Selection Report

Hiple to IN/MI State Border 345 kV Competitive Transmission Project

May 11, 2023

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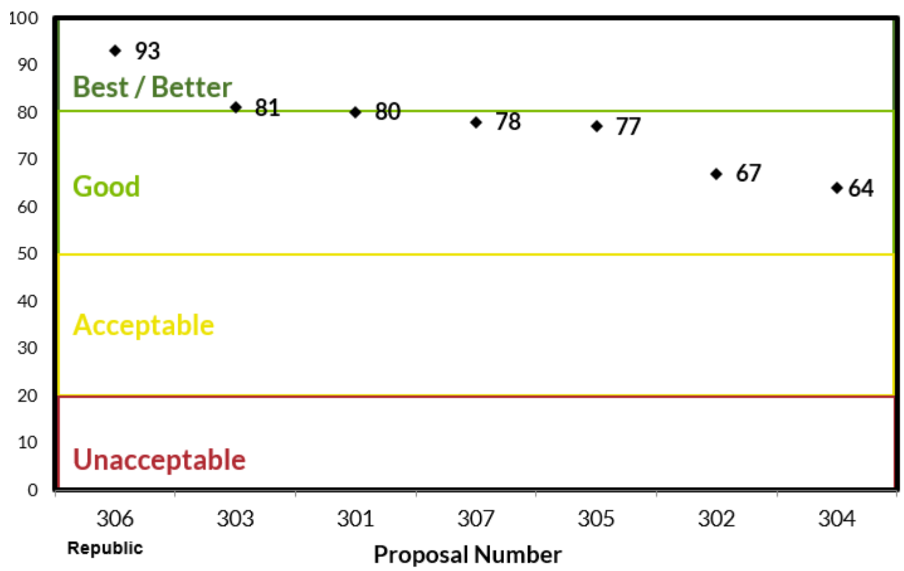
Executive Summary

This report announces the Selected Developer of the Hiple to IN/MI State Border 345 kV Competitive Transmission Project (HIMB). It also explains the competitive developer selection process and summarizes the proposals MISO received from transmission developers to construct, own, operate, and maintain HIMB.

MISO has chosen Republic Transmission, LLC to be the Selected Developer for HIMB. Republic, which is referred to as Developer C in this report, submitted Proposal 306. This proposal had a well-supported project implementation cost estimate, a superior revenue requirement commitment, and a well-reasoned routing strategy. The figure below identifies the scores MISO awarded to each of the seven proposals.

Figure 1. Evaluation Scores for HIMB 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 17, which is a double-circuit 345 kV transmission line that will run from NIPSCO's Hiple substation in LaGrange County, Indiana to Michigan Electric Transmission Company's (METC) future Duck Lake substation in Michigan.

The portion of Project 17 in Indiana is eligible for MISO's Competitive Developer Selection Process. This portion consists of a 345 kV double-circuit transmission line between NIPSCO's Hiple Substation in LaGrange County, Indiana, and the border between Indiana and Michigan. The portion of Project 17 in Michigan is not eligible for the Competitive Developer Selection Process and will be built by METC.

In September 2022, MISO issued a Request for Proposals (RFP) for HIMB. In January 2023, NextEra Energy Transmission Midwest, Republic Transmission, and Transource Energy submitted a total of seven valid proposals in response to the RFP. These three developers are referred to in this report as Developers A, B, and C, although not necessarily in that order.

The point at which HIMB will interconnect with METC's line on the Indiana-Michigan border is not yet known. The RFP required all proposed routes to cross the border within ten miles east or west of a point identified by METC as a possible point of interconnection (POI). In this report, the resulting twenty-mile section of the border is referred to as the "POI build zone." The shortest proposed route was a 23-mile route to the west, and the longest proposed route was a 39-mile route to the east.

Developer A proposed a route to the middle of the build zone and two alternate routes that branched to the east and the west of the build zone. All its routes traversed a large environmentally protected area.

Developer B and Developer C identified proposed routes to the western portion of the build zone that avoided the same environmentally protected area. Developer C also identified a route extension parallel to the build zone to demonstrate route flexibility if the POI moved to the east.

All proposed facility designs met the minimum requirements of the RFP. The developers proposed principally monopole structures made of galvanized steel, weathering steel, or concrete. They proposed a total of three different conductor sizes, all of which exceeded the RFP requirements for ampacity.

MISO's cost estimate for HIMB, which was based on a 55-mile route, was $254 million ($4.6 million/mile), in 2022 dollars. The project implementation costs of the proposals ranged from $66 million ($2.7 million/mile) to $107 million ($4.3 million/mile), also in 2022 dollars. The differences between the proposals were principally due to route length, conductor size, and structure design. The present value of the proposed revenue requirements over forty years ranged from $55 million to $107 million.

Developer A offered two project implementation cost containment options: a single cap that did not change based on the final POI or different caps based on whether the final POI was in its defined west, central, or east part of the POI build zone. It also offered to cap, until the end of the fifteenth full year, its equity structure at 45%, its cost of equity at 9.8%, and its annual revenue.

Developer B did not offer to cap its project implementation cost or its revenue requirement, but it did offer to cap its equity structure at 50% and cost of equity at 10% for ten years.

Developer C offered annual revenue caps in each of the first forty years of the project and stipulated that the caps would increase 4.5% for every mile on the border between its proposed POI and the actual POI to the east. The cap would decrease 4.5% per mile if the final POI was west of the proposed point.

Developers A and C proposed to complete the project two years before the deadline identified in the RFP of June 1, 2030. Developer B proposed to complete the project two months before the deadline but stated it could accelerate completion by one year.

All developers explained how they would procure materials and what contractors they would use to build the project. They are all well-financed entities that have the capital to finance the project. They also all demonstrated previous experience maintaining extra-high voltage transmission facilities.

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

Hiple to IN/MI State Border 345 kV Selection Report

I. Competitive Project and Process

This report explains the basis for MISO's determination of the Selected Developer for the Hiple to IN/MI State Border 345 kV Competitive Transmission Project (HIMB) and explains the selection process MISO used to make its determinations.

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 23419, which includes a double-circuit 345 kV transmission line that will run from NIPSCO's Hiple substation in LaGrange County, Indiana to Michigan Electric Transmission Company's future Duck Lake substation in Michigan.

Figure 2. MTEP21 LRTP Tranche 1 Project 17: Hiple to Duck Lake

The Indiana portion of this project, which is identified as Facility 27191, is eligible for the competitive transmission process. This portion is titled "Hiple to IN/MI State Border 345 kV Competitive Project" and is referred to as HIMB in this report.

Request for Proposals

MISO issued a Request for Proposals (RFP) for HIMB on September 13, 2022. MISO held a public meeting on October 14, 2022, 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]

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 Indiana/Michigan state border. An important element of the Project success is to plan for cost certainty, design flexibility, and schedule impact mitigation given possible regulatory requirements and/or coordination with the Transmission Owner that will influence and ultimately define the geographic location of the point of interconnection.
2. **Regulatory Certainty:** Of particular importance to Project success in planning, financing, constructing, owning, and operating this Project are regulatory requirements, necessary permits, certifications, and authorizations needed from all regulators.
3. **Coordination with Interconnecting Transmission Owners:** The Project is only a portion of the Hiple to Duck Lake transmission line. Of particular importance to Project success will be the planned coordination with Michigan Electric Transmission Company (METC) to achieve regulatory approvals to the same point of interconnection, and through energization, which will also include coordination with Northern Indiana Public Service Company (NIPSCO).
4. **In-Service Date Flexibility:** To place this Project into service as planned will require time-sensitive coordinated 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 is only a portion of the Hiple to Duck Lake 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.

[1] https://www.misoenergy.org/planning/competitive-transmission-administration/#nt=%2Fctadoctype%3ACurrent%20Projects&t=10&p=0&s=FileName&sd=desc

Submitted Proposals

On January 11, 2023, three developers submitted to MISO seven total proposals for HIMB. This report identifies those developers as A, B, and C. Figure 3 illustrates the relationship between the developers and the proposals.

Figure 3. Proposal Diagram

Developer ID	Proposal ID	Proposed and Alternate Routes (Build Zone POI)			Conductor	Cost Containment Offerings	
A	301	West	Central	East	Drake (2-795 kcmil)	Single Cost Cap Entire Build Zone	**15-yr. ATRR Cap** & PI Cost, ROE, Equity %
	303					Cost Cap Tiered by Build Zone	**15-yr. ATRR Cap** & PI Cost, ROE, Equity %
	305				Pheasant (2-1272 kcmil)	Single Cost Cap Entire Build Zone	**15-yr. ATRR Cap** & PI Cost, ROE, Equity %
	307					Cost Cap Tiered by Build Zone	**15-yr. ATRR Cap** & PI Cost, ROE, Equity %
B	302	West			Cardinal (2-954 kcmil)	No Cost Cap By Zone	**No ATRR Cap** & 10-yr. ROE, Equity %
	304				Pheasant (2-1272 kcmil)		
C	306	West	East		Cardinal (2-954 kcmil)	Cost Cap for West POI with %/mile adjust	**40-yr. ATRR Cap** & ROE

Developer A submitted four proposals based on a permutation of two different electrical conductors and two project implementation cost cap methods. Developer B submitted two proposals based on two different electrical conductors. Developer C submitted one proposal.

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 March 2023, MISO announced it had received seven valid and complete proposals from three developers: NextEra Energy Transmission Midwest, Republic Transmission, and Transource Energy.

Confidentiality, Communication Protocols, and Document Control

Confidentiality

MISO recognizes the importance of transparency in every step of the Competitive Transmission Process (as defined in MISO's tariff). At the same time, MISO is obligated to treat developer proposals as confidential, except with respect to certain content of the Selected Proposal and other proposals.

Proposal information that must be kept confidential (unless the developer has consented to disclosure) includes the following:

- 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, any information a developer has consented to release, and any information the tariff requires MISO to make publicly available.

To comply with these requirements, this report describes developers and their proposals in general terms, to avoid revealing which developer submitted which proposal and to protect commercially sensitive and confidential information.

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 required its consultants to attest that they were free from conflicts of interests with Qualified Transmission Developers participating in the RFP and has kept the identities of its independent consultants confidential.

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 (301 to 307) and a letter to each developer (A, B, and C) to enable team members to discuss proposals without referring to a developer by name.

To avoid bias due to order of evaluation during comparative analysis, each of the workstream teams (composed of MISO staff and consultants with expertise in cost, design, project implementation, and operations and maintenance) reviewed proposals in a randomly ordered sequence, and each workstream's review sequence differed from that of the 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 HIMB RFP.

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

Figure 4 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 4. Proposal Criteria Categorizations and Scores

Proposal	Cost and Design 30%		Project Implementation 35%		Operations and Maintenance 30%		Planning Participation 5%	Evaluation Score
306	Best	1	Best	1	Good	7	✓	93
303	Better	2	Good	2	Best	1	✓	81
301	Better	3	Good	2	Best	1	✓	80
307	Good	4	Good	2	Best	1	✓	78
305	Good	5	Good	2	Best	1	✓	77
302	Good	6	Good	6	Better	5	✓	67
304	Good	7	Good	6	Better	5	✓	64

Part II of this report, *Analysis of Competitive Proposals*, explains how MISO arrived at the designations identified in Figure 4. 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 two developers that submitted multiple proposals was the same. Where there were differences between a developer's multiple proposals, such as in conductor cost or cost containment, the report identifies those differences by both proposal and developer.

II. Analysis of Competitive 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 HIMB RFP, and the items in each proposal that strengthened or weakened each developer's submission.

The organization of this section closely parallels the organization of 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 contains 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, this review must constitute 35% of the decision.[2]

For Cost and Design, MISO categorized Developer C's Proposal 306 as Best, Developer A's Proposal 303 and Proposal 301 as Better, and the remaining proposals as Good.

Because HIMB is only a section of the transmission line that will connect NIPSCO and METC's substations, MISO did not feel the additional proposed cost associated with the larger conductors included in Proposals 304, 305, and 307 outweighed their benefits, which would consist of a reduction in energy loss. Therefore, in the Cost and Design section, these proposals were ranked lower than their smaller conductor counterparts.

1A. Electrical Design

A competitive proposal must include a reasonably descriptive electrical design for each competitive transmission facility specified in an RFP.[3] All proposals met the minimum requirements in the tariff for electrical design.

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

[3] MISO BPM-027 Section 7.2.4

Conductor Selection

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.[4]

Each developer included conductors in their proposals that exceeded the minimum summer emergency ratings of 3,000 amps and all other ratings specified in the RFP. All developers proposed Aluminum Conductor, Steel Supported (ACSS) conductors and demonstrated the method by which they analyzed which conductor was best suited for the project. All based their conductor ratings on MISO BPM-029 requirements.

Developers A and C proposed to use the same optical ground wire (OPGW) as the shielding wire METC will be using for the Michigan portion of the new transmission line. Developer B proposed to use the same type of OPGW it uses on the other lines it operates.

Figure 5 illustrates the technical characteristics of the proposed conductors and identifies which developers proposed each conductor. The ratings and maximum operating temperatures are different for the Cardinal and Pheasant conductors because a developer may use its own method for calculating these measurements.

Figure 5. Conductor characteristics

	Drake	Cardinal	Pheasant
ACSS (Wires-kcmil) [5]	2-795	2-954	2-1272
Steel core	MA-2	B: MA-2 C: MA-3	MA-2
Diameter (in.) [6]	1.1	1.2	1.4
Weight per 1000 ft	1,100 lbs	1,230 lbs	1,630 lbs
Emergency summer rating (amps)	A: 3,456	B: 4,188 C: 3,314	A: 4,502 B: 5,113
Line rating % over RFP requirement	A: 15%	B: 40% C: 10%	A: 50% B: 70%
Max. emergency operating temp (°F)	A: 410°	B: 482° C: 392°	A: 410° B: 482°
Proposals			
Developer A	301, 303		305, 307
Developer B		302	304
Developer C		306	

Developer A predominantly studied thirteen double-bundle conductors and proposed a Drake conductor in Proposals 301 and 303 and a Pheasant conductor in Proposals 305 and 307. It would operate the Drake and

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

5 A wire type of 2-795 means that a developer will use two conductors that each have a cross-section area of 795,000 circular mils.

6 https://www.nehringwire.com/aluminum/acss-aluminum-conductor-steel-supported/

Pheasant conductors up to 410° F in emergency conditions, which would result in ampacities 15% and 50% greater than the emergency ratings identified in the HIMB RFP, respectively.

It chose an MA2 steel core to "balance conductor and structure cost while minimizing potential procurement risks associated with higher strength core options." It analyzed conductor sag using 800-foot and 1100-foot spans, and it measured line losses and loadings using MISO Future 1 and Future 2 models.

Developer B predominantly studied eleven conductor configurations, including three-bundle conductors, and proposed a Cardinal conductor in Proposal 302 and a Pheasant conductor in Proposal 304. It would operate both conductors up to 482° F in emergency conditions, which would result in ampacities 40% and 70% greater than the minimum emergency ratings identified in the HIMB RFP, respectively. It analyzed the configurations using many of the alternate methods identified in BPM-029. It eliminated three-bundle options after its initial analysis due to the number of two-bundle options that met ampacity requirements.

It placed value on the standard conductors stored in locations close to the project. It concluded the extra cost of the trapezoidal wire (TW) version of the Cardinal conductor outweighed the electrical loss benefits. It explained that ACSS conductor allows for 900’ to 1300’ spans and limited structure heights.

Developer C predominantly studied seven types of conductor materials and proposed a double-bundle ACSS/TW Cardinal conductor. It proposed to operate the conductor at 392° F in emergency conditions, which would result in an ampacity 10% greater than the minimum emergency ratings identified in the HIMB RFP. Although it identified an ACSS Drake conductor as having the lowest capital cost for the project, it determined the lower operating costs of the trapezoidal wire (TW) version of the Cardinal conductor, due to decreased losses, make it the best overall value. It also ranked both the TW and non-TW Canary ACSS conductors higher than the non-TW Cardinal conductor chosen by Developer B in Proposal 302.

Developer C proposed a MA3 misch metal steel core, stating it best balanced the increased cost of the conductor with the cost savings of structures and foundations due to lower required structure heights. It stated the useful life of conductor cores coated in misch metal alloy is two-to-three times greater than those that use a hot-dip galvanized coating, and misch metal provides a 20% stronger steel core than aluminum clad and is less subject to thermal expansion.

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.[7]

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

7 MISO BPM-027 Section 7.2.4.1

1B. Structural Design

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.[8]

Figure 6 identifies the general characteristics of the structures proposed by the developers. All designs are adequate for the project and met the RFP requirements. Each developer included drawings and cutsheets for the structures and equipment.

Figure 6. Structure characteristics

	Developer A	Developer B	Developer C
Types	Monopole & two-pole	Monopole & two-pole	Monopole & two-pole
Material	Weathering steel	Galvanized steel	Concrete; galvanized steel
Foundation	Direct embed, drilled pier	Drilled pier	Direct embed, drilled pier
Support method	Self-supporting; guyed	Self-supporting	Self-supporting; guyed
Targeted resistance	25 ohms	20 ohms	20 ohms
Tangent pole insulators	Brace post	I-string	Brace post

All developers proposed to support the conductor with either self-supporting or guyed monopole and two-pole structures. Guyed structures have a larger footprint than self-supporting structures.

The proposed structures were a mixture of weathering steel, galvanized steel, and concrete. Concrete poles are typically shorter and have shorter spans than steel poles. They are more expensive to ship because they are heavier than steel poles and must be delivered in one piece. All developers proposed similar drilling depths for drilled piers, to a maximum of 40 feet.

All developers presented grounding methods. They discussed lightning, galloping, and vibration strategies but not in equal amount.

Developer A proposed a combination of self-supporting and guyed weathering steel poles to be embedded into the ground either directly or using drilled piers. It conducted a robust study to identify the appropriate level of lightning protection. Its chosen conductor had the lowest sag of those analyzed, which minimizes galloping, and it provided VORTX Damper Placement Software calculations to aid its vibration analysis.

Developer B proposed self-supporting, galvanized steel poles that will be secured to drilled piers. It stated recent, relevant experience informed its design strategy.

It proposed i-string insulators for its tangent structures, which are more robust and flexible than the braced post insulators used by the other developers. Tangent structures were the most common structure type proposed for HIMB. It was the only developer that did not propose to use guy wires to support any

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

structures. It chose a more stringent grounding strategy than its peers but did not provide as much specificity regarding alternate grounding methods as the other developers.

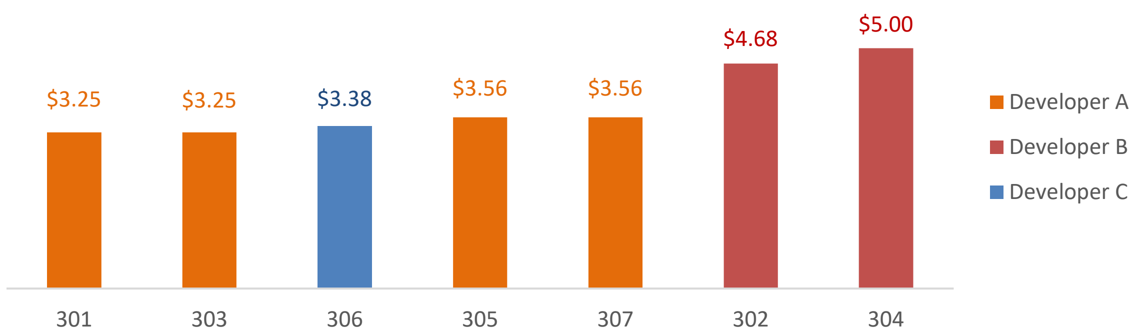
Developer B's analysis regarding lightning protection was not as strong as that of its peers. It included a limited discussion about vibration. It submitted a galloping study and proposed specialized anti-galloping structures for its larger proposed conductor but not for its smaller conductor proposal.

Developer C proposed to use concrete for the tangent poles and galvanized steel for the angle and dead-end poles. It provided a lightning study, but it was not as detailed as that of Developer A. It presented galloping criteria, but it did not present a study to provide results. It did discuss structure vibration.

1C. Project Implementation Cost

The developers submitted nominal cost estimates between $77 million and $125 million. Because the estimates are based on different route mileage to the POI build zone, Figure 7 illustrates the cost estimates by mile. Although MISO reviews each developer's estimated project implementation costs, it recognizes those estimates are not binding independent of a specific commitment to cap a project's implementation cost or its associated revenue requirement.

Figure 7. Project implementation cost (Per mile of proposed route, $M)



Supporting Information

Each proposal included a completed Project Template Workbook (PTW), which allowed MISO to understand the details of a proposal's implementation costs during and after construction.

All developers included contingency and other expenses in their proposals. Although MISO views a project's contingency as an indication of the risk that estimated implementation costs could change, it recognizes the value of a contingency estimate is related to the nature of a developer's project implementation cost containment commitment.

All developers stated some intention to account for financing expenses during construction. This section discusses developers' elections regarding Allowance for Funds Used During Construction (AFUDC) because AFUDC is a component of project implementation cost. Section 1D discusses developers' elections regarding a return on Construction Work-in-Progress (CWIP) because a return on CWIP is a distinct item in a transmission owner's revenue requirement.

Developer A estimated project implementation costs of $97 million using the smaller of its two proposed conductors. It estimated project implementation costs of $106 million for the larger of those two conductors. It based both estimates on a 30-mile route. Its proposed contingency costs, as a percentage of its estimated costs, were the highest among the HIMB proposals. It stated this percentage is consistent with previous transmission projects of this scale and complexity. It was the only developer that will not accrue AFUDC.

Developer B estimated project implementation costs of $117 million using the smaller of its two proposed conductors. It estimated project implementation costs of $125 million for the larger of those two conductors. It based both estimates on a 25-mile route. Its proposed contingency costs, as a percentage of its estimated costs, were the lowest among the HIMB proposals. It will capitalize as AFUDC 50% of its accrued financing costs during construction and collect the other 50% as a return on CWIP.

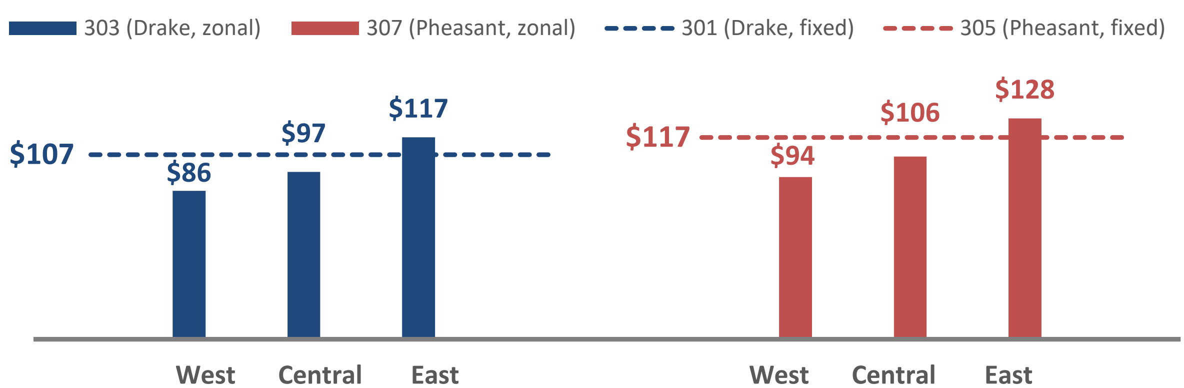
Developer C estimated a project implementation cost of $77 million, which was based on a 23-mile route. Its proposed contingency cost, as a percentage of its estimated cost, was slightly higher than that of Developer B. It will include AFUDC in its project implementation costs.

Project Implementation Cost Containment

Point of interconnection flexibility was one of the five aspects and elements of HIMB that MISO anticipates may be particularly important. Developer A was the only developer that proposed to cap its project implementation costs, and it did so in a way that accounts for the final POI.

Figure 8 illustrates Developer A's proposal, in nominal terms.

Figure 8. Developer A's proposed project implementation cost caps (in millions)



Developer A offered to limit its project implementation costs in one of two ways.

1. Under the first alternative (proposed in 301 and 305), it proposed to cap its costs, regardless of the final route, at approximately 10% more than its estimate for its central, proposed route. These caps are shown as dotted lines in Figure 8.

   For Proposal 301, which assumed the use of a smaller Drake conductor, it added an additional $10 million to its $97 million capital estimate to arrive at a $107 million cap. For Proposal 305, which assumed the use of a larger Pheasant conductor, it added an additional $11 million to its $106 million capital estimate to arrive at a $117 million cap.

2. Under the second alternative (proposed in 303 and 307), Developer A proposed to cap its costs based on whether the point of interconnection was in the western, central, or eastern portion of the POI build zone.[9] These caps are shown as bars in Figure 8.

Developer B did not offer to place a cap on its project implementation costs. However, its EPC contract contains a liquidated damages clause that will reduce project implementation costs by an identified amount for every day the project is not yet able to be energized, due to remaining EPC work, beyond Developer B's April 1, 2030, guaranteed completion date.

Developer C also did not offer to limit its project implementation costs. However, it did offer to limit its annual revenue, which can act like a quasi-project implementation cost commitment and will be discussed later in this report.

1D. Annual Transmission Revenue Requirement

The developers submitted present value annual transmission revenue requirement estimates between $55 million and $107 million, in 2022 dollars. Developer A submitted estimates of $81 million and $88 million for its small and large conductor proposals, respectively. Developer B submitted estimates of $101 million and $107 million for its small and large conductor proposals, respectively. Developer C submitted an estimate of $55 million.

Construction Work-in-Progress

Construction work-in-progress (CWIP) represents the capitalized cost of electric plant that has not yet been placed into service. FERC allows transmission owners to request timely recovery through rates of a portion of the carrying costs that accrue on CWIP. This is known as a “CWIP return.”

[9] Developer A stipulated, from west to east, the first six miles of the twenty-mile POI build zone constituted the western portion, the next eight miles constituted the central portion, and the final six miles constituted the eastern portion.

A transmission owner may capitalize any carrying costs not collected as a CWIP return as Allowance for Funds Used During Construction (AFUDC) and add them to an asset's depreciable value when the asset goes into service.

Developer A will not request to collect a return on CWIP before June 1, 2028 but will request CWIP treatment after this date once the project is complete and ready to be energized.

Developer B will seek to collect 50% of its construction financing expense as a return on CWIP. It will capitalize the other 50% as AFUDC and add that to the project's depreciable value when the project goes into service. Developer C will not seek a return on CWIP in its rates.

Return on equity and capital structure

Developers A and C based their proposals on a long-term capital structure with 55% debt and 45% equity, and a 9.8% cost of equity.

Developer B based its proposals on a long-term capital structure of 50% debt and 50% equity, and a 10.0% cost of equity.

Developer B's decision to finance 50% of its costs with equity, as opposed to the 45% proposed by the other developers, would increase its financing expense but reduce its credit risk. Its decision to seek a 10.0% return on equity reduces the competitiveness of its proposals.

Revenue Containment

All developers included revenue containment commitments in their proposals. Figure 9 identifies the nature and duration of those commitments.

Figure 9. Revenue containment provisions

	Developer A	Developer B	Developer C
Return on CWIP	no [10]	yes [11]	no
Equity / Total Capital	45%	50%	
Return on equity (ROE)	9.8%	10%	9.8%
Project delay	ROE reduction	$5000/day [12]	ROE reduction
Annual revenue caps	✓		✓
Cap adjustment			+/- 4.5% per mile
Commitment period	15 years	10 years	40 years

10 Developer A will request a return on CWIP beginning on its proposed in-service date of June 1, 2028, or once it has completed all construction, whichever is later.

11 Developer B will request a return on 50% CWIP. It will capitalize the return on the other 50% as AFUDC.

12 This proposal would reduce the project's project implementation cost, which would affect depreciation expense and financing expense.

Point of interconnection flexibility was one of the five aspects and elements of HIMB that MISO anticipates may be particularly important. Developers A and C proposed revenue containment terms that took the point of interconnection into account.

Developer A proposed to cap the equity in the project's capital structure and the cost of equity until the end of the project's fifteenth full year of operation. It also committed to annual revenue caps during that fifteen-year period. Those caps were either independent of the POI (Proposals 301 and 305) or dependent upon the POI build zone (Proposals 303 and 307). It confirmed it can meet an in-service date of June 1, 2028, and it will decrease its ROE by 25 basis points for every month, up to twelve months, completion is delayed.

Developer B also proposed to cap the equity in the project's capital structure and the cost of equity for a portion of the project's modeled cash flows. However, both commitments were slightly less competitive than those of Developer A, and the commitment was for only ten years instead of fifteen.

Developer C proposed the strongest revenue containment terms. It proposed annual revenue caps, and a fixed cost of equity, for the first forty years of the project's life. It stipulated that the annual revenue caps would increase by 4.5% for every mile the actual POI was east of its modeled POI.[13]

The terms of its project delay commitment were the same as Developer A except that this proposal is dependent upon MISO, METC, and NIPSCO confirming in writing by June 1, 2024, that they intend to "target completion of work necessary for the Project to commence commercial operation" by June 1, 2028.

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.

To facilitate thorough and consistent comparison across proposals, the evaluation team used a range of tools and perspectives to analyze cost information provided by the RFP Respondents. MISO evaluated submitted values, but also ran sensitivity studies to test how resilient or variable different proposals might be with changes to cost drivers such as higher-than-estimated capital expenditures for implementation, depreciation schedules, return on equity, cost of debt, the percentages of equity and debt in capital structure, taxes, inflation, and operations and maintenance costs.

MISO modeled ATRR estimates using common and proposal-specific values where appropriate across a range of possible scenarios. This enabled MISO to compare the rigor of submitted cost estimates and assess resulting certainty and risk mitigation offered to ratepayers while considering all relevant binding cost caps and cost containment features.

[13] If the actual POI is west of Developer C's proposed POI, the annual adjustments will be *negative* 4.5% per mile. The difference will be rounded to the nearest hundredth of a mile.

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, evaluate possible routes and obtain necessary permits, acquire right-of-way and land, construct and finance the project, and ensure safety during the project.[14] If the project only consists of a transmission line, this evaluation must constitute 35% of MISO's decision. If the project includes a substation, this evaluation must constitute 30% of the decision.[15]

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 subheadings below.

Each of the three 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 HIMB proposal did not differ across those proposals, this report evaluates the content by developer instead of by individual proposal.

For Project Implementation, MISO categorized Developer C's Proposal 306 as Best and the remaining proposals 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. The plan should identify the risks to completing a project on time and explain how stakeholders such as local, state, and federal agencies affect the proposed schedule.[16]

All developers submitted project schedules that support their project management plans. The schedules identified risks and mitigations, some with more supporting narrative descriptions than others. The schedules accounted for environmental challenges and associated permits.

In-service date flexibility was one of the five aspects and elements of HIMB that MISO anticipates may be particularly important. The RFP stipulated the project would need to be ready to be placed into service by June 1, 2030.

[14] Attachment FF. Section VIII.D.5.8. Project Implementation

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

[16] MISO BPM-27 Section 7.3.1

The table below shows that 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 METC and NIPSCO, the two interconnecting transmission owners, to energize the line for use.

	Developer A	Developer B	Developer C
Proposed completion date	June 1, 2028	April 1, 2030	June 1, 2028

Developer A submitted a detailed schedule complete with a critical path. The months chosen for its activities appear reasonable. The schedule included inputs from local, state, and federal agencies. The schedule includes two years of float.

Developer B proposed the latest guaranteed in-service date, although it stated it could accelerate that date by six-to-twelve months. Its project schedule shows activities ending on its proposed completion date. The other proposals completed activities sooner and then showed "project float" until the proposed completion dates. Developer B's schedule risk mitigations were less specific compared to other developers.

Developer C submitted a detailed schedule complete with a critical path. The schedule appeared to assume the best-case scenario most of the time, but the two years of float after the proposed completion date could help mitigate this risk.

Project Management Plan

A competitive proposal must describe how the developer will manage the project to meet the proposed schedule. It should describe the management team and how, relative to the location and jurisdiction of the project, MISO will successfully complete the project.[17]

All developers submitted reasonable project management plans. They all provided risk registers, though with different levels of specificity, and all identified relevant environmental issues.

Developer A's plan included a risk register that quantified the risks. The months identified for project activities appear reasonable. It claimed there is a low probability that the route will change. Its proposed route will likely require additional regulatory approvals because it goes through an environmentally protected area. Developer A explained how it will obtain input from local, state, and federal agencies, and it has already contacted some of those agencies.

Developer B's plan was less specific than those of the other developers. The risk register identified most risks but did not identify risk mitigation strategies as well as other submitted registers. Risk mitigation was less certain because it sometimes focused on shifting responsibility instead of direct mitigation. Although Developer B stated the condemnation process would end in August 2028, it did not explain that process as specifically as the other developers.

[17] MISO BPM-27 Section 7.3.2

Developer C submitted a plan that was low risk and project specific. It provided a Responsible Accountable Consulted Informed (RACI) chart for the entire project that showed responsible parties for different stages of the project. The plan contained a strong risk register but did not clearly show monetary impacts associated with each risk. The mitigation actions for the identified risks were reasonable. The plan discussed tree clearing in winter months to avoid impacting five species of bats.

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 to 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.[18] Point of interconnection flexibility was one of the five aspects and elements of HIMB that MISO anticipates may be particularly important.

All developers submitted comprehensive plans for at least one route from NIPSCO's Hiple Substation to the POI build zone. They all visited the site in 2022. They contacted relevant agencies to inform their plans, established their experience in obtaining the required permits to construct a transmission line in Indiana, and explained the constraints they identified to arrive at their proposed routes.

Figure 10 shows some of the characteristics of the proposed HIMB routes.

Figure 10. Characteristics of proposed HIMB routes

	Developer A	Developer B	Developer C
Route length (miles)	25.1 (west) 29.8 (central, proposed) 36.1 (east)	25.0 (west, proposed)	22.9 (west, proposed) 39.0 (east)
Right-of-way (ft)	150	130	150

Developer A proposed a route to the middle of the POI build zone and alternate routes to the eastern and western portions of the build zone. The initial stem out of Hiple Substation is the same for all three routes. All three of the routes cross an environmentally protected area. Crossing this area will likely require Developer A to acquire permitting or permission from multiple state and federal agencies and appears to introduce numerous significant risks other developers will not face. It completed a LiDAR survey and thirteen soil borings on site.

[18] MISO BPM-27 Section 7.3.3

Developer B identified many route segments before selecting its proposed route to the western part of the POI build zone. It discussed the initial screening, intermediate steps, and how those led to the final proposed route. It discussed reaching out to numerous local, state, and federal agencies, but it did not show how that outreach specifically affected its proposed route as well as other proposals.

It considered issues such as environmentally protected areas, the local Amish community, and center-pivot irrigation. It also evaluated the Michigan side of the project to determine likely interconnection points. Its proposed fieldwork was not as robust as other proposals. It based its assumption for the delineation of wetlands along its route on a desktop study.

Developer C proposed a route to the western part of the POI build zone and identified the route corridor it would use to extend the route east if necessary. The additional work to identify this corridor presumably allowed Developer C to estimate the costs necessary to support the cost per mile adjustment to the forty-year revenue requirement cap it proposed.

Although its routing study identified constraints, the study did not explain the connection between those constraints and the proposed route as thoroughly as other developers. Its proposal included a comprehensive field review plan to verify the route and identified species to avoid. Neither the proposed route nor the route extension went through large environmentally protected areas. Developer C had a strong public outreach plan, which included suggested locations for meetings.

Regulatory permitting process

A competitive proposal must describe a developer's abilities to obtain any regulatory permits necessary for the project. The proposal must also describe how the developer will perform necessary processes, such as preliminary engineering, preparation of any applications and written testimony, and participation in regulatory hearings. [19]

Regulatory certainty and coordination with interconnecting transmission owners are two of the five aspects and elements of HIMB MISO anticipates may be particularly important. All developers demonstrated relevant experience in the project area and stated they are familiar with the permits and approvals they will need to build the project. They all identified anticipated permits and the expected costs and schedule impacts.

Developer A established it understood the process for receiving approval from the state regulatory commission to construct the project, and it provided an example of relevant experience. It also explained the steps METC will need to take in Michigan to construct METC's portion of the Hiple to Duck Lake 345 kV transmission line. It noted the local, state, and federal agencies it had already contacted regarding permitting and provided record of those correspondences.

Developer B demonstrated relevant experience with the regulatory process in the jurisdiction. Its list of anticipated environmental permit requirements with timelines was more generic than those of Developers A and C. It also provided a list of typical non-environmental permits.

Developer C already has authority to operate as a public utility in Indiana and stated it will not require additional approval from the Indiana Utility Regulatory Commission to construct the project. It identified,

[19] MISO BPM-27 Section 7.3.4

among other permits, three permits that may significantly impact the project and explained how it would acquire those permits. It provided a detailed permitting plan that accounted for more local permit requirements than those of Developers A and B.

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]

All developers identified the land parcels and respective owners along their proposed routes. They determined land use types, estimated land acquisition acreage and costs, and described their land acquisition process along with its associated schedule.

Developer A proposed a right-of-way width of 150 feet. At the time it submitted its proposals, it had already obtained easement options from some of the landowners along its proposed route. It provided a sample Option and Transmission Easement agreement as well as a project brochure developed specifically for HIMB that will be distributed to landowners during the land acquisition process. Developer A provided information on its land acquisition personnel and their relevant experience. It commissioned a regional real estate market study to determine current values. However, its explanation of its condemnation process was not as thorough as other proposals.

Developer B proposed a right-of-way width of 130 feet, which was twenty feet less than that proposed by the other developers. Independent of other consequences, a narrower right-of-way is less expensive and uses less land. It provided information on its land acquisition personnel and their relevant experience. It provided sample public outreach materials, but they were not specific to the HIMB project like Developer A's brochure. Its land acquisition map was less comprehensive than the other proposals.

Developer C proposed a right-of-way width of 150 feet. It submitted a thorough land acquisition plan, and it provided a land acquisition map and a list of landowners along both its proposed and extended routes. Developer C provided a sample Utility Easement agreement. It solicited information regarding local land values from an outside appraisal company as part of the Land Valuation Study it performed. It noted its past success in completing a 345 kV transmission line in the Midwest.

2D. Construction

This subcriteria consists of a developer's proposals for engineering and surveying, material procurement, construction, and commissioning the project.

[20] MISO BPM-27 Section 7.3.5

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]

All developers identified the internal and external staff they will use or have already relied upon to prepare the studies and surveys necessary to successfully execute the project. Each identified recent projects they have completed that display they have relevant experience.

Developer A stated it will use the same engineering and surveying contractors it is currently using to build another transmission line in the Midwest. It already completed significant up-front engineering activities including taking soil borings, completing LiDAR survey, and completing some topographical survey, all of which the other two developers did not do.

Developer B stated it plans to solicit a LiDAR survey and do field investigations to locate additional utilities after the project is awarded. Its engineering plan was less project-specific than those of other developers.

Developer C also stated that it has not yet conducted field LiDAR, geotechnical, and environmental studies for surveying. It identified its engineering and geotechnical contractors, and it explained possible contractors it may use to stake foundation and offsets. It explained the different studies its contractors have already conducted to support its proposal.

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]

All developers used standardized design software to achieve accurate bills of materials. They all listed vendors that can supply necessary materials.

Developer A explained it would directly procure long lead-time items and its contractor would procure other material and equipment. It will establish two ten-acre laydown sites ten miles apart. It provided a QA/QC materials inspection template. Quotes were solicited from multiple vendors by Developer A, which provides flexibility in sourcing. The poles and framing materials will be delivered together to the right-of-way.

Developer B submitted a material procurement plan and mentioned multiple ways to mitigate sourcing risk. It stated its choice of conductor was strengthened by the conductor's availability in nearby affiliate storerooms. It provided a detailed QA/QC methodology based on ISO-9001. Vendors that have already been approved by its affiliate will supply all necessary materials.

Developer C explained it would purchase project material directly from qualified suppliers using bid packages and that its contractor would procure other materials necessary to support construction. Its schedule will provide three-to-ten months of float between procurement and fabrication. It will store the

[21] MISO BPM-27 Section 7.3.6

[22] MISO BPM-27 Section 7.3.7

concrete poles at the manufacturing facility, which is close to the site, and have them delivered directly to the site for installation. Its procurement approach is slightly riskier than other proposals due to its reliance on a single manufacturing plant for its selected concrete poles. It stated it could switch to steel poles as needed, but its plans for procuring steel poles are not as developed as its plan for procuring concrete poles.

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 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.[23]

All developers identified the internal and external staff they will use to construct the project.

Developer A's construction plan was thorough but less so than that of Developer C. It proposed to use a contractor to perform all construction, and it explained its clearing and access plan for its proposed route. It provided a risk matrix that identified the schedule impacts, costs, and mitigation plans associated with different risks.

Developer B's construction plan was less project-specific than those of its peers. It explained it had recently constructed an asset in the Midwest and it identified its EPC contractor and other local crews in the area.

Developer C's construction plan was well designed and project specific. It included access and restoration plans, and noted pulling locations, temporary easements, and wetland areas. It was the only developer to provide a thorough matting plan.

It identified the contractor that will build the project. That contractor will establish a local field office and generally work ten-hour days, six days a week. It stated the project does not present any unique construction risks but does have standard siting, soil, and endangered species risk.

Commissioning

A competitive proposal must describe how a developer will commission and energize a competitive facility.[24] All developers adequately explained how they would commission the project.

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 HIMB project. All developers proposed corporate financing through construction by funding the project from cash on hand and the existing credit facilities.

[23] MISO BPM-27 Section 7.3.8

[24] MISO BPM-27 Section 7.3.9

All developers will fund the operations and maintenance phase of the project 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.[25]

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.

Developer A explained that construction partners performing medium- and high-risk work must be prequalified and that it works with construction partners to develop site-specific plans during the bid-evaluation process. It identified numerous site-specific concerns, including slow-moving horse-drawn carriages, dirt roads, and agricultural machinery on roads and in fields.

Developer B identified two dedicated safety personnel and seven regional advisors that will be available to help with project safety. Its site-specific safety plan was much more generic than those of its peers.

Developer C identified the safety and health director who will oversee the project and the safety training required by the developer and its contractors. It will use a mobile software platform to create safety reports. It provided the OSHA 300 logs of its construction contractor for the past six years and stated it had recently completed a similar transmission line with zero recordable safety incidents.

[25] 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. If the project only consists of a substation, this evaluation must constitute 35% of its decision.[26]

The coordination of operations and maintenance with interconnecting utilities was one of the five aspects and elements of HIMB that MISO anticipates may be particularly important.

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

3A. Normal Operations

This O&M subcriteria 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 (LBAA)

A competitive proposal must describe how the project will be incorporated into a MISO Local Balancing Authority Area.[27]

Once the RFP was issued, developers were prohibited from contacting NIPSCO and METC, the owners of the connecting substations.[28] 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.

Two developers already have affiliate organizations registered as Local Balancing Authorities in MISO. The other developer stated it will work with NIPSCO and METC to reach an agreement.

Real-Time Operations Monitoring and Control

A competitive proposal must describe how the developer will monitor any transmission lines and control any substations in real-time.

If the project contains a substation, a proposal must discuss the location of the control center, the SCADA system used, the type and frequency of data collected from each substation or data provided to MISO via

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

[27] MISO BPM-027 Section 7.4.1

[28] MISO BPM-027 Section 5.7

Inter-Control Center Communications Protocol. For each control center, the proposal must discuss the number of staff per shift, the required staff qualifications, and the control capabilities and procedures. [29]

All developers are experienced transmission owners and operators and submitted sufficient information to establish they have the resources and experience to perform real-time monitoring and control of the project.

One developer does not operate any transmission lines in MISO in Indiana, but it does have existing interconnections with METC or NIPSCO. It reported fewer NERC-certified operators than the other developers.

The other two developers currently operate 345 kV transmission lines in Indiana and have existing interconnections with METC or NIPSCO, the two operators that will interconnect with the HIMB transmission line. One developer reported its average time over its last ten drills to switch from its primary to backup control center.

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.[30]

HIMB will not require the developer to install a field-mounted switch on a project facility. However, MISO concluded that all developers likely already perform switching activities on some of their transmission assets and could successfully perform this activity if it were a part of HIMB.

Planned Outage Coordination

All developers are experienced transmission owners and operators and submitted sufficient information to establish they had the resources and experience to coordinate planned outages for the project.

Developer A demonstrated a familiarity with MISO's Outage Management System, but it did not provide much information on the location of its outage personnel or the equipment it would use for outages. It provided a limited description of the sufficiency of its resources and its outage process.

Developer B demonstrated a familiarity with MISO's outage processes and stated its transmission line crew supervisors and staff live sufficiently close to the project. Its internal staff is experienced. It provided a limited description of its outage processes and did not identify the specialty equipment it would use.

Developer C described the tools, vehicles, and equipment it would use for planned outages, and it supplied the most comprehensive explanation of its outage planning process. It reported it already coordinates planned outages on 345 kV assets in MISO, and it would incorporate HIMB into its existing programs.

[29] MISO BPM-27 Section 7.4.2

[30] MISO BPM-27 Section 7.4.3

3B. Non-Normal Operations

This O&M category consists of a developer's plans for responding to unexpected (forced) outages, repairing equipment during emergencies, replacing, or rebuilding major facility assets destroyed in a catastrophe, and financing expenses incurred because of a catastrophe. In each area below, a developer must describe the owned and contracted tools, internal and external personnel, operational locations, and response time contemplated by its plans.

Forced Outage Response

A competitive proposal must describe how a developer will respond to a forced outage of each competitive facility.[31]

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

Developer A explained it would use a contractor, which would be located less than two hours from the project, to respond to forced outages. It was the only developer that identified the location of specialty equipment, but it did not identify how long it would take for that equipment to reach the HIMB line. The distance between that equipment and the line is greater than that proposed by the other developers. It was also the only developer to explain its testing procedures prior to reenergizing an offline facility.

Developer B will be able to respond to forced outages with internal personnel and will use pre-approved contractors when necessary. It identified the number and location of its internal staff, and that staff is located reasonably close to the project. The developer has an internal meteorological team that evaluates weather conditions to identify risks to assets. It provided momentary and permanent outage data for relevant 345 kV lines for the last four years. Its plan was less specific regarding its testing procedures prior to reenergizing a transmission line, and how and from where it would acquire helicopters and other specialized equipment during an emergency.

Developer C will also respond to forced outages with internal personnel, which will be located less than three hours from the project. The resources it will use are adequate. Its control center uses storm tracking and forecasting service to predict and track dangerous weather.

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.[32]

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[31] MISO BPM-27 Section 7.4.4

[32] MISO BPM-27 Section 7.4.5

All developers are experienced transmission owners and operators and submitted sufficient information to establish they had the resources and experience to repair and test project assets in an emergency.

Developer A provided examples of its ability to conduct emergency line restoration after catastrophic events and demonstrated its ability to perform maintenance. It stated it would be able to rebuild one mile of 345 kV line in seven days and will always have two miles of 345 kV conductor and OPGW available.

Developer B will be able to respond to emergencies with internal personnel and will use contractors when necessary. It can perform live wire maintenance, but it was less specific about how and from where it would acquire helicopters and other specialized equipment during an emergency.

Developer C was less specific than its peers regarding its ability to perform live wire maintenance. Its grounding and clearance safety procedures were less specific as well. Its response time was longer than the other developers. It will perform general repairs, but it will use contractors for major repairs.

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.[33]

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 stated it would be able to rebuild one mile of 345 kV line in seven days and will always maintain two miles of conductor and OPGW. Due to the significant distance between its specialty equipment and HIMB, Developer A's plans appear riskier than other proposals. It also has less staff with EHV/345 kV experience than the other developers.

Developer B stated its ability to restore two completely damaged structures within twelve days. It also has seven suspension structures and one dead-end structure in storage that meet the project's criteria and are a reasonable distance from the project.

It stated that it prefers to immediately rebuild permanent structures instead of using temporary structures and that this strategy is supported by its proposal to place at least one dead-end structure in each three-mile stretch of the project. It identified its qualified staff and tools, but it was less specific than other developers.

Developer C will rely on its contractor, which has sufficient labor and equipment located three hours from the project, to rebuild and replace major facility assets. Once all resources and materials are mobilized, it can reconstruct one mile of transmission line in one-to-two weeks.

[33] MISO BPM-27 Section 7.4.6

Both the developer and the contractor have existing contracts with several firms that can provide helicopters. It will have enough permanent spare inventory stored locally to replace up to six consecutive structures. In an emergency, it will have access to six Emergency Restoration System structures for temporary use.

Financial Strategy

A competitive proposal must describe a developer's financial strategy to timely replace facilities damaged due to catastrophic destruction.[34]

All developers established their ability to raise capital to replace facilities lost due to catastrophic destruction.

3C. Maintenance

This O&M subcriteria 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 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.[35]

All developers submitted sufficient and similar information to establish they will be able to timely replace project assets. They each plan to leverage affiliate sharing agreements, and each developer provided lead times on major equipment such as poles, conductor, ground wire, insulators, and hardware.

Developer A will continue its current practice of maintaining spare structures and hardware necessary to rebuild 1.5 miles of the project. It stores all material locally, monitors inventory using an integrated supply chain system, and will use an existing field office in the project vicinity.

Developer B will maintain locally spare material sufficient to replace three spans of project assets. It will contract with major vendors for additional spare parts, but it did not identify those vendors.

Developer C will maintain enough spare inventory to be able to replace any six consecutive structures. It identified the quantity of spares by part and pledged to maintain two circuit miles of conductor and ground wire locally. It will use one of its material laydown yards established during project construction to store spare structures after the project goes into service.

[34] MISO BPM-27 Section 7.4.9

[35] MISO BPM-27 Section 7.4.7

It will store conductors, insulators, and other small parts at locations within four hours of the project and will be able to deliver spare parts within six hours.

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.[36]

All developers submitted sufficient information to establish they had reasonable plans to perform preventative and predictive maintenance to minimize the project's in-service costs.

Developer A stated its maintenance crews are certified to perform live wire maintenance. It will have maintenance crews stationed less than ninety minutes from the project.

Developer B stated it will use a local contractor to perform live wire maintenance if it is required. It will conduct aerial surveys annually, inspect vegetation semiannually, and inspect non-wood structures comprehensively every twelve years. It reported the number of miles it has inspected in each category in the Midwest for each of the last three years. Maintenance crews will be based 60 to 150 minutes away from the project.

Developer C updates a three-year maintenance plan annually based on equipment condition, timing of outages, and required resources. It will conduct aerial surveys semiannually and inspect the project on the ground every five years. Although its proposed line will allow live wire maintenance, it did not clearly explain how it will perform such maintenance. Its vegetation management plan, as well as the priority and action items in its criteria for maintenance decisions, lacked specificity.

Financial Strategy for Maintenance

A competitive proposal must describe how the developer will finance activities due to normal wear and tear of project assets.[37]

All developers established their ability to raise capital to replace facilities lost due to catastrophic destruction.

3D. 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.[38]

[36] MISO BPM-27 Section 7.4.8

[37] MISO BPM-27 Section 7.4.9

[38] MISO BPM-27 Section 7.4.10

All the developers demonstrated they currently maintain high-voltage transmission lines.

Developer A provided a highly detailed safety plan and included industry certifications. It documented all relevant site-specific safety considerations, including identification and mitigation of induced current hazards. It identified its in-house training programs for all project equipment. It did not indicate whether it would have a dedicated safety manager for the project. It provided safety records from 2018 – 2022 for internal and contracted entities. Its TCIR and DART rates for the last three years are trending down.

Developer B identified several safety programs and practices, but the discussion was less specific than that of Developer A. It discussed a rigorous contractor safety qualification process, and its contractors are subject to qualification. It will assign a dedicated safety manager for the project. It provided safety records from 2019 – 2022 for internal and contracted entities. Its TCIR and DART rates for the last three years are trending down.

Developer C provided much less information on project safety than its peers. Unlike other developers, it did not discuss contractor safety competency, a crisis plan, safety training and certification programs, grounding and clearance safety procedures, or induced-current and hazard mitigation plans. It would assign a dedicated safety manager for the project. The DART rates of the entity that will perform O&M appear to be trending upward. It did not discuss any plans for continuous safety improvement.

4. Planning Participation

All developers received their full planning participation credit.

Appendix A. Proposal Comparative Table

	Developer A	Developer B	Developer C
Proposals	A1: 301, 303 A2: 305, 307	B1: 302 B2: 304	306
Design > Conductor			
ACSS Type (kcmil)	A1: Drake (2-795) A2: Pheasant (2-1272)	B1: Cardinal (2-954) B2: Pheasant (2-1272)	Cardinal (2-954)
Emergency summer rating (amps)	A1: 3,456 A2: 4,502	B1: 4,188 B2: 5,113	3,314
Maximum emergency operating temp (°F)	410°	482°	392°
Optical shieldwire	Same as METC selection	Standard for developer	Same as METC selection
Design > Structures			
Types	Monopole & two-pole	Monopole & two-pole	Monopole & two-pole
Material	Weathering steel	Galvanized steel	Concrete; galvanized steel;
Foundation	Direct embed, drilled pier	Drilled pier	Direct embed, drilled pier
Targeted resistance	25 ohms	20 ohms	20 ohms
Tangent insulators	Brace post	I-string	Brace post
Route (miles)			
Proposed	29.8 (central, proposed)	25.0 (west, proposed)	22.9 (west, proposed)
Alternate	25.1 (west)		
Alternate	36.1 (east)		39.0 (east)
Right-of-way width (ft)	150	130	150

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Appendix B. 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 "implementation 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

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.

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Appendix C. 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.

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 302, and 20 aluminum strands surrounding seven steel strands in each conductor bundle for the trapezoidal shaped conductor used in Proposal 306.

Concrete pole

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

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

A galvanized steel transmission structure is one in which the steel has been 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

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

MA3

MA3 behind ACSS conductor denotes 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.

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.