



AEP-ITC 765-kV Interstate Transmission Project

1. Executive Summary

The purpose of this white paper is to outline the challenges associated with lower Michigan (Michigan)'s existing electrical infrastructure and to propose a solution that will position Michigan to promote the economic health and welfare of the state and its citizens. One of the challenges is geographic: Michigan is a peninsula and currently its electric supply is similarly designed. It is important to the welfare of the state, its citizens and businesses that Michigan not remain an electric supply peninsula.

Michigan, like much of the U.S., has underinvested in its electrical infrastructure for many years. Results from the Michigan Public Service Commission (MPSC)'s Capacity Needs Forum and preliminary results from the MPSC's 21st Century Energy Plan study make it apparent that Michigan's future power needs will soon outstrip its current power supply and transmission infrastructure.

Currently, the MPSC is constructing an energy plan to address these future needs. Fossil generation, renewable generation, alternative technologies and energy efficiency all are being studied for the role they can play. Transmission is a critical component to the future energy puzzle, and one that must be included in the solution amalgam. A robust alternating current (AC) 765-kilovolt (kV) transmission grid will not only improve reliability and capacity in its own right, it will magnify the benefits of all other solutions – including new generation – by integrating them into a powerful regional network of resources, in which scale and capacity provide a self-healing safety net that ensures one resource can instantly compensate for the absence of another in times of need.

It is the belief of American Electric Power (AEP) and ITC Holdings, Inc. (ITC), that development of a Michigan 765-kV grid will enhance reliability, improve system efficiency and improve efficiency of generation markets. We believe 765-kV technology is a superior alternative to other transmission technologies and to only adding new generation in Michigan.

High-voltage AC transmission infrastructure is an essential platform for both economic development and reliability. It:

- Improves efficiency of competitive generation markets by relieving congestion,
- Creates a more reliable, self-healing grid,

- Mitigates generation market power, and
- Is critical to the efficient and economical operation of the entire electric system.

A strong electric transmission backbone is the critical component of infrastructure needed to support Michigan's 21st Century Energy Plan. It would solve several existing transmission issues in Michigan and at the same time provide a strong flexible platform for developing Michigan's electrical system well into the future.

2. Introduction

AEP and ITC *Transmission*, a subsidiary of ITC Holdings Corp., have signed a memorandum of understanding (MOU) to perform a technical study evaluating the feasibility of extending AEP's 765-kV transmission infrastructure through Michigan. The AEP-ITC study will explore the merit and benefits of building a 765-kV transmission network in Michigan that would link to AEP's 765-kV transmission system. The study will be shared with stakeholders, including the Michigan Public Service Commission's (MPSC) 21st Century Energy Plan team, the Midwest ISO (MISO), and the PJM Interconnection LLC (PJM).

The technical study is projected to be complete in early 2007. This white paper is being provided now to conceptually describe the benefits of a 765-kV transmission network in light of the 21st Century Energy Plan deliberations. It will first explain the history of Michigan's transmission development, followed by an examination of the general need for high-voltage transmission if Michigan's energy needs are to be met. Further, it will highlight the superiority of 765-kV over other high-voltage transmission options.

The MOU signed between AEP and ITC does not include provisions to build or operate transmission. Any future activities regarding this 765-kV concept will be determined after the completion of the technical study.

3. Historical Development of Transmission in Michigan

In the 1960s, Michigan utilities began a jointly planned 345-kV grid development that overlaid existing lower voltage transmission and facilitated coordinated operation of the Michigan generating plants. In 1969, Michigan utilities completed southern 345-kV interconnections with AEP and First Energy (then Toledo Edison). Those interconnections enabled capacity and energy trading between the Michigan Electric Coordinated Systems (MECS) and other Midwest utilities. As load in Michigan has grown and power transfers have increased, these interconnections and the adjacent systems have become increasingly congested.

This integration of Michigan's EHV grid with systems to its south permitted generation reserves to be shared among all East Central Area Reliability (ECAR) Coordination Agreement utilities. In 1966, AEP began the development of its 765-kV interstate transmission network, energizing the first line in 1969. This 765-kV network was expanded over the years and recently surpassed

2,100 miles with the June 2006 completion of the Wyoming-Jacksons Ferry project. The AEP 765-kV network remains the highest capacity transmission system in the United States.



Figure 1. AEP Eastern Transmission, Including 765-kV (Red) and 345-kV (Blue) Lines

In the 1970s, Michigan utilities determined that the most effective and economic transmission voltage overlay within Michigan should be 765-kV. Consequently, in the late 1970s, 765-kV construction was used for the Greenwood Energy Center transmission circuit, although the circuit has operated at 345-kV pending further grid development. Michigan companies made major reductions in their generation expansion plans in the late 1970s and 1980s, and focused on completing generating plant construction in progress. As a result, transmission expansion was placed on indefinite hold.

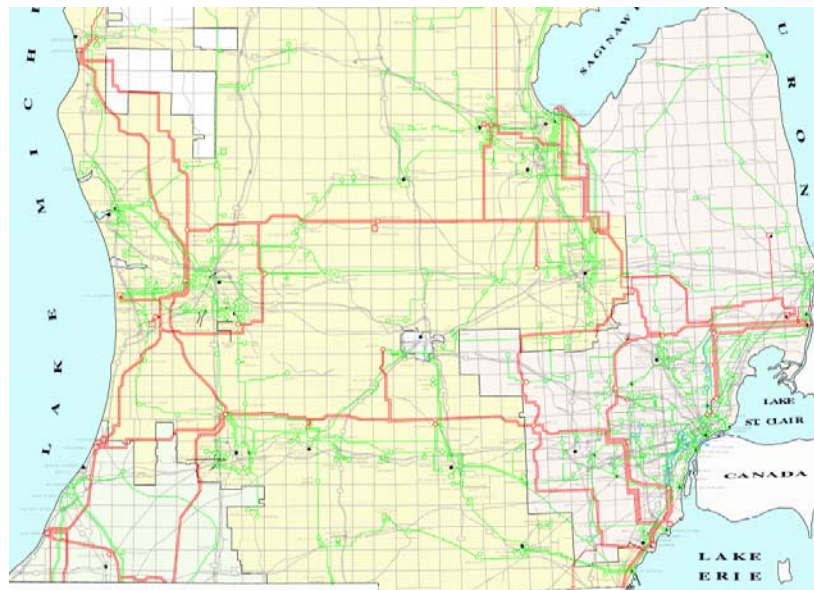


Figure 2. Lower Michigan Transmission, Including 345-kV (Red) and 138/120-kV (Green)

The MPSC's Capacity Needs Forum and preliminary findings by the 21st Century Energy Plan effort reveal that significant infrastructure investment must be made to meet Michigan's future needs. Michigan must strongly consider adoption of the world's strongest transmission technology as an integral part of its energy future.

4. The Self-Healing Nature of Transmission

A robust backbone transmission system is the key to security and reliability because a strongly integrated electrical grid is self-healing in nature. Use of 765-kV technology is inherently reliable, with an outage rate of less than 1 percent. It is even more reliable than the generators from which it draws its energy. In the case of AEP's 765-kV grid, the regional expanse – more than 2,100 miles – provides access to many generators feeding the grid. When one generator fails, a strong 765-kV infrastructure enables other widely dispersed generators to instantly be called upon to fill in the gap to meet demand.

For example, if a generating unit in Michigan experiences a sudden unplanned outage, the missing energy due to that outage is immediately supplied by the entire Eastern Interconnection via the transmission system, without any human action whatsoever. Similarly, if a natural or human-created disaster unexpectedly removes a transmission line from service, the power flowing on that line is immediately and automatically redistributed to other parallel transmission lines, again without any human action. This is an inherent benefit of a robust 765-kV grid.

In both examples, sufficient transmission capacity must exist to accommodate the resultant power flows. Because of its superior capacity, a 765-kV platform provides the greatest self-healing potential. Only the AC transmission system can automatically respond in real time. Generation, demand response, DC transmission and similar other resources generally require far more time to implement remedial action when problems occur.

The existing Michigan transmission system is not adequate for large interstate or interregional power transfers. As such, generation alone will not provide Michigan with the long term benefits that can be achieved through improvements to the transmission infrastructure through the addition of 765-kV transmission. Moreover, the existing system does not have the reliability margins necessary to protect against events such as the Northeast blackout of August 14, 2003, which left roughly 50 million U.S. and Canadian citizens without power. In fact, engineering judgment suggests that the effects of the blackout would likely have been far less reaching had the 765-kV grid been extended into Michigan. This view is supported by the fact that the propagation of the blackout to the south and west stopped at AEP's 765-kV transmission system.

5. Efficiencies and Flexibility of 765-kV

Expansion of 765-kV into Michigan would provide the flexibility to reduce the need for new generating capacity by allowing Michigan's load serving utilities to access economical power supplies outside the state. In addition, a 765-kV backbone in Michigan would reduce transmission system losses by approximately 95 MW within Michigan and 230 MW on the

interconnected network outside of Michigan, which have a combined effect of a 325 MW demand reduction. The forthcoming technical study will address this benefit in greater detail. In addition to the financial benefit of loss reductions, environmental benefits also are measurable. Less line loss means less generation is required to serve load. And less generation means fewer emissions.

The use of 765-kV would greatly increase Michigan's import capability. It is expected that new 765-kV lines into and through Michigan would increase Michigan's import capability by approximately 4,000 MW. Increased import capability would open the door to Michigan's customers benefiting from additional economic purchases of power beyond the state's borders, further enhancing Michigan's reliability as well as reducing costs. Moreover, increasing the import capability assists in minimizing the effect of being an electrical peninsula.

Throughout the evolution of the electric utility industry, diverse types of generation have developed in various regions of the country. This has led to significant regional differences in economics and fuel usage. Wholesale energy purchases can enhance any state's electricity market by enabling more economical purchases from other regions. An interstate transmission grid will facilitate such trade.

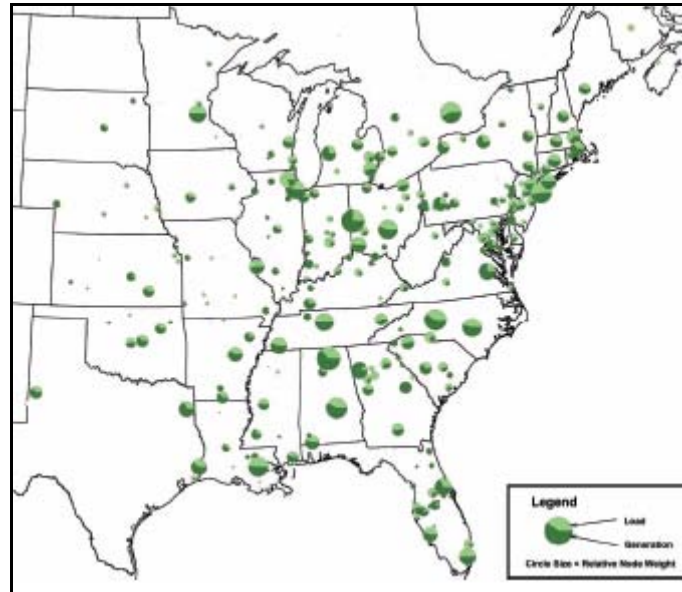
Regional Transmission Organization (RTO) scheduling procedures will always seek the lowest priced generation available and accessible via the transmission grid. The key however to minimizing the cost to consumers is the accessibility of generation. Absent a robust transmission grid, lower cost generation can be locked out and consumers locked into reliance on higher priced generation. A robust transmission grid enables a broader scope of generators to supply a given load, eliminating risk of market power for a single generator inside a load pocket. A robust transmission grid facilitates better use of both native and imported power to help reduce costs to Michigan consumers and throughout the Eastern Interconnection. A high capacity interstate 765-kV grid capable of reliable, long distance power transfers would allow Michigan to fully leverage the wholesale generation markets by providing access to the more economical sources of power supply.

6. Congestion Costs and Their Impact on Prices

Use of 765-kV transmission alleviates congestion costs by dramatically reducing the potential for congestion in favor of the free flow of power. This would better prepare Michigan in meeting its future energy needs.

Congestion on the transmission grid is a direct result of system limitations to transport energy across the grid resulting in increased energy costs. The increases are due to the need to rely on higher cost generation within a constrained area and an inability to transport lower-cost generation to a given area. If a new generation facility is constructed near a load pocket, but congestion exists on the transmission grid between the facility and the load, the new generation will not be able to reach the area to address the need. This is why new generation capacity by itself is only a partial solution and why new generation without new transmission is unlikely to address Michigan's current situation or future needs.

The map below, taken from the U.S. Department of Energy (DOE) National Transmission Grid Study, August 2006, shows the most severe congestion locations in the eastern U.S., with each individual circle indicating both load and generation capacity in a given area. The lighter green portion of each circle is the load with the darker green indicating generation capacity. Metropolitan southeastern Michigan shows a severe generation shortage compared to load. Without ability to construct new generation in the Detroit metroplex (as addressed in the next section of this white paper), transmission is the only means to alleviate this imbalance. Learning from the lessons of the East Coast, the MPSC and the 21st Century Energy Plan team are in position to protect the citizens and businesses of Michigan from enduring such hardships.



**Figure 3. Congestion pockets throughout the Eastern U.S.
DOE, *Transmission Grid Study*, 2006**

AEP and ITC feel the addition of 765-kV transmission in Michigan will help prevent such dire situations as those plaguing heavily populated eastern areas, such as those currently being experienced in both the PJM and ISO-NE regions, from occurring here.

7. Meeting Energy Needs of Urban Areas

Some metropolitan areas have environmental or other restrictions that make it difficult, if not impossible, to support the siting of new fossil-fueled generation to meet growing demands. This is especially true in non-attainment areas. Although nuclear power has been identified as a cleaner alternative to fossil fuels, siting new nuclear plants in the midst of populous areas may be politically impossible. The expansion of the current nuclear supply, then, can only be reasonably accomplished if the power can be transmitted into urban areas from a distant plant.

As a result, significant transmission import capability is required to deliver remote generation resources to these large metropolitan areas.

765-kV transmission technology can carry significantly greater quantities of power for much greater distances than lower voltage lines. Substantial economies of scale result: one 765-kV circuit can carry the power that would otherwise require six 345-kV circuits, which would necessitate a significantly wider right-of-way and greater property encumbrance, as well as increased construction costs.

Portions of right-of-way sufficient to accommodate 765-kV transmission have been acquired within the ITC and METC footprints in the past. Furthermore, because fewer circuits are needed to transport the same capacity, fewer rights-of-way will be required. Therefore, expanding Michigan's grid with 765-kV will be less disruptive to landowners and to the environment than constructing equivalent total capacity with lower voltages.

8. 765-kV – Empowering Generation, Addressing Existing Problems

Since the 1980s, cumulative electricity demand growth has been substantial. This growth has far outpaced the level of investment in transmission infrastructure. In the recent past, the nation has realized the importance of an adequate and reliable electricity supply to support the economy as well as for reasons of homeland security, as evidenced by the passage of the landmark Energy Policy Act of 2005.

Michigan has a plethora of transmission-related issues that must be addressed or repaired. The use of 765-kV technology will allow the state to address them in a manner that is cost-efficient, while allowing room for growth to accommodate future needs.

Today, an interstate transmission system also is needed to facilitate the development of and access to renewable generation resources. Many such resources must be deployed over a large region to be effective because they typically have lower power production capability. Similar to conventional fuels, renewable/green resources are often located in areas distant from the major load centers. Already, a number of wind power generators have declined to move forward in the thumb region of Michigan due to lack of transmission infrastructure and cost of new transmission needed to move their wind power to populated areas.

Eastern Michigan, especially metropolitan Detroit, suffers from insufficient transmission infrastructure to transfer generation from the western part of the state into the more densely populated portions of the state's eastern side. A 765-kV transmission system would alleviate this constraint and allow southeastern Michigan utilities to use currently existing generation resources. This would reduce the amount of new capacity that would otherwise be needed to serve those same customers. Finally, more reliable access to emergency power supplies from surrounding states will reduce the reserves needed within Michigan and facilitate economy sales driven by regional variations in weather and/or peak demand.

The establishment of a 765-kV grid in Michigan would also eliminate several existing problems associated with lower voltage systems. It would reduce the possibility of experiencing low transmission voltages throughout the state, particularly within the METC footprint. It would further reduce the possibility of voltage collapse and/or cascading within the "mitt" region of

Michigan for a critical tower outage between Saginaw Valley generation and the ITC system. And it would eliminate the issue of low voltages within the First Energy system requiring voltage support via reactive supply from Michigan companies.

An AC 765-kV system can be tapped at strategic locations within Michigan, Indiana, and Ohio, providing “off-ramps” to enhance local reliability as well as “on-ramps” to accommodate new generation. This provides significant improvements in regional and interregional transfer capability by moving power up onto the interstate superhighway (the I-765) and down onto the lower voltage local transmission.

This 765-kV expansion project has the ability to provide the comprehensive transmission reinforcement necessary for Michigan over the next 20 to 30 years. It addresses the need for transmission upgrades in the southeastern region of Michigan, providing a platform for further reinforcement of transmission both in the northern region of the Lower Peninsula and in the Upper Peninsula. It provides that same platform for increasing Michigan-Ontario interface capacity without overburdening other portions of the ITC grid.

In addition to its superiority over lower voltage AC transmission, 765-kV is also a more effective and flexible choice than HVDC transmission. HVDC does not lend itself to future intermediate connections (e.g., no “off ramps” or “on ramps”). HVDC is best suited for point-to-point transfer of power over long distances or where the systems being integrated do not operate in synchronism. To establish an intermediate station, either for system reliability or for economic development, is cost prohibitive and in many cases such intermediate connections are technically impossible. Depending on the level of capacity required and the corresponding magnitude of AC/DC station conversion requirements, the cost ratio can be as high as three to four times the cost of a comparable AC station. Also, the complexity of AC/DC stations can adversely affect station and system reliability.

9. 765-kV – A Practical Solution

The conceptual long-range plan would require construction of new 765-kV lines not only in Michigan, but also in Ohio and possibly Indiana. All three states are represented in both the Organization of PJM States, Inc. (OPSI) and Organization of MISO States (OMS) regional state forums. Consequently, it is reasonable to expect that a regional plan approved by the appropriate RTOs would receive due siting consideration by the affected state siting bodies.

In Ohio, for example, the Ohio Power Siting Board is the statewide siting authority and issues the certificates of environmental compatibility and public need required prior to constructing this kind of transmission line. Among other things, the Ohio Power Siting Board considers environmental impacts and whether a facility is consistent with regional plans for expansion of the electric grid. Issuance of a statewide siting certificate in Ohio precludes the raising of questions regarding the need for the facility by property owners along the proposed route in an eminent domain proceeding. A statewide siting certificate also creates an exemption from local zoning and regulation concerning the location and construction of a transmission line. The Ohio

process can take approximately one year after the formal application is filed, although recent experience has been closer to eight months for approval of electric transmission line projects.

10. 765-kV – A 21st Century Vision

Because it would be integrated with the AEP grid, a 765-kV expansion in Michigan would provide a significant capacity expansion, avoiding a need for excessive new line redundancy, and thus avoiding additional costs. Furthermore, customers in more densely populated southeastern portions of the state will gain greater access to existing generation in the western part of the state when transmission constraints are removed.

This plan would leverage the strong backbone transmission system in AEP and effectively utilize the existing ITC transmission system to provide reliable and low-cost electricity to Michigan. The intent of this plan is to meet long-term future transmission needs in the most cost-effective and efficient manner, with the least environmental impact. This is accomplished best by the addition of a 765-kV transmission overlay.

The conceptual long range plan currently under study by AEP and ITC would include extending the 765-kV transmission system ultimately from three locations within AEP, including the Donald C. Cook nuclear generating station in Bridgman, Michigan (See Figure 4). The system would be connected to key existing stations as well as strategic new stations to create a reliable, secure, and high-capacity integrated system. The fully developed project, as proposed, is expected to increase import capability into Michigan by approximately 4,000 MW. The forthcoming technical study will address this increase in import capability in greater detail.

While the plan as described presents the fully developed vision, its implementation would be staged in phases with resulting immediate incremental benefits. The timing of each phase would be designed to meet existing and developing reliability and power import needs. Integration of new generation, coordination of regulatory approvals, right-of-way acquisition, construction schedules, and required outages of existing facilities during construction would also be factors. It is expected that the project will be included in the Midwest ISO Transmission Expansion Plan (MTEP) process, and also reviewed by PJM.

AEP and ITC are uniquely positioned to move forward from this conceptual plan to realization. This 765-kV interstate transmission project would expand what has proven to be the most flexible, reliable, secure, and high-capacity electric system in the United States. This partnership between AEP and ITC demonstrates the commitment needed to enhance the electric system within the State of Michigan to meet the needs of the 21st Century.

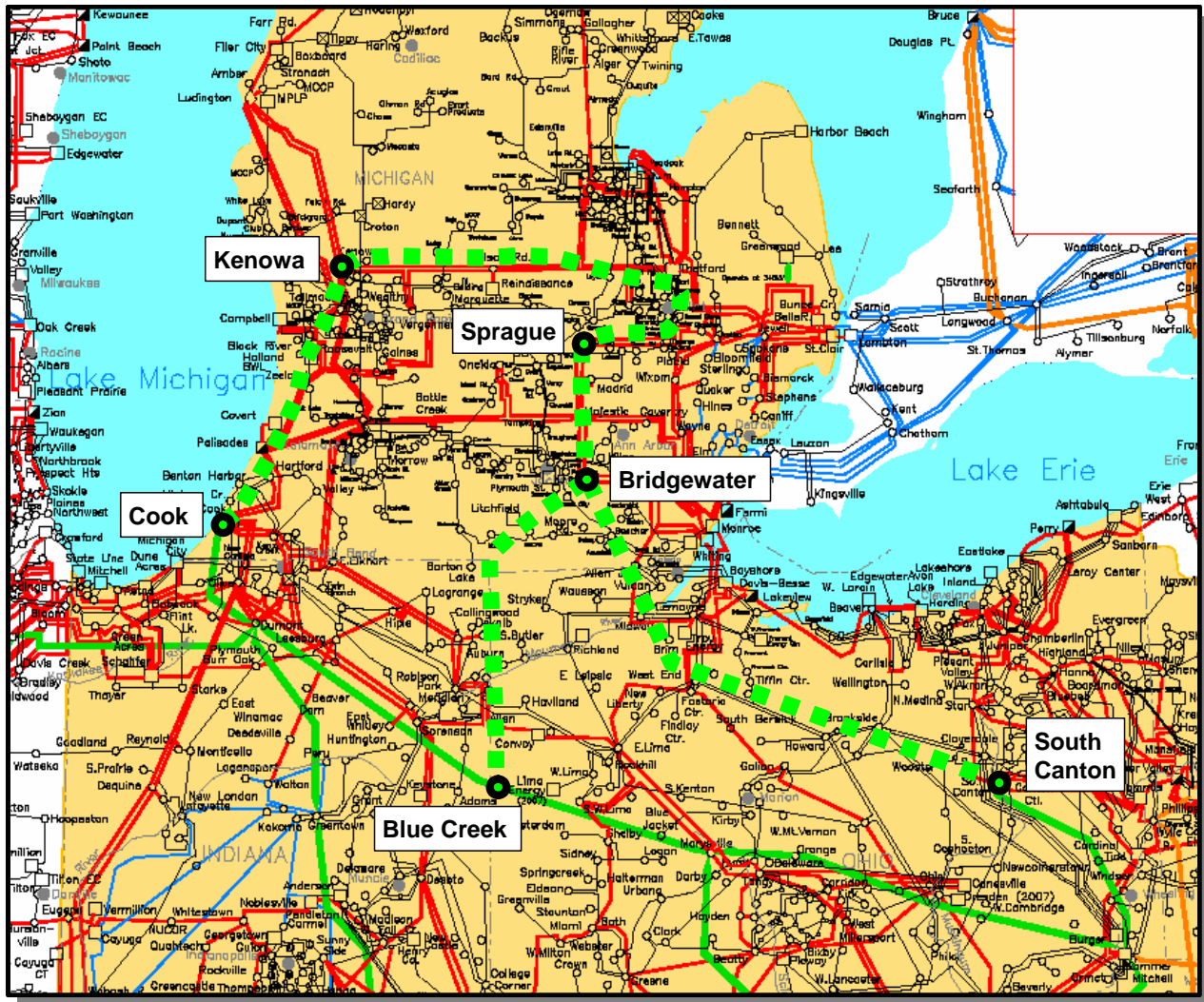


Figure 4. Map of the Conceptual AEP-ITC 765-kV Interstate Transmission Project

The right-of-way routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected.