both internal resources and a contractor to respond to forced outages. Two high-voltage technicians will be based at the developer's field office 30 minutes from the Denny substation and an additional 14 affiliate employees will be two hours from the project. In the event of a forced outage, the substation's DC batteries will be able to power the control house for twelve hours.

Emergency Repair and Testing

A competitive proposal must describe how a developer will address emergency repairs and testing on each competitive facility. It must explain anticipated response times, methods of transporting spare equipment to an emergency location, the quantity and location of resources that will be maintained to conduct emergency repairs, and how it will determine when a facility may remain in service during emergency service.[37]

Developer A stated it will use its own personnel to provide emergency repairs and it has external backup. Its personnel will be a reasonable distance from the project. It stated it can perform live wire maintenance, but it did not identify where a helicopter or other specialized and leased equipment would come from during an emergency.

Developer B met the requirements of the RFP but provided generalized information related to Emergency Repairs and Testing and stated it will utilize internal and external personnel to address this need.

Developer C will address emergency repair with internal personnel. It explained the locations, response time, and expertise of that personnel. Its internal first responder will be onsite in 40 minutes, substation/relay crews in 60 minutes, and line crews in 150 minutes.

[37] MISO BPM-27 Section 7.4.5

If its internal personnel are insufficient to address an emergency, the developer will leverage its master service agreements with nineteen industry companies. These companies can work anywhere on its existing system. If the developer needs additional help, it can request resources from a utility resource sharing organization, of which it is a member. The developer's parent can replace any single line component within 48 hours and can replace any substation equipment caused by an N-1 situation within six weeks.

It does not perform live line maintenance on its system, but the proposed FDIM facilities will permit such maintenance. If that maintenance is necessary, the developer will use external contractors, with which it already has existing contracts. It identified three states where specialized line crews and equipment would mobilize.

Developer D will rely on its own personnel to respond to and repair the project in an emergency. It identified the location and number of local and regional technical staff that would always be available to respond. It verified that its design safely accommodates live-line maintenance and that it is qualified to perform live-line maintenance.

Major Replacement and Rebuilding

A competitive proposal must describe how the developer will complete any major asset replacement or rebuild because of catastrophic destruction or normal degradation.

This must include: (1) how the developer will secure the necessary internal and external labor and materials and equipment and (2) the design criteria and estimated timeline for using temporary construction to restore service until permanent construction is complete.[38] [39]

All developers are experienced transmission owners and operators and submitted sufficient information to establish they had the plans, resources, and experience to rebuild and replace major project assets due to a catastrophe or normal degradation.

Developer A identified two emergency operation plans for two different affiliates, but it did not state which one it would use and whether that plan would be modified for FDIM. It stores batteries in mobile trailers at four locations nearby.

Developer B will have permanent spare inventory stored locally available to rebuild more than one mile of transmission line and rebuild/replace substation equipment. It does not anticipate the need to use temporary structures for the Project but will have access to six Emergency Restoration Structures in stock

Developer C discussed how it could rebuild a catastrophic destruction of the transmission line in thirty days by using temporary line structures. It did not specify how many miles of 345 kV transmission line it could permanently rebuild in a certain period. Also, it stated it could replace any single piece of equipment at Denny in six weeks and could restore Denny to full working condition in six months if the substation was completed destroyed assuming that equipment and crews were readily available.

Developer D stated it will be able to rebuild one mile of the transmission line in one week. It will have forty high-voltage technical staff in the region and its contractor will have more than 500 extra-high-voltage

[38] MISO BPM-27 Section 7.4.6

[39] FDIM RFP Part II, page 33

personnel in the region. Both groups will be available in two to four hours. It provided key restoration plans for transmission lines, reactors, and circuit breakers.

Financial Strategy

A competitive proposal must describe a developer's financial strategy to timely replace facilities damaged due to catastrophic destruction.[40] All developers established their ability to raise capital to replace facilities lost due to catastrophic destruction.

3C. Maintenance

This O&M topic refers to a developer's strategy and ability to maintain necessary spare parts, conduct preventative or predictive maintenance, and perform and finance major replacements or rebuilds needed due to natural aging of equipment.

Spare Parts, Structures, and Equipment

A competitive developer must describe how it will ensure replacement equipment for project assets is timely available if necessary. It must state what spare parts are necessary, how many it has or will store in inventory or have available from vendors, the agreements it has with any vendors, where all spare parts will be located, and how quickly the spare parts will be available if needed.[41] A developer must also describe any spare parts with a lead time of at least one year that would need to be studied as part of TPL-001-4.[42]

Developer A will rely primarily on its affiliate sharing agreements to ensure spare parts for FDIM are reasonably available. It has also negotiated special terms with major vendors for essential equipment that can be expedited in an emergency. It submitted a construction plan that contains a list of pre-approved vendors for new material.

The developer identified its current inventory of conductor and stated it will store one spare 345 kV shunt reactor 30 minutes from Denny.

Finally, the developer comprehensively identified lead times for project parts. It specified that two necessary substation components currently have a lead time greater than one year, but these are not subject to TPL-001-4 because they are available from its affiliates.

Developer B will use internal resources to manage and maintain spare parts for FDIM. It will own the spare equipment and monitor quantities using its Computerized Maintenance Management System. It will replace parts as they are used and will assess inventory annually. It will incorporate the project into its parent's existing maintenance plan, and it confirmed that the plan will not result in any lead times greater than a year that would need to be studied pursuant to TPL-001-4.

40 MISO BPM-27 Section 7.4.9

41 MISO BPM-27 Section 7.4.7

42 FDIM RFP, Part II, page 34

It will maintain enough structures locally to replace one deadend and up to five consecutive structures. It will also maintain locally one circuit mile of spare conductor and OPGW and two miles of spare insulator and conductor hardware. It will store a second 345 kV, 50 MVAr shunt reactor at Denny and will locally store a significant number of other spare parts for the substation.

The developer will enter into a sharing agreement with its parent company, which will give it access to six emergency restoration system (ERS) structures that can replace any non-deadend structure in the project. It also identified the type and number of spare structures held by its parent in separate states. It did not state however how quickly it could transport the ERS or spare structures to the project.

Developer C will use internal resources to manage and maintain spare parts for FDIM. It identified four regional locations where it will store those parts, and it attached a critical material strategy documents for both transmission line and substation facilities. It also stated it participates in a regional mutual assistance group from which it could acquire additional parts.

It will store four steel tangent structures close to the project and will use wood poles if more structures are immediately needed. It also sufficiently identified the line material and hardware currently in storage.

It identified the location, number, and type of spare parts it would use to temporarily rebuild the lines until it could permanently rebuild them. It stated it can restore five miles of the line within 30 days.

Developer D will rely primarily on sharing agreements with its affiliates and its principal contractor to ensure spare parts for FDIM are reasonably available.

Line structure hardware and wire will be stored at a maintenance facility thirty minutes from FDIM. The developer stated it would have enough structures and material in storage to rebuild two miles of the FDIM line. It will store other spare equipment, including a compatible shunt reactor and a 345 kV circuit breaker, nine hours away. It satisfactorily identified lead times for project parts.

Preventative and Predictive Maintenance and Testing

A competitive developer must describe how it will maintain and test project assets to minimize costs while the asset is in-service. The developer must discuss when, how, and how often it will execute preventative maintenance (such as tree-trimming) versus predictive maintenance (such as equipment testing) and what data will be recorded or used to make maintenance decisions.[43]

Developer A will use the same internal personnel to maintain FDIM as it will use to respond to normal and non-normal events. Its transmission crews and equipment will be 120 minutes from FDIM, and its substation and protection and control crews and equipment will be 60 minutes from FDIM.

It stated that all work performed by its EPC contractor will be warrantied for two years and repairs within this period will be warrantied for at least one year. It will inspect the FDIM lines annually from the air and inspect the lines comprehensively from the ground every twelve years. It identified both the helicopter contractor it will use for aerial inspection and the contractor it will use for live line maintenance. It will inspect Denny each quarter and listed fifteen equipment inspection and maintenance frequencies. MISO noted the other three developers indicated monthly inspection practices.

[43] MISO BPM-27 Section 7.4.8

Developer B will maintain FDIM with both internal and external personnel. It will incorporate the project into its parent company's existing maintenance program and execute that program from a local maintenance facility.

It explained the frequency and scope of the preventative and predictive maintenance it will conduct on project facilities. It specifically discussed the real-time, monthly, and annual monitoring it will conduct on the substation's circuit breakers and shunt reactor. It will inspect the FDIM lines from the air every year and from the ground every five years. It did not identify the contractor it will use for vegetation management.

Developer C will maintain FDIM with both internal and external personnel. It will use an affiliate's existing resources for the maintenance it will support internally. Those resources will be 40 to 150 minutes away from FDIM. It identified the contractors it will use for aerial services, ground inspection of structures and foundations, and vegetation maintenance.

The developer will inspect the FDIM lines from the air every year and from the ground every ten years. Regarding vegetation management, Developer C will inspect the lines at least twice each year. It explained how it will staff the inspection and prioritize issues discovered. It also listed maintenance intervals and explained its plans for numerous substation equipment.

Developer D will maintain FDIM with internal personnel. It will coordinate that maintenance out of an affiliate's existing facility thirty minutes from FDIM. It will inspect Denny substation monthly and will test the breakers at Denny every five years. It will use predictive maintenance technologies such thermographic cameras, DGA, and LiDAR to proactively maintain FDIM assets.

Financial Strategy for Maintenance

A competitive proposal must describe how the developer will finance activities due to normal wear and tear of project assets.[44] All developers established their ability to raise capital to replace facilities lost due to catastrophic destruction.

3D. Safety

A developer must describe the general and specific aspects of the project safety plan and include the OSHA/DART reports of the entities that will be maintaining the FDIM facilities.[45] It must attach both a table of contents for detailed safety plans and programs and its safety record report.

All developers demonstrated they currently maintain high-voltage transmission lines in the United States. Regarding the developers' site-specific safety plans for FDIM, MISO determined the differences to be insignificant. Each developer described its project safety plan and attached a table of contents for the plan.

Regarding the developers' O&M safety records for internal and contractor teams, MISO determined the differences to be insignificant. Each developer provided evidence of TCIR rates below 2 and DART rates below 1.

44 MISO BPM-27 Section 7.4.9

45 MISO BPM-27 Section 7.4.10

4. Planning Participation

All developers received their full planning participation credit.

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Appendix A. Glossary

Any capitalized terms used in this report for which definitions are not provided in this glossary are as defined in the MISO Tariff or the applicable MISO business practices manuals.

For some terms defined in the MISO Tariff, definitions provided in this glossary have been adapted to make them easier to understand when separated from the Tariff, but the formal Tariff definitions are controlling for all purposes.

For readability, many of the terms defined below are not capitalized when used in the body of this report.

Allowance for Funds Used During Construction (AFUDC)

AFUDC is an abbreviation for "allowance for funds used during construction." In the context of transmission rate regulation, it refers to a request by the owner of a transmission facility to be allowed to capitalize, and earn a permitted rate of return on, the net cost of borrowed funds used during construction, as well as equity funding. Recovery of AFUDC is not available until after the facility has been placed in service.

Annual Transmission Revenue Requirement (ATRR)

The sum of the revenues required to pay all operating and return on rate base costs of providing transmission service. Generally, this term is used in the calculation of the Attachment O revenue requirement of a transmission owner within MISO.

For purposes of the RFP, a proposal is to include an aggregate ATRR value determined by combining the annual transmission revenue requirements of each individual RFP Respondent and each individual Proposal Participant identified in a proposal, as provided in Attachment FF of the Tariff.

All statements in this report describing proposals' ATRR estimates are referring to the present value, in 2022 dollars, of submitted ATRR over a 40-year period, discounted annually at 6.9%.

Aspects and Elements

Characteristics MISO emphasized in the RFP as particularly important to the success of a project.

Business Practices Manual (BPM)

Document that contains instructions, rules, policies, procedures, and guidelines established by MISO for the operation, planning, accounting, and settlement requirements of the MISO region.

For purposes of the RFP, BPM-027 provides further background information, business rules, processes, and guidelines for the Competitive Transmission Process (including the roles and responsibilities of MISO, Transmission Owners, Members, and any other non-MISO Members and other interested parties).

CCN

Certificate of Convenience and Necessity

CEII

Critical Energy Infrastructure Information, as described in 18 C.F.R. § 388.113(c)(1).

Competitive Developer Selection Process

The process utilized to solicit Proposals, evaluate Proposals, and designate a Selected Proposal and Selected Developer in accordance with the MISO Tariff.

Competitive Transmission Executive Committee (CTEC)

A team of three or more MISO executives, including at least one officer, charged with overseeing MISO staff and consultants involved in implementing the MISO Competitive Transmission Process. The MISO Tariff provides that the Executive Committee has exclusive and final authority to approve or reject Transmission Developer Applications and certify Transmission Developer Applicants as Qualified Transmission Developers.

Competitive Transmission Process

The process used to certify Qualified Transmission Developers, identify Competitive Transmission Projects, solicit proposals, evaluate proposals, and designate a Selected Developer and Selected Proposal, all in accordance with the MISO Tariff. The competitive transmission process includes the competitive developer qualification process and the competitive developer selection process.

CWIP (Construction Work-in-Progress)

In the context of transmission rate regulation, it refers to a request by the owner of a transmission facility to be allowed to include costs of facility construction in rate base before the corresponding transmission facility has been placed in service. Under FERC rules, CWIP funding is limited to amounts that would otherwise qualify for AFUDC.

DART

Days Away, Restricted, or Transferred is an OSHA safety metric.

EHV

Extra-High Voltage

Evaluation Criteria

The four FERC-approved criteria the Tariff requires MISO to use for the competitive developer selection process: (1) cost and design, (2) project implementation, (3) operations and maintenance, and (4) planning participation.

Evaluation Principles

The four evaluation principles specified in Section 8.1 of BPM-027, which MISO uses to guide and influence the collective application of the MISO evaluation criteria. The evaluation principles are: (1) certainty, (2) risk mitigation, (3) cost, and (4) specificity.

Evaluation Team

Designated members of MISO management and staff responsible, together with independent consultants retained by MISO to assist management and staff, responsible for administration of MISO's competitive developer selection process, subject to oversight by the Executive Committee.

FERC

Federal Energy Regulatory Commission.

KMZ

KMZ is a file extension for a file type used by Google Earth. KMZ stands for "Keyhole Markup language Zipped," which is a compressed version of a KML (Keyhole Markup Language) file. KML is notation related to geographic display and visualization within Internet-based, two-dimensional maps and three-dimensional Earth browsers.

LiDAR

LiDAR (Light Detection And Ranging) is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor.

Local Balancing Authority

An operational entity or a "Joint Registration Organization" (as defined by NERC) that is: (a) responsible to NERC for compliance with the subset of NERC Balancing Authority Reliability Standards defined in the Balancing Authority Agreement for its local area within the MISO Balancing Authority Area, (b) a Party (other than MISO) to the MISO Balancing Authority Agreement, and (c) shown in Appendix A to the Balancing Authority Agreement.

Long Range Transmission Planning (LRTP)

A key initiative of the Reliability Imperative. The focus of LRTP is to improve the ability to reliably move electricity across the MISO region from where it is generated to where it is needed, at the lowest possible cost.

MISO

Midcontinent Independent System Operator, Inc.

MISO Tariff

MISO's Open Access Transmission, Energy and Operating Reserve Markets Tariff (including all its schedules and attachments), as amended from time to time.

MTEP (MISO Transmission Expansion Plan)

A long-range plan used to identify expansions or enhancements to the MISO transmission system to (a) support efficiency in bulk power markets, (b) facilitate compliance with documented federal and state energy laws, regulatory mandates, and regulatory obligations, and (c) maintain reliability.

The MTEP is developed biennially or more frequently, and subject to review and approval by MISO's Board of Directors.

MTEP21

MISO's 2021 Transmission Expansion Plan, the transmission plan in which the project was approved.

NESC

National Electrical Safety Code, which sets the ground rules and guidelines for practical safeguarding of utility workers and the public during the installation, operation, and maintenance of electric supply and communication lines and associated equipment.

Nominal Dollars

Nominal dollars reflect the costs to construct / operate the project at the time the cost is incurred. For example, if an RFP Respondent expects an item will cost $1,000 in 2025, then the cost estimate in nominal dollars in 2025 will be $1,000.

OSHA

The U.S. Occupational Safety and Health Administration.

Project Implementation Cost

For purposes of this report, project implementation cost (or simply "PI cost") refers to the cost estimate (in nominal dollars) for fully implementing the proposal and placing the project into service. Project implementation cost is calculated in the Proposal Template Workbook based on required inputs for cost categories explained in Part 2 of the RFP package.

Project Template Workbook (PTW)

An Excel spreadsheet template, included as part of the RFP materials, for each RFP Respondent to use in submitting financial information for its proposal.

Proposal Participant

For purposes of this project, a Proposal Participant is an entity that is involved in a proposal and is not the RFP Respondent but will co-own the project and rely on the RFP Respondent to be responsible for constructing and implementing the project. A proposal may designate a Proposal Participant as responsible for one or more aspects of operations, maintenance, repair, or restoration, on terms comparable to those that would apply if the RFP Respondent intended to rely on a third-party contractor.

Every proposal must specify whether the RFP Respondent plans to convey any interests in the project to one or more Proposal Participants.

Proposal Submission Deadline

The date and time by which proposals responding to an RFP must be delivered to MISO.

Qualified Transmission Developer

A MISO Transmission Owner, independent transmission company, or non-owner Member of MISO that submits a Transmission Developer Application and is subsequently determined by MISO to meet the minimum requirements for a Qualified Transmission Developer as outlined in Attachment FF of the Tariff.

RFP

A request for proposals issued by MISO, which constitutes an invitation (including associated requirements) for Qualified Transmission Developers to submit proposals to construct, implement, own, operate, maintain, repair, and restore a Competitive Transmission Project.

SCADA

Supervisory Control And Data Acquisition.

Selected Developer

The RFP Respondent designated by the Executive Committee as having submitted the Selected Proposal, and therefore selected to implement the project according to the Selected Developer Agreement.

Selected Developer Agreement

The agreement, as set forth in Appendix 1 to Attachment FF of the Tariff, to be executed between the Selected Developer and MISO. This agreement establishes the terms and conditions under which the Selected Developer will construct and implement the project as specified in its Selected Proposal.

Selected Proposal

The proposal selected by the Executive Committee (in accordance with the Competitive Developer Selection Process) as the highest-scoring proposal submitted in response to the RFP.

Switching Order

A switching order is a written set of instructions, using three-way communications during implementation, to ensure that an electrical facility is de-energized and put into an electrically safe condition before maintenance is performed. It would typically include (1) switching activities step by step, (2) estimated times, (3) responsibility assignments, (4) applicable safety measures, and (5) necessary personal protective equipment for each step.

Appendix B. Design-Related Terminology

ACSR

Aluminum conductor, steel reinforced. With ACSR conductor, both the primary conducting material (aluminum) and steel strands contribute to overall conductor strength. Because the aluminum is important as a supporting material, system operators must be careful not to allow the conductor to become so hot that the aluminum starts to soften (referred to as annealing). Extended operation at higher temperatures could cause ACSR to start losing its strength, increasing risk of low clearance or conductor failure.

ACSS

Aluminum conductor, steel supported. ACSS conductors use fully annealed aluminum supported on high-strength steel. Because the steel is the primary source of conductor strength, ACSS conductor usually can be operated at higher temperatures than ACSR.

BAAH

A breaker-and-a-half arrangement consists of two main buses, both of which are normally energized. Associated facilities interconnect with the main buses in sets of two positions, and these pairs of positions each have three associated breakers – a center circuit breaker common to the two positions. Each position is therefore associated with one-and-a-half breakers. A breaker-and-a-half arrangement is more robust than a ring bus, and less robust than a double-breaker, double-bus.

Bus

An electrical bus in a substation is a conductor or group of conductors that serves as a collection and transfer point for energy flowing into and out of substation feeders. A bus has an associated arrangement of circuit breakers that allow the bus to be disconnected from individual or sets of positions, so that, with all breakers open, the bus is electrically isolated from remaining power system elements. The number and positions of the circuit breakers vary with different substation designs, as further described in the glossary under the definitions for "DBDB," "BAAH," and "ring bus."

Cardinal

Cardinal is a trade name for a conductor variety of a specific gauge (as measured in kcmil), with a particular combination of steel and aluminum strands—in this case, 954 kcmil 54/7, denoting 54 aluminum strands surrounding seven steel strands in each conductor bundle as used in Proposal 403, and 20 aluminum strands surrounding seven steel strands in each conductor bundle for the trapezoidal shaped conductor used in Proposal 402.

Concrete pole

A transmission structure made of prestressed steel strands embedded in high-strength concrete that has been spun into a cylindrical shape.

DBDB

A double-breaker, double-bus arrangement consists of two main buses, both of which are normally energized. Associated positions interconnect individually to each bus, with two circuit breakers for each position (one for each of the connections to each of the buses). As compared to a ring bus or a breaker-and-a-half arrangement, a double-breaker, double-bus is the most robust arrangement.

Dead-end structures (also failure containment, containment, or storm structures)

Dead-end or failure containment transmission structures are designed to withstand more mechanical stress than standard “tangent” or “running angle” structures (explained below). They are used at heavy-angle turns along transmission routes (where the forces created by the high degree of the angle in conjunction with the conductor weight and tension make it harder for support structures to remain upright). They are also placed at specified intervals along a transmission line so that, if something seriously damages or destroys some of the supporting structures, the structure failure will not cascade through many miles of transmission line. Instead, the dead-end structures on either side of the damaged area will arrest the structure failures.

Direct embedded

Transmission structures that are direct embedded are generally anchored by extending the structure shaft below grade, relying on the surrounding earth and backfill material for support. To place direct-embedded structures, construction workers excavate a hole of sufficient depth, place the structure in it, and then refill the space around the structure. The fill material may be gravel, engineered material or replacement of the excavated backfill. A bearing plate may be engineered into the design of the foundation as needed.

Drake

Trade name for a conductor variety of a specific gauge (as measured in kcmil), and a particular combination of steel and aluminum strands—in this case, 795 kcmil 26/7, denoting 26 aluminum strands surrounding seven steel strands in each conductor bundle.

Drilled pier

A concrete pier foundation with steel reinforcement and anchor bolts. Depending on soil conditions installation may be with or without casing. Either permanent or temporary casing may be used. Installation may require specialized techniques and drilling fluids.

Galloping

Galloping is a term for how overhead power lines will oscillate (generally, but not exclusively, in a vertical direction) in a low-frequency, high-amplitude motion due to wind and the formation of a thin layer of ice on the wire. Sustained or severe galloping can damage or cause failure of transmission line components and supporting structures.

Galvanized steel structure

Transmission structure made of steel coated in zinc to prevent corrosion. This gives it a shiny appearance.

Guying (or guyed)

Practice of attaching tensioned cables (typically steel) to transmission structures to increase their stability.

Kcmil

Abbreviation for thousands of circular mils, a measurement of wire gauge (a mil is 1/1000 inch).

MA3

Core high-strength steel strands available in ACSS.

Monopole

A single primary structure (typically wood or steel) that supports an overhead transmission line—as distinguished, for example, from H-frame, three-pole, or lattice tower structures. Tangent monopole structures typically have davit arms to position conductor assemblies a minimum distance away from the structure.

Optical ground wire (OPGW)

A wire composed of optical fiber surrounded by conductive material (steel and aluminum) used in conjunction with overhead transmission lines to combine the functions of grounding (see the explanation of shield angle below) and communications.

Pheasant

Trade name for a conductor variety of a specific gauge (as measured in kcmil), with a particular combination of steel and aluminum strands—in this case, 1,272 kcmil 54/19, denoting 54 aluminum strands surrounding nineteen steel strands in each conductor bundle.

Ring bus

In a ring bus arrangement, the positions associated with the bus form a closed loop or "ring," with each position separated by a circuit breaker. The numbers of circuit breakers and positions are equal. A ring bus arrangement is a sound design but is less robust than a breaker-and-a-half or double-breaker, double-bus arrangement.

Running angle structure

Structures used for portions of a transmission line route that have light- or medium-angle turns. Typically, the suspension assemblies for attaching the conductor to the structures will permit the insulators to swing away from the support structure.

Shield (or shielding) angle

Position of optical ground wire secured on a transmission structure in relation to the position of the conductor below for which it provides shielding.

Because the optical ground wire is positioned above the conductor, it will attract lightning strikes that might otherwise strike the conductor, and safely conduct the resulting electrical charge along grounding material on the structure to grounding rods or other devices below.

Specifically, shield angle describes the angle between (a) an imaginary vertical line drawn from the attachment point of the optical ground wire and (b) an imaginary line drawn between the attachment point for the optical ground wire and the attachment point (on the same structure) for the shielded conductor. A smaller shield angle more effectively protects the conductor beneath.

Tangent structure

Structures used for portions of a transmission line route that are mostly straight or have very minor turns).

TW (Trapezoidal Wire)

Trapezoidal Shaped Aluminum Strands in conductor construction.

Weathering steel

Weathering steel forms an adherent protective rust that limits further oxidation of the metal. Hot-dipped galvanized steel is produced by dipping bare steel in a bath of molten zinc metal. The resulting metallurgical reaction between iron and zinc provides both a barrier and cathodic protection that protects steel from corrosion.