1 Study Overview

Renewable Portfolio Standards (RPS) passed by most Midwest ISO member states mandate meeting significant percentages of total electrical energy with renewable energy resources. To develop transmission portfolios fulfilling these requirements and meeting the objective function of achieving the lowest delivered dollar per MWh cost, Midwest ISO, with the assistance of state regulators and industry stakeholders, conducted the Regional Generator Outlet Study (RGOS).

1.1 RGOS Results Summary

During initial RGOS phases, analysis showed locating wind zones in a distributed manner throughout the system—as opposed to only locating the wind local to load or regionally where the best wind resources are located—results in a set of least-cost wind zones that help to reduce the delivered dollar per MWh cost needed to meet renewable energy requirements. From this earlier work, a combination of local and regional wind zones were identified and approved by the Upper Midwest Transmission Development Initiative (UMTDI). Further solidifying the validity of this methodology, the Midwest Governors' Association affirmed the method employed selecting these wind zones as the best approach to wind zone selection.

- RGOS determined the best fit solution to be a transmission overlay encompassing all Midwest ISO states, premised on a distributed set of wind zones, each with varying capacity factors and distances from load.

RGOS narrowed its focus to the development of three (3) transmission expansion scenarios to integrate wind from the designated zones: (1) a **Native Voltage** overlay that does *not* introduce new voltages such as 765kV in areas where they do not currently exist; (2) a **765 kV** overlay allowing the introduction of 765 kV transmission throughout the study footprint; and (3) **Native Voltage with DC** transmission that allows for the expansion of DC technology within the study footprint.

- All three (3) transmission expansion scenarios meet respective state Renewable Portfolio Standards (RPS) requirements within the Midwest ISO footprint.
- The addition of renewable energy zones with the transmission overlays reduced the Midwest ISO load-weighted LMP between $4.30 to $4.90/MWh (2010 USD).
- The three (3) transmission overlay plans represent potential investment of $16B to $22B in 2010 USD in transmission over the next 20 years and consist of new transmission mileage of 6,400–8,000 miles.
- Total cost for the transmission overlays range from $19/MWh to $25/MWh. The cost of the wind generation is an additional $72/MWh. However, the overlays and generation also produce Adjusted Production Cost (APC) savings of $41/MWh to $43/MWh within the Midwest ISO footprint, creating a net cost of $49/MWh to $54/MWh. This cost does not include the value associated with an additional $20/MWh to $22/MWh of APC savings which would accrue to the rest of the Eastern Interconnect as the result of the RGOS transmission overlays and generation.
- Analyses of these three (3) transmission plan alternatives through the RGOS study, along with additional analytics performed within Midwest ISO planning processes, have identified a sub-set qualifying as inputs into the Candidate Mutli-Value Project (MVP) portfolio analysis.

Because of RGOS, Midwest ISO has identified the next, most immediate step to transmission investment: a set of robust Candidate MVPs designed to address current renewable energy mandates and the regional reliability needs of its members. Viable for near-term development, these projects represent $5.8B (2010 USD) of capital investment, approximately $4.4 billion in the Midwest ISO footprint with the remainder in PJM. These Candidate MVPs will serve as inputs into the 2011 Candidate MVP Portfolio analysis, the first of a cyclical set of MVP Portfolio analyses which will propose and evaluate transmission to meet a changing policy landscape. While none of the overlay scenarios—Native Voltage, 765 kV, Native Voltage with DC—has emerged as the definitive renewable energy transmission solution, it is important to note all selected Candidate MVPs are compatible with all three (3) transmission plans.

1.2 Long-term Transmission Strategies

All three (3) transmission plans were developed to provide reliable delivery of the RPS-identified levels of renewable energy. Reliable delivery assumptions are discussed within Section 5 and focus on transmission system constraints 200 kV and higher. Refer to Figure 1.2-1. The study region consists of Midwest ISO and neighboring facilities including MAPP, Commonwealth Edison, and American Electric Power.

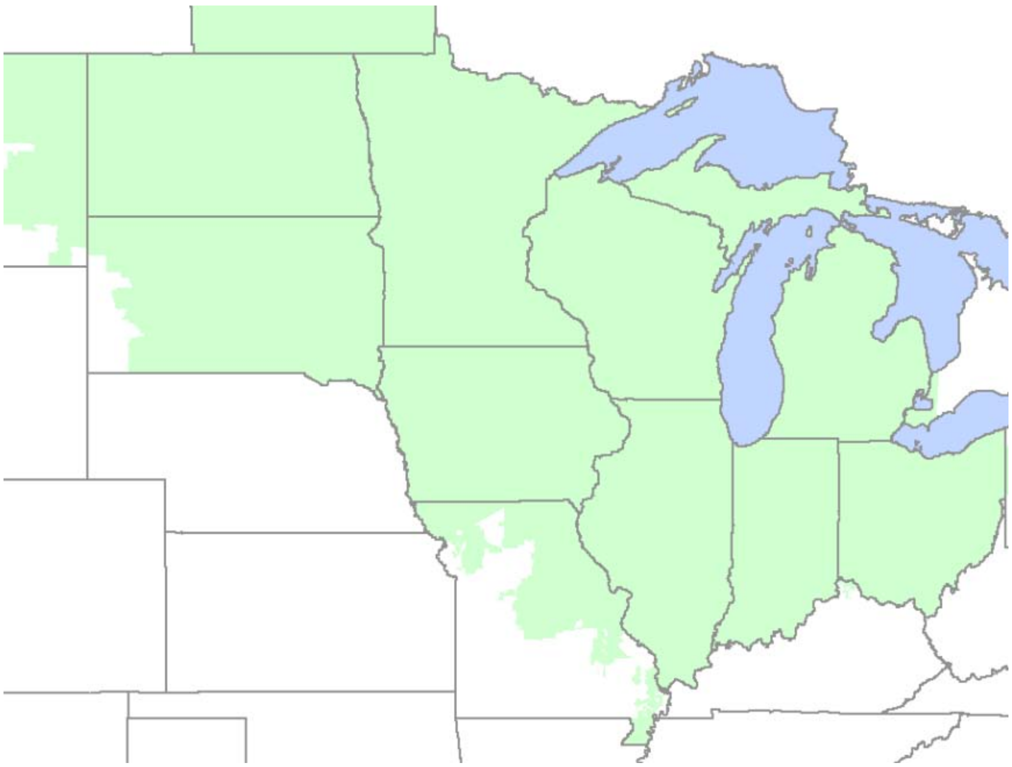

Figure 1.2-1: RGOS Study Footprint

Because RGOS transmission plans impact MAPP and PJM systems, references to these neighboring systems are made whenever RGOS is discussed, the result of necessary assumptions regarding planning practices and strategic assessment. For example, a 765 kV grid logically connects into an already existing 765 backbone on the PJM system, but PJM references are not yet indicative of any projects in the PJM Regional Transmission Expansion Plan. Evaluation of overlays moving forward will continue to require coordination between impacted neighboring entities, including PJM, MAPP, SPP, and TVA.

1.2.1 Transmission Expansion Drivers

The Midwest ISO region observed two significant drivers for transmission expansion: (1) state RPS mandates; and (2) associated generation in the Midwest ISO Generation Interconnection Queue (GIQ). For more detailed information regarding state RPS mandates and goals, refer to section 3 and Appendix 2 of this document. The second major driver for transmission expansion is the Midwest ISO Generation Interconnection Queue (GIQ), which—as of the end of July 2010—held approximately 64,500 MWs of wind requests. After careful examination of the inherently complex issues involved, Midwest ISO staff and stakeholders determined the GIQ process would not be an efficient means for building a cost-effective transmission system either immediately, over the next 5–10 year period or in the foreseeable future beyond that time-frame.

1.2.2 Indicative Zone Selection Rationale

Several different generation siting options were analyzed during previous phases of RGOS. This analysis focused on the relative benefits of local generation, which typically requires less transmission to be delivered to major load centers, and regional generation, which can be located where wind energy is the strongest. A total of fourteen (14) generation siting options were developed, with options ranging from purely local generation siting, purely regional generation siting, or a combination of local and regional generation siting. Transmission overlays were then developed with Transmission Owners (TOs) on a high-level, indicative basis for each generation siting option. Capital costs for each generation siting option and its associated high-level transmission overlay were calculated and plotted against each other to determine the relative cost of each generation siting approach. Refer to Figure 1.2-2.

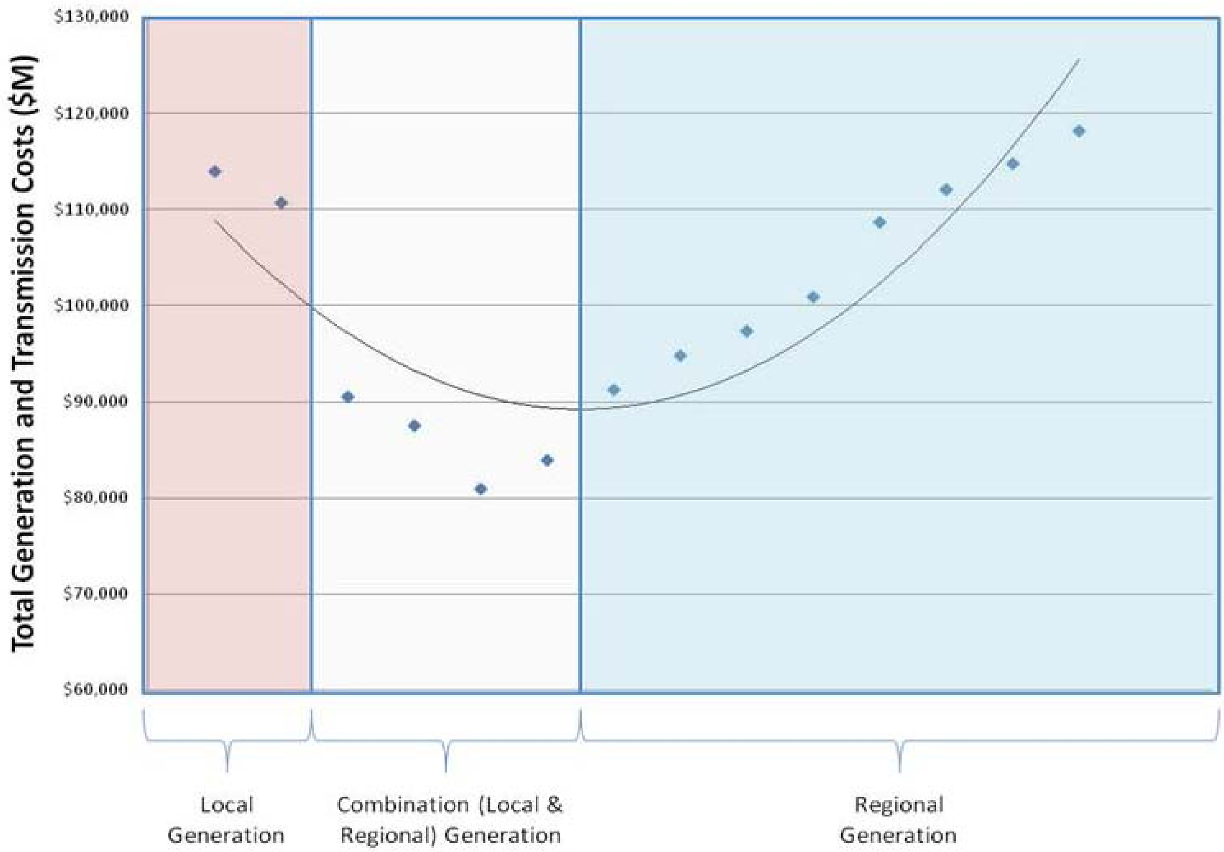

Figure 1.2-2: Zone Scenario Generation and Transmission Cost Comparison

It was determined the least cost approach to generation siting is a methodology containing a combination of local and regional wind generation locations, as shown by the white area on Figure 1.2-2. This was the approach affirmed by the Midwest Governors' Association as the best approach to wind zone selection.

For greater detail regarding the indicative transmission results, design, and optimization, refer to sections 4.1,1, 5.1, and Appendix 3 of this document. Also refer to section 9.1 of the Midwest ISO Transmission Expansion Plan (MTEP) 2009, which more fully describes the rationale driving zone scenario generation.

1.2.3 Comparative Analysis

During the study process, the RGOS group focused on the development of three (3) transmission expansion scenarios mentioned in the previous section: (1) a **Native Voltage** overlay that does *not* introduce new technology or voltages in the area; (2) a **765 kV** overlay allowing the introduction of 765 kV transmission throughout the study footprint; and (3) **Native Voltage with DC** transmission that allows for the expansion of DC technology within the study footprint. Refer to Table 1.2-1, which describes the physical characteristics of the three (3) overlay scenarios. It shows how the number of new lines, total line miles, acres of right-of-way, river crossings, and substations differ between scenarios. It also breaks down each scenario geographically between Midwest ISO, PJM, and Total study footprint. Joint/DC represents AC and DC transmission projects that may constitute shared costs between Midwest ISO and PJM.

The data reveals, for example, that the Native Voltage scenario requires more new lines, more line miles, and more substations than the 765 kV overlay for the total study footprint but does, however, require less acres of right-of-way.

Table 1.2-1: Summary of RGOS Overlay Physical Infrastructure

Overlay	Purview	# of New Lines	Line Miles	Acres of Right-of-way	River Crossings	Substations
Native	**Total**	**122**	**6,795**	**126,637**	**7**	**139**
	Midwest ISO	107	5,938	109,248	7	119
	PJM	13	685	13,197	0	20
	Joint/DC	2	173	4,192	0	0
765	**Total**	**90**	**6,412**	**136,612**	**7**	**124**
	Midwest ISO	69	5,029	104582	7	94
	PJM	17	1,047	23,891	0	30
	Joint/DC	4	336	8,139	0	0
Native DC	**Total**	**113**	**8,033**	**150,094**	**7**	**132**
	Midwest ISO	95	5,340	100,917	7	101
	PJM	17	836	16,289	0	21
	Joint/DC	1	1,857	32,887	0	10
*** Right-of-way widths used in Calculation: 230 kV–100ft ; 345 kV–150ft; Dbl Ckt 345 kV–160ft; 765 kV–200 ft**						

Refer to Table 1.2-2, which describes the costs to build new transmission and generation for the three (3) overlay scenarios. Transmission costs were calculated by multiplying line mileage by cost per mile, with cost per mile differentiated by state. These calculations also included substations, transformers, and related infrastructure. Construction cost estimates also attempted to include the regulatory permitting process. The table categorizes these factors by Native Voltage, 765 kV, and Native Voltage with DC scenarios, as well as Midwest ISO, PJM, and Joint/DC geographies.

Based on these factors, RGOS produced total overlay estimates of $16.3 billion (2010 USD) for the Native Voltage system, $20.2 billion for 765 kV, and $21.9 billion for the Native Voltage with DC scenario for the RGOS study footprint.

Generation costs were calculated by multiplying the total amount of RPS required MW by construction cost estimates of $2 million per MW. This cost, at $58.1 billion (2010 USD), does not vary between scenarios.

Table 1.2-2: 2010 Cost Summary - Construction (2010 USD in Millions)

Category	Geographic Purview	Native Voltage	765 kV	Native DC
Transmission	**Total**	$16,301	$20,249	$21,544
	Midwest ISO	$13,865	$15,099	$12,662
	PJM	$1,952	$4,196	$2,138
	Joint/DC*	$484	$955	6,744
Generation	**Total**	$58,100	$58,100	$58,100
	Midwest ISO	$44,737	$44,737	$44,737
	PJM	$13,363	$13,363	$13,363
	Joint/DC*	$ -	$ -	$ -
Total	**Total**	$74,401	$78,349	$79,644
	Midwest ISO	$58,602	$59,836	$57,399
	PJM	$15,315	$17,559	$15,501
	Joint/DC*	$484	$955	$6,744

Refer to Table 1.2-3, which describes 2010 Levelized Annual Costs, which are the total revenue requirements (2010 USD) for the three (3) scenarios. Revenue requirements refer to the total annualized costs for the new transmission and generation. These levelized annual costs are determined through application of proxy Attachment O of the Midwest ISO FERC tariff. Table 1.2-3 breaks these factors down by Native Voltage, 765 kV, and Native Voltage with DC (Native DC) scenarios, and Midwest ISO, PJM, and Joint/DC geographies.

RGOS found total study footprint annual levelized costs vary between $1.7 billion per year for Native Voltage, to $2.1 for 765 kV, to $2.2 for Native Voltage with DC (Native DC), with generation annual costs at $4.9 billion.

Table 1.2-3: Cost Summary - 2010 Levelized Annual Costs***

Category	Geographic Purview	Native Voltage	765 kV	Native DC
Transmission	**Total**	**$1,686**	**$2,064**	**$2,188**
	Midwest ISO	$1,419	$1,537	$1,304
	PJM	$209	$424	$227
	Joint/DC*	$57	$102	$656
Generation	**Total**	**$6,334**	**$6,334**	**$6,334**
	Midwest ISO	$4,931	$4,931	$4,931
	PJM	$1,402	$1,402	$1,402
	Joint/DC*	$ -	$ -	$ -
Total	**Total**	**$8,019**	**$8,397**	**$8,521**
	Midwest ISO	$6,351	$6,469	$6,236
	PJM	$1,612	$1,826	$1,630
	Joint/DC*	$57	$102	$656

Table 1.2-4 describes 2010 Annual Costs $/MWh, which takes total costs from Table 1.2-3 and presents total costs as a per MWh value. This calculation is based on 88.6 TWh of energy delivered from renewable energy zones. Table 1.2-4 describes transmission and generation costs for the modeled RGOS renewable wind zone energy.

These are not incremental costs; rather, these are a comparative measure of total MWh cost if wind served as the only energy source relative to RGOS wind and transmission. This table indicates transmission costs for the modeled RGOS renewable energy wind zone delivered would be $19, $23, or $25 per MWh based on the addition of the various RGOS transmission overlays in the Midwest ISO footprint. On the generation side, MWh cost would increase to $72/MWh for all scenarios. It should be understood that the wind and the subsequent transmission have impacts on the entire system being served. This includes providing additional potential reliability benefits to the system for the transmission additions, as well as providing reductions in the production costs on the system. Within this study, only adjusted production costs were given a value to compare to the costs. Because costs are added to the system infrastructure as a direct result to the renewable energy zones to meet RPS requirements, the energy delivered from those zones was used as a common denominator for the per unit comparsion.

Table 1.2-4: Cost Summary – 2010 Annual Costs ($/MW*)**

Category	Geographic Purview	Native Voltage	765 kV	Native DC
Transmission	**Total**	**$19**	**$23**	**$25**
	Midwest ISO	$16	$17	$15
	PJM	$2	$5	$3
	Joint/DC*	$1	$1	$7
Generation	**Total**	**$72**	**$72**	**$72**
	Midwest ISO	$56	$56	$56
	PJM	$16	$16	$16
	Joint/DC*	$0	$0	$0
Total	**Total**	**$91**	**$95**	**$96**
	Midwest ISO	$72	$73	$70
	PJM	$18	$21	$18
	Joint/DC*	$1	$1	$7

* Joint/DC represents AC and DC transmission projects that may constitute shared costs between Midwest ISO and PJM. Note, too, there is one AC project: the Pioneer 765 kV project in Indiana. The rest represent DC projects.

** Transmission costs include line and substation cost estimates

*** Levelized annual costs determined through application of proxy Attachment O calculation to determine annual revenue requirements

**** Calculation based on energy delivered from renewable energy zones: 88.6 TWh (each overlay effectively delivered the same amount of energy)

Adding wind to the system reduces energy costs. This benefit is captured through the adjusted production cost calculated by dividing total production cost savings by total MWh. Refer to Table 1.2-5, which describes regional per MWh adjusted production savings based on 88.6 TWh of RGOS wind zone delivered energy. Adjusted cost savings within the Midwest ISO footprint for Native Voltage, 765 kV, and Native Voltage with DC (Native DC) scenarios would be $41/MWh, $43/MWh, and $43/MWh (2010 USD), respectively.

Table 1.2-5: 2010 Adjusted Production Cost (APC) Savings ($/MWh)

Entity	Native Voltage	765 kV	Native DC
Midwest ISO	$41	$43	$42
Midwest ISO/MAPP	$56	$57	$57
Midwest ISO/MAPP/PJM	$62	$63	$63
Eastern Interconnect	$62	$63	$63

Table 1.2-6 summarizes net cost. Subtracting 2010 MWh Adjusted Production Cost (APC) benefits from 2010 installed costs results in the following net costs per MWh of delivered RGOS wind zone energy.

Table 1.2-6: 2010 Net Total Cost Summary ($/MWh)

Entity	Native Voltage	765 kV	Native DC
Midwest ISO	$49	$52	$54
Midwest ISO/MAPP	$35	$37	$39
Midwest ISO/MAPP/PJM	$29	$32	$33
Eastern Interconnect	$29	$32	$33

When analyzing the information presented in Tables 1.2-1–1.2-4, it is important to note while overall metrics show some disparity among plans, the Native Voltage and 765 kV overlays are very similar when looking solely at Midwest ISO-only impacts. It is more problematic, however, when comparing either of these two (2) overlays to the Native Voltage with DC option since DC transmission costs are not categorized as solely Midwest ISO or solely PJM because the lines start in one system and terminate in the other.

1.2.4 Native Voltage Overlay

The Native Voltage solution focuses on transmission development that does **not** introduce a new voltage class within areas. This means areas with 345 kV transmission as the native Extra High Voltage (EHV) transmission must be limited to a maximum of 345 kV transmission for new infrastructure expansion. However, those areas with existing 765 kV transmission would be allowed to expand 765 kV infrastructure. Refer to Figure 1.2-3, which depicts the Native Voltage transmission solution meeting the RGOS design criteria. For a large (42 in. x 36 in.), detailed version of the Native Voltage overlay, refer to Appendix 10, attached.

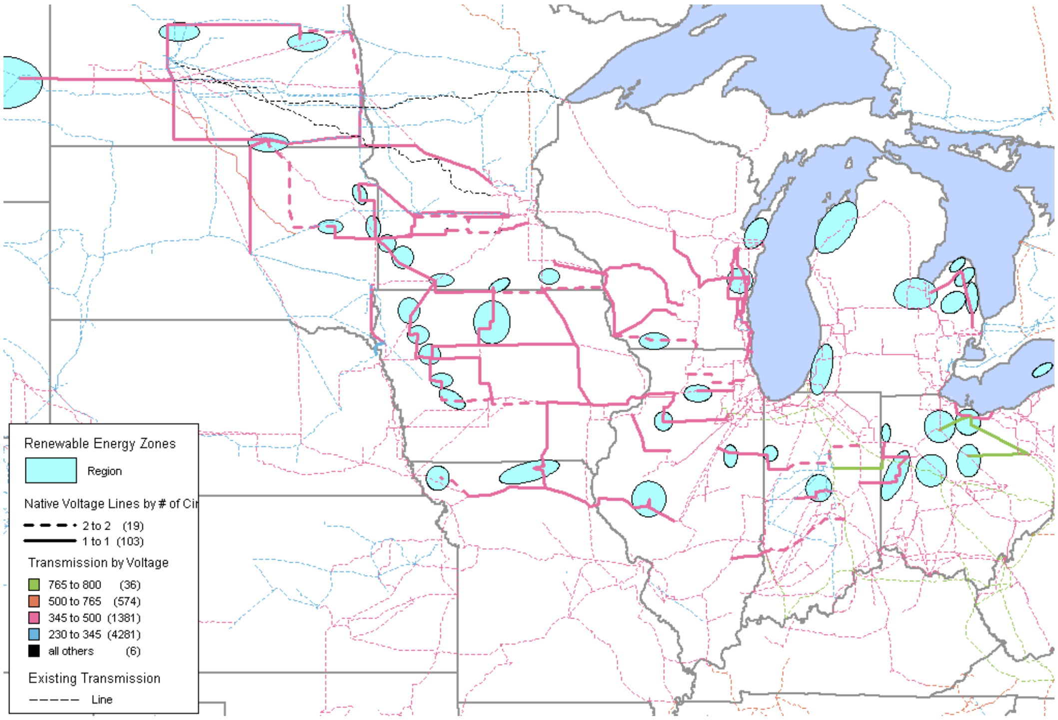

Figure 1.2-3: Native Voltage Transmission Overlay Strategy

As currently designed, the Native Voltage transmission overlay has the lowest construction cost. Although Native Voltage has more line miles than the 765 kV overlay, it requires fewer acres of right-of-way. When considering Midwest ISO alone, although the economic metrics of the Native Voltage overlay may not be as attractive as the metrics for the 765 kV overlay, Native Voltage requires about $1,200M less in capital investment to construct. The Native Voltage plan, like the two other transmission overlays, achieves the reliability objectives of the study. However, this plan does not extend as far south as the other two plans. This is part of the reason the other plans have higher construction/capital costs.

The Native Voltage strategy does have some risks and benefits. If renewable energy mandates are increased within the study footprint, or if there is an increased need for exports, additional transmission may need to be constructed. This would likely require additional right-of-way and more miles of transmission line when compared to the 765 kV and Native Voltage with DC overlays. In the long-term, this may result in escalating costs and environmental impacts that are not accounted for in this study. However, the Native Voltage Overlay has less dependence on the future transmission expansion plans of neighbors. By not introducing new voltages, the Native Voltage strategy readily integrates into the existing Midwest ISO system and may allow for quicker construction and better sequencing with other overlay components compared with the 765 kV overlays. Additionally, this strategy possibly puts less cost at risk if actual wind requirements of the Midwest ISO states are determined to be lower than the amount of wind included in the RGOS study—a determination not yet made. This risk will be minimized by carefully sequencing the construction of whichever overlay is chosen.

1.2.5 765 kV Overlay

The 765 kV solution emphasizes the development of transmission that introduces a new voltage class to much of the RGOS footprint. Figure 1.2-4 depicts the 765 kV transmission solution meeting RGOS design criteria. For a large (42 in. x 36 in.), detailed version of the 765 kV overlay, refer to Appendix 10, attached.

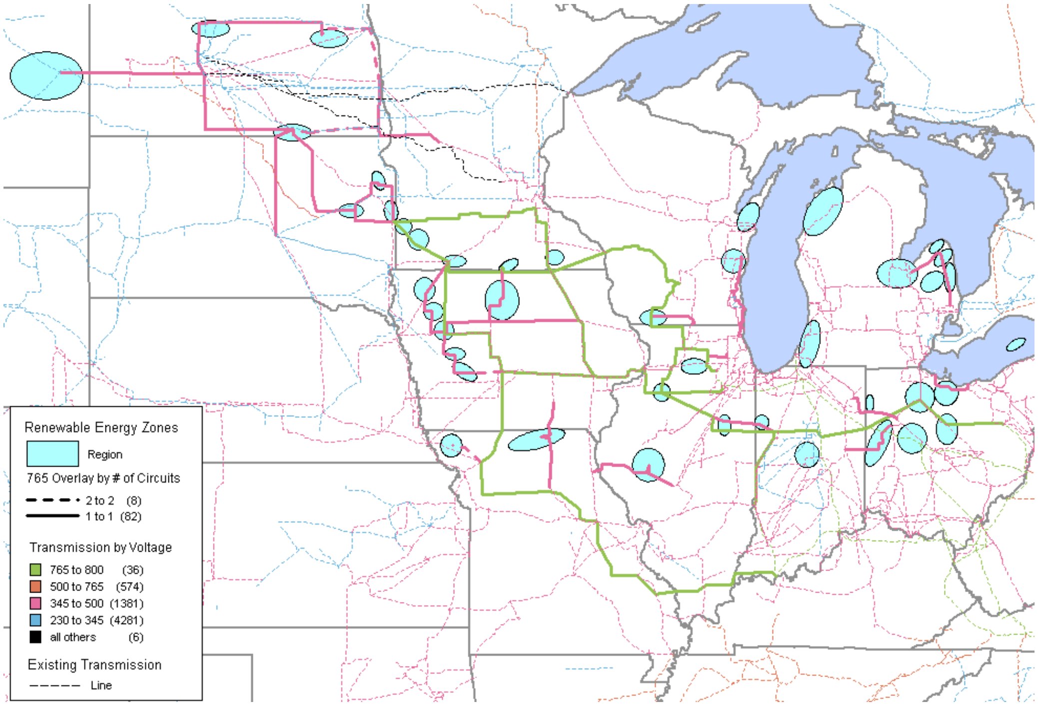

Figure 1.2-4: 765 kV Transmission Overlay Strategy

The 765 kV overlay results in Adjusted Production Cost (APC) savings greater than the Native Voltage overlay. The 765 kV overlay also uses less line miles of transmission lines than the Native Voltage overlay, although the 765 kV overlay does require more acres of right-of-way due to the wider right-of-way needed for 765 kV transmission. However, in the Midwest ISO portion of the overlay, the comparison of transmission costs, mileage, and acreage may favor the 765 kV plan.

Selecting 765 kV as an overall strategy also holds risks. For example, system development may not be achievable without cooperation among the transmission expansion strategies of two RTO regions; e.g., investment in 765 kV construction within Midwest ISO may be more heavily dependent upon the investment of the 765 kV grid within the western PJM region than the Native Voltage overlay. Proper coordination of development within Midwest ISO is also an important consideration. Transmission built in the western portion of the footprint to 765 kV standards may default to 345 kV transmission operation if eastern portions of the Midwest ISO footprint do not commit to the same 765 kV development in the same time-frame, resulting in potential cost risk. Finally, introducing 765 kV into new portions of the footprint will require costs associated with the learning curve required for the development and management necessitated by a new voltage type in the system.

Adopting a 765 kV strategy does, however, offer a number of benefits. For example, the 765 kV overlay demonstrates the need for less miles of transmission than the miles of transmission required by Native Voltage to deliver the same amount of renewable energy. If wind development in the region continues to increase over the future—and it is reasonable to expect this would be a continuing trend—the 765 kV overlay will reduce the amount of environmental impact caused by transmission construction. Although the current 765 kV plan has the potential to create better interconnection access to areas to the south and Southeast of Midwest ISO, additional refinement of the 765 kV plan that results in the same geographical footprint access as the current Native Voltage design could further reduce the line mileage of the strategy while also reducing total costs.

1.2.6 Native Voltage with DC Overlay

The Native Voltage with DC solution focuses on the development of transmission that introduces a new voltage class to much of the RGOS study footprint. Figure 1.2-5 shows the Native Voltage with DC transmission solution that meets RGOS design criteria. For a large (42 in. x 36 in.), detailed version of the Native Voltage with DC overlay, refer to Appendix 10, attached.

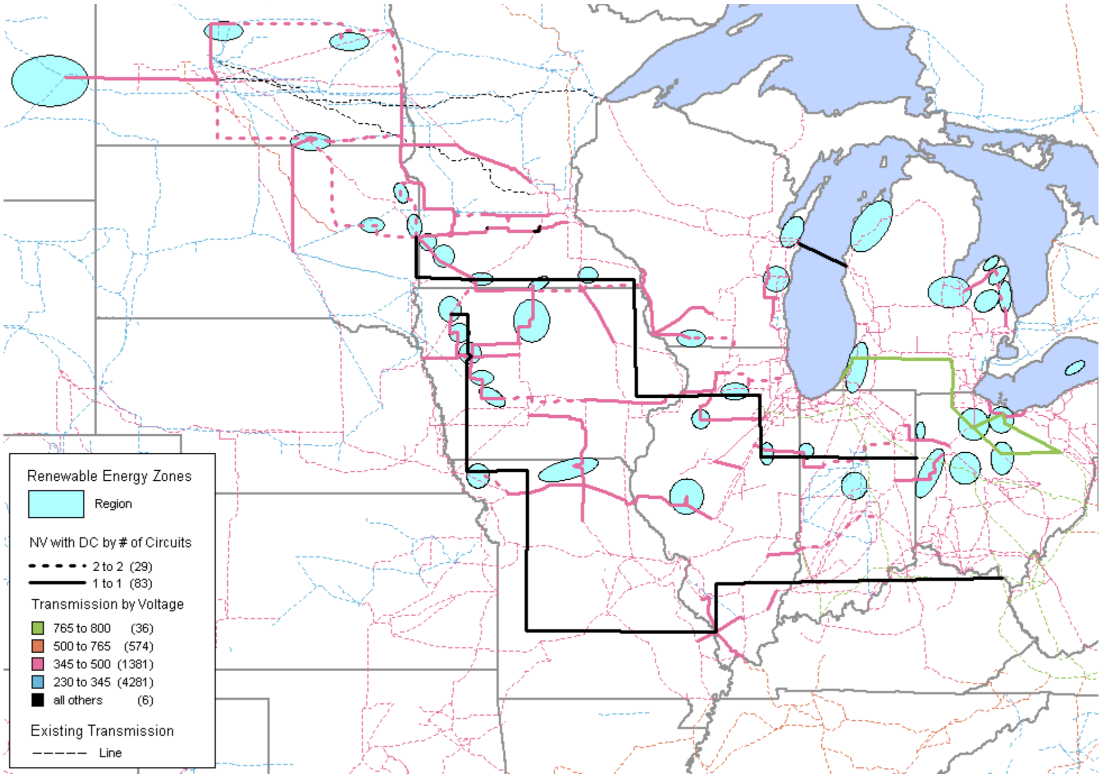

Figure 1.2-5: Native Voltage with DC Transmission Overlay Strategy

The Native Voltage with DC overlay provides benefits to the system—reducing, for example, the amount of AC transmission needed by allowing energy to be gathered in the western region of the study footprint and delivered to points to the east while avoiding potential impacts on the underlying systems. This scenario demonstrates that the crossing under Lake Michigan has the potential to reduce land-based transmission within Wisconsin and along the southern shores of Lake Michigan. Like 765 kV, Native Voltage with DC accesses part of the footprint that the Native Voltage strategy would not.

Land-based High Voltage Direct Current (HVDC) transmission was modeled as conventional HVDC. However, there are other options for the DC design available for future analysis that may provide for operational benefit that could not be captured through this study. For example, HVDC–Voltage Source Control (VSC) provides real power flow control beyond generator dispatch at full range of capability where conventional has limitations at lightly loaded schedules. In addition, HVDC–VSC has voltage control capability independent of the real power flow on the line, whereas conventional design reactive support is dependent on the real power flow. Finally, it is more functional in being able to interconnect at more intermediate locations compared to conventional HVDC which limits intermediate interconnection points.

Unfortunately the costs of adding DC to the system are rather high compared to the AC alternatives at shorter distance needs, and the entries to tap the lines are much more expensive and less integrated than providing AC paths across the system. However, it is difficult to eliminate DC transmission as an option for bulk energy delivery from renewable energy areas across long distances because of not-yet-evaluated option values. Proper evaluation of these other metrics along with improved design of what type of HVDC as well as interconnection locations could improve the case for long-distance DC energy delivery.

1.3 RGOS Candidate Multi-Value Projects

Although RGOS focused on the development of holistic system solutions meeting long-term needs for the integration of renewable resources into the transmission system, it is important to identify an initial group of projects that are compatible with the three overlays that provide a practical first step towards meeting the renewable resource requirements. Midwest ISO staff has developed an analytical framework to identify the best potential transmission projects. These RGOS-identified projects will require more detailed analysis. Because a Midwest ISO long-range transmission expansion strategy has not yet been determined and was not within the scope of RGOS analysis, it is important Candidate Multi-Value Projects (MVPs) not pre-determine Midwest ISO long-range strategic aims and equally important Candidate MVPs prove compatible with all potential strategies.

Refer to the Venn diagram in Figure 1.3-1 conceptualizing RGOS Candidate Multi-Value Project (MVP) selection.

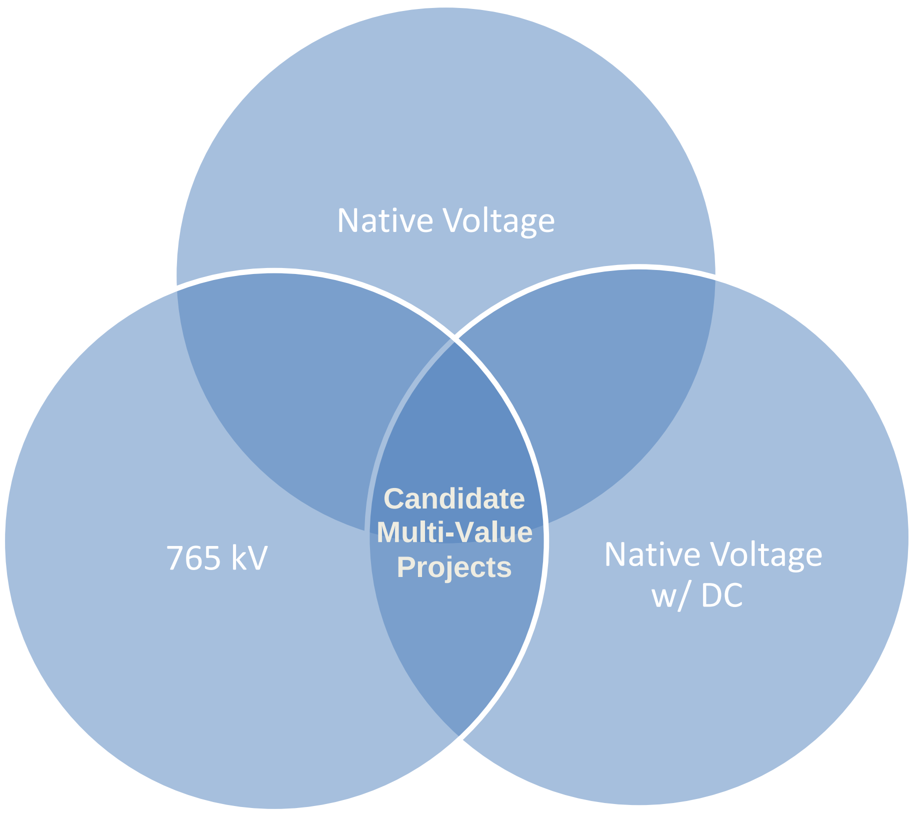

Figure 1.3-1: Candidate MVP Strategy Development Venn Diagram

1.3.1 Identifying RGOS Candidate Multi-Value Projects

The RGOS inputs into the Candidate Multi-Value Projects (MVPs) portfolio were identified by means of the steps outlined below. Please note other studies were considered in collecting the final Candidate MVP portfolio; not all projects in that portfolio are derived from the RGOS study effort. For greater detail regarding the steps comprising the Candidate MVP identification process, refer to section 7 of this document. For a summary of the future ramifications of Candidate MVP portfolio identification, refer to section 8.

- **Step 1:** Identify useful corridors common to multiple Midwest ISO studies.
- **Step 2:** Identify RPS timing needs and synchronize with generation interconnection queue locations.
- **Step 3:** Evaluate constructability of transmission.

An initial set of transmission projects was identified using the inspection steps listed above. These transmission projects served as an input into the overall Candidate MVP portfolio described in section 7.1. The selected Candidate MVPs are compatible with RGOS-developed overlays and provide potential value for other needs identified within the transmission system. Refer to Figure 1.3-2, which depicts Candidate MVPs from the RGOS analysis. Estimated cost for this RGOS Candidate MVP set is approximately $5.8 Billion, with $4.4 billion of that amount within Midwest ISO borders.

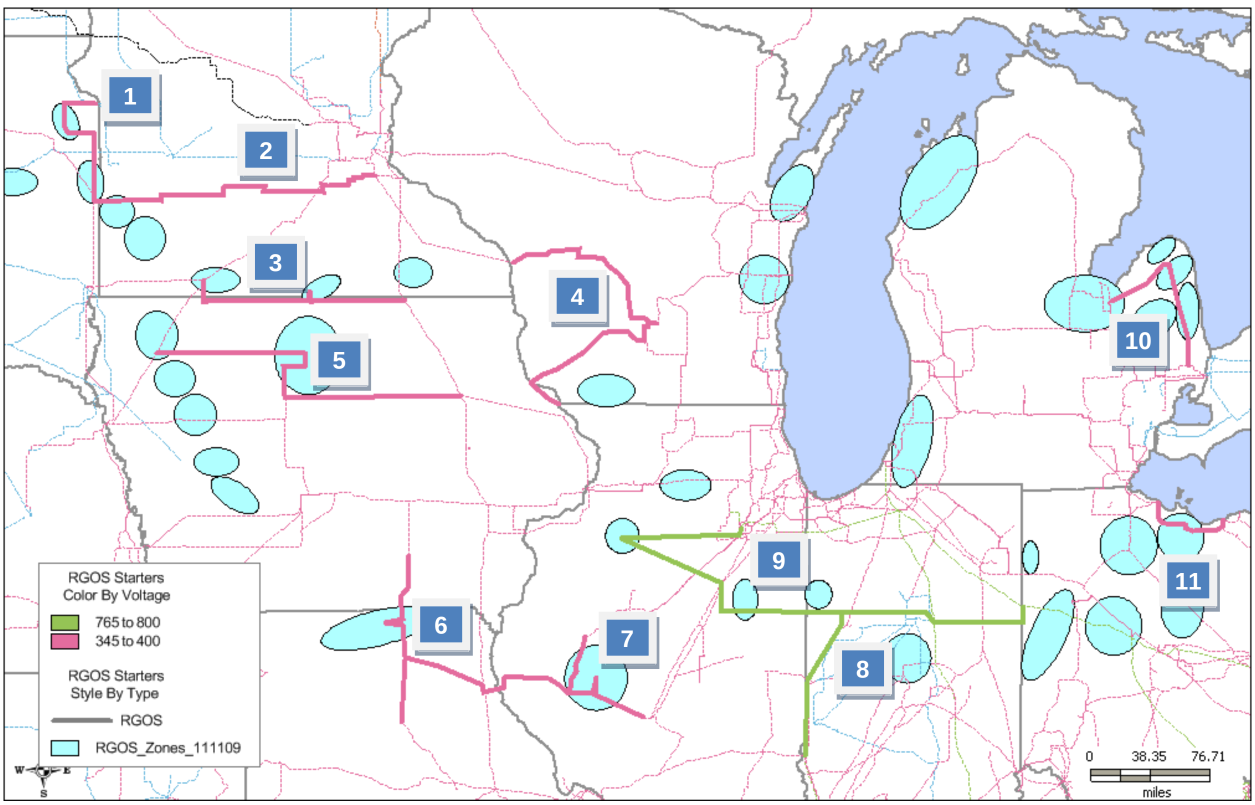

Figure 1.3-2: RGOS-identified Candidate Multi-Value Projects (Midwest ISO and PJM Lines Shown)

The numbered list shown in Table 1.3-1, below, corresponds to the Candidate MVP identifiers depicted in Figure 1.3-2 on the previous page.

Table 1.3-2: Candidate Multi-Value Projects

ID	Candidate MVP	Estimated Installed Cost (2010 USD in millions)
1	Big Stone to Brookings 345 kV line	150
2	Brookings to Twin Cities 345 kV line	700
3	Lakefield Junction to Mitchell County 345 kV line constructed at 765 kV specifications	600
4	North LaCrosse to North Madison to Cardinal, Dubuque to Spring Green to Cardinal 345 kV lines	811
5	Sheldon to Webster to Hazleton 345 kV line	458
6	Ottumwa to Adair to Thomas Hill, Adair to Palmyra 345 kV lines	295
7	Palmyra to Meredosia to Pawnee, Ipava to Meredosia 345 kV lines	345
8	Sullivan to Meadow Lake to Greentown to Blue Creek 765 kV line	908
9	Collins to Kewanee to Pontiac to Meadow Lake 765 kV line	964
10	Michigan Thumb 345 kV transmission loop	510
11	Davis Besse to Beaver 345 kV line	71

The RGOS effort encompassed not only Midwest ISO but also immediate neighbors within PJM. This broadening of the study footprint resulted in development of transmission overlays that also include transmission within the PJM footprint. However, for purposes of Candidate Multi Value Project (MVP) evaluation, only Midwest ISO projects are included.

1.4 RGOS Results Summary

RGOS provides industry stakeholders and policy makers with a regional planning perspective identifying potential investment opportunities and demonstrating the integration of renewable energy policies into electrical system development. The purpose of RGOS has been to explore long-term transmission strategies ensuring study defined reliability objectives in delivery of renewable energy as well as RPS compliance. Aside from developmental considerations and regulatory concerns, determining a long-term transmission expansion strategy also serves to frame and define near-term needs. With these factors in mind, RGOS contributors considered the following when formulating viable long-term transmission strategies:

- **Performance:** Does the proposed strategy perform well under a variety of future scenarios?
- **Developmental Considerations:** Noting many of the more reliable wind resources reside far from large electrical load centers and lack adequate long-distance transmission lines, what is the expectation for further long-term development of wind resources within Midwest ISO?
- **Time Constraints:** Can finalizing a single, long-term strategy decision be deferred long enough to allow continued testing of important assumptions without jeopardizing legal requirements and renewable investment or risking the potential for stranded investment?

The best fit solution is a transmission overlay encompassing all Midwest ISO states, premised on a distributed set of wind zones, each with varying capacity factors and distances from load.

Midwest ISO cannot currently recommend a long-term transmission development strategy employing Native Voltage, 765 kV, or Native Voltage with DC. All three plans meet study objectives. Costs and benefits vary between scenarios, but not significantly. Methodologies for analyzing performance under a variety of possible futures require continued development along with determining 'options value' for each strategy. Detailed construction design analysis is still required.

The best fit solution is a transmission overlay encompassing all Midwest ISO states, premised on a distributed set of wind zones, each with varying capacity factors and distances from load.

No consensus exists regarding the amount of renewable generation ultimately needed to comply with current and future RPS mandates. Predictions vary. Some assert a much higher level of wind generation will be required than those included in RGOS analyses while others, equally confident, claim a lower amount. Regardless of the long-term uncertainty engendered by expansion or reduction of renewable energy standards, states within the Midwest ISO system will need new transmission to meet current and near-term renewable energy requirements, to ensure reliable operation of the transmission grid, and to facilitate the generation interconnection queue process. Midwest ISO will continue to work with policy makers and industry stakeholders to determine a strategy for transmission development within the footprint.

Because of RGOS, Midwest ISO has identified the next, most immediate step to transmission investment: a set of robust Candidate Multi-Value Projects (MVPs) meeting current renewable energy mandates and the regional reliability needs of its members.