Appendix F: Transmission in ROW Case Studies

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Contents

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CASE STUDY: Champlain Hudson Power Express

Project Summary

The Champlain Hudson Power Express (CHPE) is a high-voltage direct current (HVDC) transmission line that will run 339 miles from the U.S.-Canada border to Queens, New York. Construction of CHPE began in 2022, following over a decade of planning, permitting, and stakeholder engagement. Upon completion (estimated spring 2026), CHPE will help New York State meet its energy goals by transmitting 1,250 MW of renewable energy. This energy will primarily originate from 60 hydroelectric generating stations owned by the Canadian utility Hydro-Québec and will be transmitted through buried HVDC lines. Once the energy is transmitted to New York City, it will be converted to alternating current power for local distribution. Along the route, 60 percent of the cables will run underwater in the Hudson River and Lake Champlain. The remaining cables will be buried within highway and railroad right-of-way.

Project Motivation

In 2008, Transmission Developers Inc. (TDI) began exploring opportunities for new transmission projects and identified New York State as a high-need area. New York City represents one-third of the state's electricity demand yet faces transmission bottlenecks and constraints in the electricity grid that pose a barrier to accessing energy from north of the city.[1] There are significant sources of low-cost hydroelectric power north of the city. In addition, state level environmental policies provide incentives for energy sources such as hydroelectric that do not create air pollution that harms human health..[2]

TDI and the New York State Department of Public Service (NYSDPS) conducted independent modeling to estimate the project's benefits, which they expect to include:

- Saving New York homes and businesses $17.3 billion in electricity costs over 30 years.[3]
- Generating $1.4 billion in funding for 73 municipalities and 59 school districts through property taxes.[4]
- Creating more than 1,400 jobs across New York State during project construction, which are anticipated to generate more than $400 million in wages and benefits.[5]

[1] New York State Energy Research and Development Authority. "Tier 4 – New York City Renewable Energy." Accessed on December 10, 2024. https://www.nyserda.ny.gov/All-Programs/Large-Scale-Renewables/Tier-Four.
[2] New York Independent System Operator. "2023 Power Trends: A Balanced Approach to a Clean and Reliable Grid." Report, August 2023. https://www.nyiso.com/documents/20142/2223020/2023-Power-Trends.pdf/7f7111e6-8883-7b10-f313-d11418f12fbf.
[3] NYSDPS. "Champlain Hudson Power Express Article VII (10-T-0139) NYDPS Staff Estimates of Ratepayer Economic Benefit and Air Emission Reduction Benefits." Summary for Settlement Parties Meeting, January 2011. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={4F9CC9C0-3C45-4385-B3C7-4337AD040B8B}.
[4] PA Consulting Group. "Champlain Hudson Power Express: Analysis of Economic, Environmental, Resiliency, and Reliability Benefits to the State of New York." Report prepared for TDI CHPE, May 2021. https://chpexpress.com/wp-content/uploads/2021/05/PA-Consulting-Tier-4-REC-Bid-Report_05-10-2021.pdf.
[5] PA Consulting Group. "Champlain Hudson Power Express: Analysis of Economic, Environmental, Resiliency, and Reliability Benefits to the State of New York."

- Reducing annual emissions of carbon dioxide by approximately 1.5 million tons, sulfur dioxide by 751 tons, and nitrogen oxides by 641 tons.[6]

Project Planning and Implementation

Early in the project, TDI planned to locate as much of the line underwater as possible to minimize conflicts on land. However, concerns about sensitive aquatic environments during the environmental review process led to locating more of the proposed line onshore, largely in transportation rights-of-way. This approach required detailed planning to navigate the landscape of existing utilities and infrastructure, particularly in areas with dense development.

Securing regulatory approval and managing the right-of-way for CHPE involved thorough assessments to determine the best routes, prioritization of existing infrastructure, and minimizing environmental impacts. Stakeholder engagement also played a critical role in the project's success. As a complex, international project, CHPE required permits from multiple state and federal agencies: the New York State Public Service Commission (NYSPSC), the U.S. Department of Energy (DOE), the U.S. Army Corps of Engineers (USACE), and the New York State Department of Transportation (NYSDOT). While TDI started planning the project in the 2000s, the company did not begin permitting with NYPSC until 2010, with their Article VII permits completed in 2013. NYSDOT was an active party in settlement conferences for the Article VII Certificate of Environmental Compatibility and Public Need, but additional in-depth discussions with NYSDOT regarding right-of-way began in 2019. Throughout, TDI recognized the importance of establishing relationships with state and federal agencies, local communities, and environmental groups through frequent communication.

For railroad rights-of-way, additional coordination with railways was required to ensure that construction activities did not disrupt existing services and adhered to safety and operational standards. TDI hired an electrical consultant recommended by the railways to perform a study to confirm that their transmission line would not have any impacts to the railroad switching and communications systems. Then, they leveraged rail experts on staff with their Owner's Engineer to guide the design process.

Permit Application to NYSPSC

CHPE required a Certificate of Environmental Compatibility and Public Need from NYSPSC under Article VII of the New York State Public Service Law. TDI filed their original application with NYSPSC on March 30, 2010, which included a description of the proposed route, a statement explaining the need for the transmission line, a summary of potential environmental impacts, a description of reasonable alternative routes, and a justification for the selected route.

NYSPSC held five public statement hearings in October and November 2010 along the proposed CHPE route to allow the public and stakeholders to present their formal comments and to allow the public to ask informal questions of PSC and TDI representatives. In addition, CHPE engaged in over fifty confidential settlement conferences between November 2010 and February 2012 with the organizations

[6] NYSDPS. "Rebuttal Testimony of NYSDPS Staff Members Leka Gjonaj and David Wheat, Regarding the CHPE Project. Submitted on Behalf of NYSDPS to NYSPSC. Case 10-T-0139." Written transcript of testimony, June 2012. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={927554D1-3443-4557-86FE-AEF33B3C6A35}.

that filed for party status,[7] including state agencies, municipalities along the proposed routes, and conservation advocacy groups. Throughout the process, accordance with the State Environmental Quality Review Act (SEQR), TDI provided intervenor funding to support active parties in "contribut[ing] to a complete record leading to an informed decision as to the appropriateness of the facility and route, and facilitat[ing] broad participation."[8] For example, intervenor funding supported an independent technical review of CHPE's application initiated by two environmental organizations.

Early in the process, NYSDOT expressed its concerns about potential project siting issues on the Tappan Zee Bridge and the Crown Point Bridge, offered several considerations for use of railroad right-of-way, and suggested alternative routes for consideration in areas of concern.[9] The settlement conferences addressed these issues, as NYSDOT noted in its letter of support: "With the completion of the Joint Proposal and due to its participation in the settlement negotiations, NYSDOT is satisfied that the project will minimize any adverse impacts on transportation facilities under its jurisdiction considering the state of available technology, the various alternatives and other considerations."[10]

Overall, as result of the settlement conferences and public comments, TDI modified the location of its converter station and made changes to the proposed route to avoid environmentally sensitive areas, among other updates. These were reflected in the February 2012 Joint Proposal TDI submitted. Rather than locating the converter station in a residential area of Yonkers, where many residents and city leaders expressed their opposition, TDI worked with Con Edison to use a portion of their land in an industrial area of Astoria, Queens, for the converter station. Instead of exiting Lake Champlain at Whitehall, the southern tip of the lake, the Joint Proposal had the cable exit further north at Dresden. This change bypasses the southern narrows of Lake Champlain, where the transmission line could impact endangered species and be more exposed to anchor strikes. From there, TDI proposed to build underground along New York State Route 22 to Whitehall. From Whitehall, it would follow the original route along CSX and CP railroad right-of-way to Coeymans. Instead of entering the Hudson River at Coeymans, it would remain in CSX right-of-way until Catskill, where it would enter the Hudson. This change avoids more of the upper Hudson River, where the riverbed contains a higher concentration of PCBs from former industrial activities that could be released into the water during construction. Finally, the Joint Proposal called for the transmission line to exit the Hudson again near Stony Point and run along CSX railroad right-of-way approximately 8 miles to Clarkston. This bypasses Haverstraw Bay, the widest part of the Hudson, with many shallow areas home to endangered and threatened species. In addition to siting changes, the Joint Proposal included a certificate condition that TDI should establish a

[7] Party status, under Article VII, allows the public to take on an active role in the evidentiary process. See NYPSC's guide to the Article VII process (p. 13) for additional details: https://dps.ny.gov/system/files/documents/2024/06/article-vii-certification-review-process-guide.pdf.

[8] NYSDPS, "16 CRR-NY 85-2.4" Rules and Regulations of the PSC. Accessed on December 30, 2024. https://dps.ny.gov/rules-and-regulations-psc-16-nycrr.

[9] NYSDOT. "NYSDOT Submits its Comments." Letter, November 2010. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={53597774-91F6-4563-801D-F66C557F8F9E}

[10] NYSDOT. "NYSDOT Submit Letter in Support of Application." Letter, August 2012. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={A21C913C-9AD2-43D3-ACAC-63A418E06B96}

$117 million environmental trust fund for environmental protection programs, broadly in response to concerns from active parties and the public.

NYSPSC held six more public statement hearings in April 2012 to allow the public opportunities to comment on the Joint Proposal, including in areas near the revised proposed route. The application contained an updated Environmental Impact Statement based on the new route. During this round of public statement hearings, some participants expressed support for the new alignment, while others reiterated ongoing concerns. These concerns included questions about the necessity of the project, potential adverse impacts on the environment and property values, and the decision to source power from Canada instead of local providers. In response to comments from open space and recreation groups, TDI agreed to widen the project Deviation Zone for a section of the project in Washington County along railroad right-of-way to allow for possible accommodation of recreational trail use. TDI further committed to consider trail accommodation at the time of final engineering and construction plan development.

After a thorough review of the evidence presented in public statement hearings, evidentiary hearings, and in the Joint Proposal, NYSPSC issued a Certificate of Environmental Compatibility and Public Need (CECPN) on April 18, 2013, authorizing TDI to construct and operate the CHPE project, subject to specific conditions to mitigate environmental and community impacts. In particular, the conditions required CHPE to develop an Environmental Management and Construction Plan for each of twenty-three segments to prevent and mitigate impacts to sensitive habitat, endangered species, air and water quality, and surrounding communities. The NYPSC issued CHPE a State Section 401 Water Quality Certification in conjunction with the CECPN. TDI has continued to work with the NYSPSC to submit additional minor route changes and modifications as needed.

Presidential permit application to DOE

Because of the cross-border nature of the project, CHPE required a Presidential permit from the DOE Office of Electricity Delivery and Energy Reliability. On January 25, 2010, TDI submitted their application, which included detailed information about the project, such as the route, technical specifications, environmental impacts, and the purpose of the transmission line.

DOE conducted an environmental review under the National Environmental Policy Act (NEPA) to assess potential impacts and project alternatives. In July 2010, DOE opened a 45-day scoping period and held seven public scoping meetings to identify potential environmental impacts to be covered in the Environmental Impact Statement (EIS). After TDI submitted a revised application for a Presidential Permit, reflecting changes made in the Joint Proposal to NYSPSC, DOE opened a second public scoping comment period in April 2012.

DOE released a Draft EIS on November 1, 2013. DOE opened a comment period on the Draft EIS from November 1, 2013, to January 15, 2014, and held four public hearings to allow the public to comment on the Draft EIS in November 2013. Environmental concerns that arose during the environmental process include impacts on protected and sensitive species, water quality in Lake Champlain and the Hudson River, cultural and historic resources, human health and safety, air quality, scenery, navigation in the Hudson River, and road traffic. Based on public comments, DOE revised the Draft EIS to include additional discussion of: impacts for commercial and recreational vessels in the Hudson, updated minimum burial depths in aquatic portions of the proposed CHPE route, impacts of concrete mats on

aquatic life and water resources, impacts on wetlands (and which wetlands would be affected), impacts on northern long-eared bat and red knot species, and incorporating language aligning with NYSPSC certificate conditions on minimizing water supply impacts. DOE published a Final EIS on August 8, 2014. DOE Released a Record of Decision approving the Presidential permit on September 24, 2014.

TDI continued its engagement with stakeholders after the release of Final EIS. In 2020, TDI notified DOE and NYSPSC of proposed changes to the route after the publication of the Final EIS. The changes rerouted an additional 4.9 miles out of Lake Champlain, shifted 10 miles from railroad right-of-way to road right-of-way due to environmental impacts, construction, and public opposition, and bypassed downtown Schenectady and two railyards due to ongoing construction and expansion activities.

USACE Permit

CHPE required a permit from USACE due to its potential impacts on the Hudson River and Lake Champlain, both of which are navigable waterways regulated by USACE. TDI submitted an initial application in 2010, with supplemental information provided in February 2012 and July 2013. USACE reviewed the application under Section 404 of the Clean Water Act, which governs the discharge of dredged or fill material into U.S. waters, and Section 10 of the Rivers and Harbors Act, which regulates activities that could affect navigable waters. The review process assessed potential impacts on aquatic resources, water quality, and navigation. Alongside this, USACE issued a public notice which allowed stakeholders to provide comment on the proposed project. Upon completing its review in April 2015, the USACE issued the necessary permits, including specific conditions that TDI had to comply with during construction and operation. These conditions involve measures to minimize impacts on aquatic resources and ensure the project adheres to environmental standards, including requirements for mitigation plans, Environmental Management and Construction Plans, and construction timing and techniques.

NYSDOT Permitstech

TDI sought the necessary permits from NYSDOT for the portions of the project route located on state highways. TDI consulted the NYSDOT headquarters office, and headquarters communicated expectations and requirements for occupying NYSDOT right-of-way. TDI then submitted permit applications directly to NYSDOT regional offices, as is standard for NYSDOT permitting. For permit applications, NYSDOT typically expects a full construction plan for the entire project before they engage in detailed review, but TDI was unable to provide this because it has an iterative design-build process. TDI used design-build because of the timeline for the project and its funding structure; CHPE's owners incrementally funded the development efforts. This approach is different from investor-owned utility development projects, which are generally fully funded and designed before the permitting process. NYSDOT and TDI worked together to accommodate this within NYSDOT's permitting processes.

Specifically, for the 14-mile northern portion of the route within NYSDOT Region 1, TDI conducted an extensive design consultation that culminated in a work permit request submission in July 2022. CHPE subsequently was issued a Highway Work Permit (PERM 32) in February 2023. For the 8-mile segment through NYSDOT Region 8, the Highway Work Permit was issued in December 2023.

By the time TDI pursued NYSDOT permits, CHPE had already been granted Article VII permits by NYSPSC, which specified a route for the transmission line. While NYSDOT representatives were active parties in the Article VII process, the regional teams at NYSDOT had less latitude to require a specific alignment in

the right-of-way. In some cases, NYSDOT permitting occurred several years after the initial Article VII process and involved different individuals at NYSDOT due to staff turnover. Throughout the NYSDOT permitting process, coordination with all existing utilities within the NYSDOT rights-of-way, infrastructure owners, and contiguous property owners was necessary to avoid conflicts and ensure smooth integration into existing rights-of-way. TDI conducted significant outreach to right-of-way stakeholders and held information sessions in partnership with NYSDOT.

Final Route

The final route will originate at the U.S.-Canada border and run 97 miles south buried in Lake Champlain. Between Lake Champlain and the Hudson River, it will run along railroad right-of-way, owned by CSX Transportation and Canadian Pacific, and NYSDOT and local municipal rights-of-way for 137 miles. The line will be buried in the Hudson River for a total of 88 miles, bypassing both the sensitive habitat of Haverstraw Bay and space-constrained CSX right-of-way via 8 miles along U.S. Route 9W in Rockland County.

In New York City, the last 6.3 miles of the route will proceed from the Hudson River into the Harlem River and make landfall into the NYSDOT-owned Harlem River Yards before crossing into Randall's Island Park. It will connect at the Con Edison Astoria Complex via a new converter station facility that will convert the transported power from DC to AC.

Construction

TDI modified techniques for constructing the conduit according to the unique characteristics of each region of New York the HVDC line will cross through. For the underwater sections, including those in Lake Champlain and in the Hudson River, the project will be constructed using cable lay and burial technologies including simultaneous lay and burial using jet plows and post lay burial via a remedial burial tool. For land to water transitions, horizontal directional drilling (HDD) will be employed to minimize shoreline impacts. In contrast, the cable for the underground sections in New York will be laid in duct banks installed in trenches, though they will employ HDD technology in areas where minimizing surface disruption is a key priority. Construction commenced at the end of 2022 and will continue through 2025.

Outcomes

The CHPE project is expected to be fully operational in spring of 2026, delivering 1,250 MW of low-cost renewable power directly into the New York Metro area and offering a reduction of 3.9 million metric tons of CO_2 emissions in its first full year of operation.[11]

As a part of the CHPE project, Hydro-Québec and TDI developed a Green Economy Fund (GEF) with $40 million to support job training for New York State residents. The fund focuses on providing resources to disadvantaged communities, creating pathways to good paying jobs and supporting transitioning fossil fuel workers. The GEF's direction is informed by an Advisory Board made up of experienced local community members, experts in workforce development, and environmental justice leaders across New York State. The decision making is finalized by a Board of Trustees from TDI and Hydro-Québec. In its first funding round, the GEF awarded $750,000 to organizations including Pathways to Apprenticeship,

[11] PA Consulting Group. "Champlain Hudson Power Express: Analysis of Economic, Environmental, Resiliency, and Reliability Benefits to the State of New York."

Stacks + Joules, Nontraditional Employment for Women, and the NYC District Council of Carpenters Apprenticeship Journeyman Retraining Educational & Industry Fund (AJREIF).[12]

Challenges and Solutions

Cable installation required different methods in a state with a diverse physical landscape. The construction of the transmission line necessitated varying installation techniques to accommodate unique terrain along the project's route.

- **TDI used two different construction techniques in different areas of the state.** TDI largely used traditional open trench construction in some locations in northern sections of the route or where conditions required. Horizontal directional drilling, an alternative technique that involves the cable being drilled deep beneath the surface and results in less disruption from construction, was used in environmentally sensitive areas and in densely settled areas primarily in the southern part of the route. The NYSDOT regions involved are working together to uniformly apply their requirements to the ongoing construction to preserve the integrity of the right-of-way as the project is being built.

Existing infrastructure within highway and railroad right-of-way created significant obstacles during the siting and permitting process. The existing infrastructure within highway and railroad right-of-way posed challenges during both the siting and permitting process for CHPE. The dense concentration of utility crossings, fiber optic lines, and other infrastructure elements complicated the design and implementation of the project. This was exacerbated by the need to coordinate with a wide range of stakeholders, including other utilities and commercial, industrial, and residential landowners. From a design perspective, avoiding existing infrastructure in the right-of-way is difficult, and securing agreements from the owners of this infrastructure adds another layer of complexity. There is a growing need to accommodate future infrastructure projects as well.

Physical limitations of the HVDC cable restricted the modifications that could be made to TDI's original design package. The size and bend radius of the cables chosen by TDI created issues when re-aligning the route along areas with narrower roadways and existing utilities. When NYSPSC approvals were granted, the ability to change the design of the route was constrained. However, NYSDOT was not fully aware of the exact dimensions of the approved corridor, which added complexity to the planning and coordination process. Bringing all the approving stakeholders together based on CHPE'S schedule to understand the uniqueness of its physical limitations in comparison to existing water or fiber optic development projects within the right-of-way would have made the process more straightforward. One specific challenge was along the Route 22 corridor, where earlier coordination and more detailed planning would have benefited all parties.

- **Flexibility enabled effective responses to diverse stakeholder needs and regulatory landscapes.** The ability to adapt plans and designs based on physical constraints, regulatory requirements, and stakeholder priorities is vital for the success of any large-scale infrastructure project. NYSDOT and TDI found that flexibility was necessary to address the unique challenges presented by the CHPE project, such as the physical limitations of the HVDC cables and the need to minimize impact on existing infrastructure. Being adaptable ensures that the project can

[12] TDI CHPE. "Green Economy Fund Awardees." Accessed December 20, 2024. https://chpexpress.com/green-economy-fund-awardees/.

meet the needs of all parties involved while staying on track. NYSDOT noted around 270 changes to the horizontal and vertical alignments as a result of discussions with TDI.

TDI's lack of name recognition along the corridor proved to be a challenge during public engagement. Unlike traditional utilities, which are widely recognized for their role in delivering electricity directly to households, TDI is a third-party developer that does not provide direct services to the public or manage customer relationships. As a result, TDI faced challenges in gaining public trust and establishing a presence in the stakeholder communities.

- **Early stakeholder involvement helped TDI improve familiarity.** Involving all relevant stakeholders early in the planning process is essential to prevent miscommunication, misaligned priorities, and project delays. NYSDOT and TDI learned that early engagement with stakeholders, including landowners, local governments, and other interested parties helped identify potential issues sooner and allowed for more effective solutions. This proactive approach could have fostered collaboration and minimized conflicts later in the project. Over the course of the project development, TDI held over 300 public meetings to communicate project benefits, address community concerns, and ensure transparency. In addition, TDI worked closely with local elected and community leaders to ensure local support despite an Article VII permit process that did not require, in most instances, local approvals. By involving communities, local and state elected officials, and other key stakeholders in the planning process and responding to feedback, the CHPE team was able to build trust and garner support from community organizations, labor unions, and environmental groups alike. This support has carried the project through construction.

The alignment and design of the whole project was not prepared at the same time. Throughout the planning years, agreements between NYSDOT and TDI on the alignment of CHPE were managed through smaller design packages. Each design package covered different terrain conditions, municipal challenges (e.g., traffic volume, business access from NYSDOT right-of-way, and underground utilities), and property types. As designs were refined, they required significant modifications, including changes in construction procedure. This piecemeal approach to alignment and design presented a significant challenge for both TDI and NYSDOT, as it lengthened the overall review time and prevented NYSDOT from fully understanding the broader scope of the project. NYSDOT's considerable history with investor-owned utility projects faced institutional challenges when dealing with a privately owned developer whose efforts and processes were necessarily different based on funding and staffing.

The limited coordination between state and federal agencies slowed down progress. Coordination between the various state and federal agencies involved in the project also proved to be a significant challenge, impacting both the efficiency and effectiveness of planning and approval processes. On the federal level, agencies including the USACE, National Oceanic and Atmospheric Administration, and Fish and Wildlife Service, were involved. The limited coordination between these agencies led to duplication of work for the TDI team. For example, separate studies were conducted on endangered species to meet state and federal requirements but with different results. Coordinating these studies from the outset could have reduced costs and delays by avoiding redundancy.

- **Integrating federal and state permitting processes can save time and money.** Performing coordinated studies for required documents, such as Environmental Impact Statements or

endangered species reports, would have avoided redundant efforts and ensured that the highest standards were met. By integrating federal and state requirements, agencies and TDI could both have saved time and resources while producing more consistent and comprehensive reports. This coordination is essential for reducing delays and ensuring that regulatory requirements are met efficiently.

Misalignment of priorities and communication between NYSDOT and TDI led to delays, inefficiencies, increased complexity, and higher costs, impacting overall execution of the CHPE project. At times, NYSDOT's and TDI's priorities as an organization were misaligned, which made communication challenging. This misalignment was particularly evident when discussing the burial of HVDC cables within the right-of-way, which is an unusual and complex request for many of the stakeholders involved. NYSDOT requested that CHPE move the cable within the right-of-way but outside the pavement to minimize impact on roadway infrastructure. However, due to the physical constraints of the cable, particularly the limited bend radius, CHPE was unable to make these adjustments in every location that NYSDOT requested. This challenge was compounded by the nature of the cable technology itself, which is different from other types of underground installations. This cable, which is delivered on spools in short lengths, required the installation of underground splice boxes much more frequently than typical transmission projects. These splice boxes, which are the size of shipping containers, presented additional difficulties in terms of placement within the right-of-way. As a result of the final route, the project required encroachment onto private property to avoid both roadways and existing utilities while adhering to these best practices for utility placement.

- **Improving processes for maintaining institutional memory can help avoid misalignments.** While TDI and NYSDOT had been in contact since 2010, some conversations and decisions made by the representatives from the organizations were not well known to their colleagues years later when more in-depth right-of-way conversations started in earnest. Other times, staff turnover would create confusion about prior agreements. Organizational silos for both NYSDOT and TDI – between headquarters and regional teams at NYSDOT and between TDI and its contractor completing the construction – exacerbated this. Additional, well-circulated documentation of prior communication between TDI and NYSDOT could have averted misunderstandings due to organizational silos and staff turnover.

Intra-state coordination was essential to ensure the uniformity of construction techniques and consistent regulatory approaches. Coordination was challenging within the state, particularly between NYSDOT's different regions. New York State is divided into several regions for administrative and planning purposes. Regions 1 and 8 worked together in the construction of CHPE. Region 1 covers the urban Capital District around Albany in the eastern part of the state, and Region 8 covers the rural and suburban Hudson Valley just north of New York City. Ensuring that Regions 1 and 8 were aligned in their responses and policies required significant effort. Because Region 1 was further ahead in the process, Region 8 was included in meetings to hear how Region 1 handled issues based on design. This ongoing communication was crucial to maintaining a consistent approach and avoiding conflicting guidance.

- **Establishing a centralized body for meetings and information sharing improved coordination and communication**. NYSDOT recognized the importance of centralized coordination and communication in managing complex projects like CHPE. Establishing a central coordinating

body that holds regular meetings and facilitated information sharing among all involved agencies and stakeholders would have streamlined communication and decision-making. This approach would have been crucial for aligning efforts, reducing misunderstandings, and ensuring that all parties were working toward common goals.

Right-of-way responsibilities differed for each stakeholder. For those managing the right-of-way, such as railways and state DOTs, their primary focus is safety. There is little incentive to expend extra resources to proactively accommodate infrastructure like HVDC cables within their domain. State DOTs' responsibilities do not typically involve supporting large-scale transmission projects, even if another state agency has permitted them. As a result, the processes and structures currently in place are not well-suited to accommodate projects of CHPE's magnitude.

- **Establishing liaisons who have utility right-of-way accommodation and coordination duties as a major part of their work role can help bridge the gap between the transportation and utility domains.** As demand for transportation right-of-way space increases, it could benefit state DOTs to designate personnel who have the authority and bandwidth necessary to work with their utility or developer counterparts and vice versa. Robust engagement by state DOTs early in the process, in particular, would be useful for more smoothly accommodating projects like CHPE in the future. The cost for such liaisons' time could be paid by the developer, prior to or in addition to the state DOT's standard highway permit process.

There can be a shortage of qualified individuals available to help navigate the complex requirements of working within the railroad right-of-way. The lack of qualified railroad flaggers available for this project presents a significant challenge during the ongoing construction phase within the railroad right-of-way. Railways have their own operations to run and must ensure that construction activities do not impact their business. A shortage of flaggers further complicates the construction process, as TDI has to ensure that their work does not interfere with railroad operations while also managing the limited availability of these critical personnel.

- **Expanding the workforce of railroad flaggers can help ensure smooth construction activities without disrupting railroad operations:** To address the shortage of qualified individuals to navigate the complex requirements of working within the railroad right-of-way, it is crucial for railways to train and hire more railroad flaggers and explore alternative sourcing options for these critical personnel to help fill variable or short-term flagging demands associated with a project like CHPE. This could involve collaborating with staffing agencies that specialize in transportation and infrastructure to quickly identify and recruit qualified flaggers.

Lessons Learned

Looking proactively and systematically at opportunities to integrate transportation and utility planning and construction can help advance projects that serve the public. 23 CFR Part 645 states that "it is in the public interest for utility facilities to be accommodated on the right-of-way of a Federal-aid or direct Federal highway project when such use and occupancy of the highway right-of-way do not adversely affect highway or traffic safety…"[13] Looking wholistically at the set of current or likely utility accommodation requests can help transportation agencies and utilities consider opportunities for

[13] 23 CFR Part 645. https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-645.

maximizing efficiency and minimizing roadway disruption. These opportunities can include joint use of trenches or conduits for multiple utility installations and strategic siting and timing of utility installations and roadway construction or maintenance.

Early integration of state design requirements is essential for baseline project development. In the planning stages of a project, it is vital to incorporate relevant design requirements from right-of-way owners such as the state DOT as early as possible. By doing so, potential challenges can be identified and addressed proactively. Early integration of these requirements facilitates better coordination among all parties involved, ultimately leading to smoother project execution and minimizing the risk of delays or conflicts related to utility accommodation and future developments.

Detailed documentation of plans throughout the project's development ensures that everyone stays informed and up to date. Providing thorough and detailed information to all stakeholders throughout the project is critical for maintaining transparency and accountability. In the CHPE process, detailed planning and documentation would have helped NYSDOT and TDI ensure that everyone involved had a clear understanding of the project's scope, timeline, and objectives. This level of detail is important for managing expectations and reducing the likelihood of costly revisions or delays.

Enhancing collaboration from the outset can streamline decision-making and improve project outcomes. Fostering improved communication and finding common ground amongst state agencies responsible for implementation and regulation is essential. Establishing regular meetings and updates can enhance collaboration, ensuring that both organizations remain aligned on project requirements and objectives. A proactive approach can help facilitate a smoother decision-making process and minimize misunderstandings, ultimately contributing to the successful execution of the project.

Establishing a collaborative framework is needed to address right-of-way responsibilities and accommodate HVDC cables effectively. To address the differing right-of-way responsibilities among stakeholders, it is crucial to establish a collaborative framework that encourages creative thinking and flexibility in accommodating infrastructure like HVDC cables. This could involve creating joint working groups that include representatives from railroad operators, state agencies, and infrastructure developers to facilitate open dialogue and share best practices. By aligning safety concerns with the needs of large-scale transmission projects, stakeholders can develop tailored solutions that integrate HVDC cables into existing right-of-way frameworks while ensuring compliance with safety regulations.

Conclusion

The Champlain Hudson Power Express project highlights the critical importance of proactive stakeholder engagement and public outreach. Navigating the complexities of existing infrastructure, and the varying responsibilities of stakeholders in rights-of-way necessitates a collaborative framework to streamline processes and ensure effective integration of HVDC cables. Enhanced coordination between federal and state agencies, along with a centralized communication body, can significantly reduce redundancy and improve project outcomes. Ultimately, projects like CHPE underscore the need for flexibility, adaptability, and strategic planning in managing large-scale infrastructure projects.

CASE STUDY: Removing Barriers to Transmission Siting in Minnesota

Introduction

In 2020, the Minnesota Department of Transportation (MnDOT) embarked on a process of research, collaboration, and policymaking to identify and overcome barriers to co-locating electric transmission lines in its right-of-way. MnDOT's efforts in collaboration with the NextGen Highways Coalition demonstrates the power of overcoming siloes between the electricity and transportation sectors. Ultimately, the partnership resulted in legislation enabling the co-location of transmission in interstate rights-of-way, which has prompted an influx of requests to develop new transmission lines in MnDOT's right-of-way. The challenges, solutions, and lessons learned from these efforts can help transportation and energy professionals better prepare for and cooperate with requests for using their rights-of-way for co-located electricity transmission facilities.

Formation of the NextGen Highways Workgroup

The NextGen Highways Coalition is focused on integrating electric transmission infrastructure with highways and other public rights-of-way to meet the growing demand for electricity. Its members include environmental non-profits, business organizations, and labor groups who support the co-location of electric transmission lines within existing infrastructure corridors. The coalition aims to advance transmission line siting solutions that can help deliver more timely projects with fewer environmental and private landowner impacts. Installing additional transmission lines helps to ensure the United States has the grid capacity it needs to deliver affordable, reliable, domestic energy and support the expansion of electrification technology.[14]

By working together, MnDOT and the NextGen Highways Coalition aim to use linear highway corridors to support the transition to renewable energy and zero-emission vehicles, promote the co-location of fiber and broadband infrastructure along highway rights-of-way to bridge the digital divide in rural areas, and explore public-private partnership opportunities between the DOT, telecommunications industry, and communities.[15]

In 2020, MnDOT established the Sustainable Transportation Advisory Council (STAC) to guide Minnesota's transition to a low-carbon transportation system and achieve transportation emission reduction targets set by the Next Generation Energy Act. Council members include representatives from utilities, transportation industry groups, local governments, and advocacy organizations. Shortly after its establishment, STAC recommended that MnDOT collaborate with the NextGen Highways Coalition to explore the potential of using MnDOT's rights-of-way for co-locating electric transmission infrastructure.

[14] Minnesota Department of Transportation. *NextGen Highways Feasibility Study for the Minnesota Department of Transportation: Buried High Voltage Direct Current Transmission.* Accessed January 8, 2025. https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=29715913.

[15] Minnesota Department of Transportation. *NextGen Highways Feasibility Study for the Minnesota Department of Transportation: Buried High Voltage Direct Current Transmission.* Accessed January 8, 2025. https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=29715913.

Following STAC's recommendation, MnDOT formed a NextGen Highways Workgroup in December 2021 to evaluate possible future policy expansions for the allowance of transmission/broadband in MnDOT right-of-way. The workgroup brought together members from:

- MnDOT
    - Sustainability and Public Health Division
    - Office of Environmental Stewardship
    - Regional Transportation Management Center
    - Minnesota Connected and Autonomous Vehicles (CAV-X) Office
    - Construction & Innovative Contracting Office
    - MnDOT District 2
    - Office of Land Management
    - Office of Maintenance
    - Office of Right of Way
    - Office of Transportation System Management
    - Office of Chief Counsel
- Other State Agencies
    - Minnesota IT Services (MNIT)
    - Minnesota Department of Commerce
    - Minnesota Public Utilities Commission

This collaboration also brought in clean energy experts from NGI Consulting, a firm focused on helping cities, states, and corporations implement next-generation infrastructure; Great Plains Institute, a national non-profit accelerating the transition to net-zero carbon emissions for the benefit of people, the economy, and the environment; and The Ray, a national nonprofit and net-zero highway testbed in Georgia.

From 2021 to 2023, these stakeholders aligned strategies with MnDOT's renewable energy interests and sustainable transportation goals. This collaboration supports Minnesota's goal of achieving 100 percent carbon-free electricity by 2040, which was established in 2023.

Identifying Highway Rights-of-Way as Opportunities for Co-Located Transmission

Between June and December 2021, the NextGen Highways Coalition team, along with its partners, collaborated with the internal MnDOT working group to explore the opportunities and challenges of installing buried high-voltage, direct current (HVDC) transmission lines and fiber-optic cables within highway rights-of-way. The project team published their findings in a white paper entitled NextGen Highways Feasibility Study for the Minnesota Department of Transportation: Buried High Voltage Direct

Current Transmission.[16] This document provides a review of the legal and regulatory frameworks for using highway rights-of-way for buried transmission lines, including state and federal policies. It also addresses specific HVDC technical and engineering standards, such as burial depth and safety requirements, while evaluating typical highway right-of-way designs for siting these lines. The report highlights the need to study and resolve planning, regulatory, and engineering barriers to enable the siting of HVDC and fiber in interstate right-of-way. It confirms the cost-effectiveness of buried HVDC transmission and provides recommendations for state DOTs, utilities, energy developers, and governors related to the implementation of buried HVDC transmission co-located in transportation corridors.

In 2022, NextGen Highways led a peer exchange with MnDOT and the Federal Highway Administration (FHWA), where siting HVDC transmission in highway right-of-way was presented to the fifteen other State DOTs. This was described alongside other NextGen Highways accomplishments (including numerous collaborations with MnDOT) in a 2023 report.[17]

Addressing Regulatory Barriers

Advancing State-Level Transmission Co-Location and Policy Reform

FHWA's memo, "State DOTs Leveraging Alternative Uses of the Highway Right-of-Way Guidance, provided helpful information to the NextGen Highways Coalition and MnDOT.[18] The FHWA memo discusses ways in which state DOTs can leverage highway right-of-way to address pressing public needs related energy, environment, and communications. The memo explains that these uses are allowed under federal regulations and provide benefits to the public.

The NextGen Highways Coalition is working to expand these practices around the country by encouraging states to address barriers to co-locating transmission projects in highway right-of-way and take advantage of opportunities to expand transmission infrastructure. NextGen Highways' efforts aim to speed up the permitting process, increase the capacity of the grid, and avoid disruptions to private landowners.

Legislative Successes

As part of a suite of major state climate laws and policies passed in 2024, Minnesota ended a prohibition on siting utility infrastructure on land along Interstate highways owned and operated by MnDOT. This effort was led by the NextGen Highways Minnesota Coalition with support from the utilities in Minnesota. The new law, HF 5247,[19] includes the following relevant provisions amending Minnesota Statutes 161:

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[16] NextGen Highways. *NextGen Highways Analysis Report.* April 6, 2022. Accessed January 8, 2025. https://rayweb.wpenginepowered.com/wp-content/uploads/2022/04/NexGen-Highways-Analysis-Report-4.6.22-v7.pdf.

[17] NextGen Highways. *NextGen Highways Accomplishments.* January 2023. Accessed January 8, 2025. https://nextgenhighways.org/wp-content/uploads/2023/01/NextGen-Highways-Accomplishments.pdf.

[19] Minnesota House of Representatives, HF 5247, 93rd Legislature, 4th Engrossment (2024), https://www.revisor.mn.gov/bills/text.php?number=HF5247&type=bill&version=4&session=ls93&session_year=2024&session_number=0.

- **Minnesota Statutes Chapter 161**: Previously, this chapter restricted utility placements in highway ROW. HF 5247 provides exceptions that allow utility infrastructure—such as transmission lines—to be co-located in highway ROW under specific safety and design conditions regulated by MnDOT.[20]
- **Minnesota Statutes Chapter 222, Section 222.37**: While this section primarily governs utilities along railroad ROW, HF 5247 clarifies coordination between highway and railroad corridors, enabling streamlined decision-making where the two intersect or are adjacent.[21]
- **Minnesota Rules Chapter 8810**: These administrative rules, which provide MnDOT's guidelines for accommodating utilities in trunk highway ROW, were updated to incorporate new procedures, safety standards, and design considerations specific to the co-location of utility infrastructure introduced by HF 5247.[22]
- **Minnesota Statutes Chapter 216E (Power Plant Siting Act)**: HF 5247 works in tandem with the Power Plant Siting Act, ensuring that new transmission lines and large energy facilities can leverage highway ROW. The amendments prioritize minimizing environmental and land-use impacts while simplifying the approval process for such projects.[23]

Current Status

MnDOT's Office of Land Management has seen an increase in early coordination requests, indicating a growing interest in transmission projects in the right-of-way, even prior to the 2024 legislation passage. These requests typically focus on three types of proposed activities: **crossings** (where transmission lines pass over or under the right-of-way), **co-locations** (occupancy within the right-of-way), and **paralleling** (where lines run adjacent to the right-of-way with aerial encroachment). This increase indicates an expanding pipeline of over 800 miles of proposed projects from public and private utilities as well as energy and natural resource firms requiring MnDOT's input. To address this demand, MnDOT will continue strengthening its capacity for detailed analysis during early coordination to anticipate potential conflicts and streamline subsequent permit applications with the Public Utilities Commission. This proactive approach helps identify potential conflicts early in the process, streamlining the approval and implementation stages. The 2024 legislative change requires a "constructability report," providing detailed pole placements to aid MnDOT analysis of proposed routes.

Challenges and Solutions

Transportation and energy sectors often operate within distinct frameworks. MnDOT recognized the importance of evaluating how expanded transmission siting aligns with its existing utility accommodation processes and identifying where new procedures, resources, and capacity would be required. This work necessitated collaboration beyond MnDOT's traditional scope, including tasks like transmission site prioritization, typically managed by state departments of energy. The integration of electricity domain knowledge into MnDOT's processes underscored the need for interagency coordination.

[20] Minn. Stat. § 161 (2025).
[21] Minn. Stat. § 222.37 (2025).
[22] Minn. R. 8810 (2025).
[23] Minn. Stat. § 216E (2025).

- **Interdisciplinary collaboration allowed MnDOT to fill in subject matter expert gaps.** Minnesota has found success in taking an interdisciplinary approach and deeply engaging with a range of offices, particularly in the energy sector. MnDOT directed several of their program offices to study the issues, but most progress came from engagement with other stakeholders and state partners. Managing rights-of-way requires continued conversations between transportation and energy sectors, in addition to utilities and the state Public Utility Commission to address policy, technical, and economic challenges.

Statutory prohibitions in Minnesota historically prevented co-locating utilities on interstate and controlled access highways: For decades, longitudinal utility installation was not allowed on interstate and other controlled access highways in Minnesota.

- **NextGen Highways overcame this challenge by pushing for a change to state law.** Legislation passed in 2024 allows for the co-location of utilities along state and interstate highways owned and operated by MnDOT. This legislative change occurred through collaboration with key stakeholders, including state and federal partners, to demonstrate the public benefits of this change. The success of this approach can serve as a model for states where similar statutory restrictions exist, such as Colorado, Iowa, Illinois, and Michigan and several others.

Permitting processes can stall progress on co-located transmission projects. Permitting is crucial for the successful execution and expansion of infrastructure projects, but current state and federal practices can result in protracted processes and higher costs, which can deter potential applicants.

- **Permitting reform and early coordination are key to successful transmission siting:** MnDOT has established new processes, including a "constructability report" and "early notification memo" to facilitate this coordination. These tools enable MnDOT to identify potential impacts early in the project life cycle, before projects reach the public utility or permitting stages. By addressing permit considerations earlier, MnDOT can reduce delays, lower costs, and lay the groundwork for smoother and more efficient project development.

Stakeholder priorities can influence their preference for aboveground or buried transmission lines. While the NextGen Highways Coalition was in favor of buried HVDC lines, Minnesota's PUC did not agree. The PUC expects that the high upfront cost of buried lines would not be offset by future maintenance savings because overhead lines do not face the threat of wildfires in Minnesota. Underground lines are also more costly to relocate than overhead lines, in the case of a future highway expansion or realignment. The NextGen Highways white paper notes the significant benefits of buried transmission lines, including improved climate resilience, lower maintenance costs, and reduced visual and environmental impacts, while noting that Minnesota will require further study on the relative benefits of buried and overhead transmission lines.

Environmental impacts to the right-of-way should be mitigated. Advocates of transmission in transportation right-of-way often tout the environmental advantages of avoiding greenfield siting of transmission lines, including impacts to agricultural acreage and natural lands. However, some right-of-way professionals, environmental groups, and Tribal partners do not agree with the assumption that all right-of-way is previously disturbed land.

- There may be assets such as habitats for protected species, vital hydraulic infrastructure, and intelligent transportation systems (ITS) technologies already occupying space.
- Transportation agencies also incorporate sustainable features such as living snow fences, native plants, pollinator habitat, wildlife corridors, and wildlife crossings in their right-of-way management practices, which transmission projects could adversely affect.
- Transmission can affect scenic byways negatively, altering rural scenic viewsheds and scenic easements.
- Vegetation may be removed during the construction of transmission infrastructure which may disrupt ecosystems in place, affect local wildlife, and reduce carbon sequestration.
- Transportation agencies can work with stakeholder groups to understand concerns, reduce tradeoffs, and maximize synergies. For instance, native plantings can be included in a project to install transmission lines.

Lessons Learned

- **The ability to recover costs associated with co-located transmission lines varies by state.** The ability of state DOTs to recover costs associated with co-located transmission lines, such as relocation costs if a highway is widened or realigned, varies by state and may present a barrier to implementation. Minnesota law prohibits MnDOT from charging occupancy fees for the use of the right-of-way, even though the department incurs costs. In contrast, other states have established occupancy fees, such as Wisconsin's $10,000 per mile fee for broadband and transmission projects. In addition, DOTs must consider the cost of relocating existing infrastructure and the cost of removing vegetation.
- **Proactive stakeholder inclusion ensures diverse perspectives and needs are addressed during the planning and implementation phases of transmission projects.** MnDOT hosted listening sessions with PUC, Department of Commerce, transmission developers, independent power producers, advocates, and associations. Discussion centered around the challenges and opportunities of siting transmission lines in or along highway right-of-way.[24] With the recent increase of permit applications for right-of-way occupancy and parallelling, MnDOT's focus will shift towards bringing stakeholders together to encourage siting proposals that better account for transportation planning, timelines, and safety concerns.
- **Learning from other states helped MnDOT gain valuable insight.** MnDOT learned from Wisconsin's playbook for siting transmission in highway right-of-way by hosting presentations about Wisconsin's experience siting and building electric transmission in the right-of-way.[25] These efforts will allow MnDOT to advance its efforts in Minnesota and adapt Wisconsin's successful strategies to the local context.

[24] NextGen Highways. "About Us." Accessed January 8, 2025. https://nextgenhighways.org/about-us/.

[25] The Ray. *ROW Transmission Analysis Tool: Wisconsin.* March 2023. Accessed January 8, 2025. https://rayweb.wpenginepowered.com/wp-content/uploads/2023/03/ROW_Wisconsin_23.pdf.

- **Quantifying benefits of the utilization of highway rights-of-way can help to justify the value of rights-of-way in the rapid and efficient deployment of transmission projects**. Demonstrating quantifiable benefits is essential for justifying the value of transmission projects in rights-of-way. This involves evaluating how the right-of-way transmission projects will realize economic benefits sooner, save ratepayers money due to quicker transmission siting, bring renewable projects online quicker, support economic growth, and integrate with existing transportation infrastructure. Such assessments help build a strong case for transmission in the right-of-way project's approval and funding.

Conclusion and Next Steps

The MnDOT NextGen Highways Transmission analysis represents a significant step forward in the integration of electric transmission infrastructure within highway rights-of-way, aligning with the state's ambitious goals of achieving a low-carbon transportation system and 100 percent carbon-free electricity by 2040. The collaborative efforts of MnDOT, the Sustainable Transportation Advisory Council, and the NextGen Highways coalition have identified and are successfully navigating the complex challenges associated with co-locating transmission lines alongside existing infrastructure.

Despite the significant progress made, challenges remain, particularly in the areas of cost recovery and stakeholder preferences regarding transmission line placement. Continued dialogue among transportation and energy stakeholders will ensure that diverse perspectives are considered and that projects can be implemented effectively. The lessons learned from this project will inform future initiatives, reinforcing the importance of collaboration, stakeholder engagement, and adaptive regulatory frameworks in the pursuit of a cleaner, more efficient transportation and energy landscape.

CASE STUDY: SOO Green HVDC Link

Project Summary

The SOO Green HVDC Link is a planned high-voltage, direct current (HVDC) transmission line. When complete, it will span 350 miles from Mason City, Iowa, to Plano, Illinois, primarily through underground conduits installed within the right-of-way of CPKC, a freight railway company formed from the merger of Canadian Pacific Railway and Kansas City Southern in 2023. Smaller portions will be co-located within highway rights-of-way of the Iowa and Illinois Departments of Transportation (DOTs). The SOO Green HVDC Link will connect two electricity markets: the Midcontinent Independent System Operator (MISO), which operates the electricity grid in fifteen states in the Midwest and South, and the PJM Interconnection, a regional transmission organization that manages the grid in all or part of thirteen states, with territory ranging from greater Chicago to northeast North Carolina.

The project is designed to alleviate transmission congestion in MISO's operating area, which has caused a backlog of solar and wind power projects, representing over 220,000 MW of future generating capacity waiting for connection to the grid.[26] In the near term, the project will increase electricity imports to the PJM footprint to serve growing demand there in the face of generating resource retirements. In the long term, the SOO Green HVDC Link will allow energy producers in the Midwest to sell abundant wind power to customers in PJM Interconnection's market to help meet the nation's growing demand for reliable and affordable electricity. The transmission line will be bi-directional, meaning it will also allow power to flow from the PJM Interconnection to MISO's operating area to balance the supply and demand of power, enhancing the resilience and reliability of both grids. Finally, it will enable economic development by allowing more wind and solar power generators to come online.

Project Motivation

The project aligns with Illinois's goal to reach 100 percent clean energy by 2050[27] and with Iowa's goal to support the development of wind energy for export.[28] Ultimately, the transmission line will enable economic development in the Midwest, unlock new sources of low-carbon electricity for the mid-Atlantic region, and improve the resilience of the electricity grid in both regions.

[26] Lawrence Berkeley National Laboratory. Maps of projects by region, state, and County. Accessed January 7, 2025. https://emp.lbl.gov/maps-projects-region-state-and-county.

[27] https://www.illinois.gov/news/press-release.23893.html

[28] Iowa Code 476.53A. Accessed January 7, 2025. https://www.legis.iowa.gov/docs/code/2022/476.53A.pdf.

Figure 1. Map of the proposed route of the SOO Green HVDC Link. Source: SOO Green. https://soogreen.com/about/

Project Implementation

When complete, the transmission line will be capable of transmitting 2,100 MW of electricity, enough to power approximately 1.5 million homes.[29] Most of the 525-kilovolt transmission line will be situated within buried conduits placed in underground duct banks at a minimum three-foot depth below grade. Periodic splice vaults will allow access to the line for maintenance without opening the trench after it is installed. Where the route crosses existing infrastructure, rivers, wetlands, or sensitive habitat, SOO Green will use trenchless installation methods (primarily jack and bore method or horizontal directional drilling) to avoid digging an open trench. The transmission line will primarily be co-located in the railroad right-of-way of CPKC, and smaller portions will be co-located with Iowa and Illinois DOT roads. The transmission line will also cross highways owned by the Iowa and Illinois Departments of Transportation. In Iowa, 158 miles (91 percent) of the route will be located on railroad right-of-way, with the remaining 16 miles located on U.S. Highway 18. Locating the line within existing transportation right-of-way will minimize impacts to productive agricultural lands, private landowners, and the natural environment, and burying the line underground will allow the project to avoid impacts to scenery, tree canopy, wildlife habitat, and railroad operations.

Inception of the Project

SOO Green HVDC Link ProjectCo, LLC, (SOO Green) is owned by a partnership of energy and infrastructure firms. It was created with the sole purpose to construct, own, and operate the SOO Green HVDC Link project. The SOO Green HVDC Link will be a merchant transmission line, meaning its revenue will come from transmission capacity subscribers paying to transmit electricity over the line rather than from ratepayers.

The partnership between SOO Green and CPKC has been central to the project. From the project's outset, the SOO Green HVDC Link was designed to be underground to avoid interfering with rail operations and development. SOO Green hired a former employee of the railway company to ensure

[29] energyRe. SOO Green. Accessed January 7, 2025. https://www.energyre.com/project/illinois/transmission/soo-green

that they had the expertise needed for detailed conversations with CPKC about minimizing the project's impact on the railway. SOO Green further coordinated with the Iowa Utilities Commission (IUC) during the planning stage to address questions and uncertainties ahead of time, such as use of eminent domain, grid benefits, health and safety aspects, defining the project as a public utility in Iowa, and gaining project approval before approaching other stakeholders.

Obtaining Electric Franchises in Iowa

In Iowa, the SOO Green HVDC Link was required to obtain an electric franchise from IUC, which is an authorization that allows a company to construct, maintain, and operate a transmission line in rural Iowa.[30] Following IUC's process to petition for an electricity franchise, SOO Green first notified individuals with an interest in the land that would be affected by the project. In May 2020, SOO Green held informational meetings for each of the eight counties that the route traverses as required by IUC. After the informational meetings, interested parties submitted their input by filing comments, objections, or letters of support with IUC.

Nine landowners filed objections claiming the railway did not have the requisite property rights in the right-of-way to allow SOO Green to construct the project. The Iowa Farm Bureau filed comments in support of the landowners and expressed concern that SOO Green's construction could affect the interests of its members who own underlying land in the railroad right-of-way. The Iowa Environmental Council filed a letter of support noting the environmental benefits of bringing more wind power online and the benefits of burying transmission lines underground to avoid impacts to wildlife, habitat, and natural scenery. The Center for Rural Affairs and the Iowa Association of Business and Industry also filed supportive comments, noting the anticipated positive impacts to Iowa's economy. Iowa's Office of the Consumer Advocate filed comments that were broadly supportive of the project, emphasizing that construction costs would be borne by investors instead of by Iowa electricity ratepayers. After resolving issues arising from ambiguous property rights, IUC held a public hearing on July 11 and 12, 2023, in the city of Elkader, the route's midpoint in Iowa, and granted SOO Green's electricity franchise in September 2023.

In addition to the IUC electric franchise, completion of the project requires a separate electricity transmission franchise from each of the twenty-four Iowa municipalities along the route. SOO Green worked with city councils, public works departments, city managers, and city attorneys to earn support for obtaining these franchises. In some municipalities, SOO Green will install fiber conduits in the same trench as the transmission line. SOO Green is also constructing permanent surface improvements in certain municipalities to be used for access. Iowa law required SOO Green to present at each municipality's city council three times, unless a waiver was granted. Most city councils approved the franchises unanimously. As of November 2024, SOO Green has obtained twenty-one municipal franchises and expects to obtain the remaining three by early 2025. The process has taken approximately two years to complete.

[30] The Iowa Utilities Commission was known as the Iowa Utilities Board before July 2024.

Economic Benefits

According to an economic impact analysis[31] filed by SOO Green and cited by IUC in its decision, the earnings benefit to Iowa will include $726 million due to construction, between $1.3 billion and $1.6 billion by enabling additional wind and solar generators to come online, $340 million in long-term earnings during the 30-year operating period of the project, and $2.1 billion to support the operations and maintenance of future wind and solar facilities. Additionally, Iowa DOT will generate revenue from annual occupancy fees, starting at approximately $350,000 per year.

Environmental Review

The project underwent both state and federal environmental review processes. At the state level, the Iowa Department of Natural Resources, the Illinois Environmental Protection Agency, and the Illinois Department of Natural Resources reviewed the project for impacts on wildlife and wetlands. The Illinois Cultural Resources Agency, Historical Preservation Division, assessed potential impacts to historical and archaeological sites along the route, such as Native American archaeological sites and historic buildings. At the federal level, the U.S. Army Corps of Engineers (USACE) is the lead agency for environmental review under the National Environmental Policy Act (NEPA) and the Rivers and Harbors Act, due to the project's crossing of the Mississippi River and levees on both sides. The U.S. Fish and Wildlife Service assessed potential impacts to wetlands and endangered species.

As of August 2024, the SOO Green HVDC Link is permitted in the project corridor, and SOO Green has held pre-construction informational meetings in all project counties. While all water, wetland, biological, and cultural resource surveys have been completed and reports submitted to USACE, the Environmental Assessment reviews under NEPA will be led by USACE in 2025, with approval expected in early 2026. Construction is scheduled to begin as soon as 2026, and commercial operations are expected to begin in 2030.

Challenges and Solutions

Railroad real estate interests are often complex. Of the 172 miles of CPKC railway in Iowa that will be used by the route, only 36 miles are owned by CPKC by deed. CPKC holds rights to the remaining miles of right-of-way through adverse possession,[32] land grants, and easements. Many of the easement documents date back to the 1870s, when the track was first laid, and do not clearly define the scope of the railway's property rights – for example, whether the railway only has rights to the track, or to the land underneath as well. Nine landowners of property adjacent to CPKC tracks filed objections to SOO Green's permit application before IUC, arguing that their easements with CPKC did not allow the railway to extend subsurface rights to their property to SOO Green. SOO Green counterargued that federal and Iowa case law has established that railroad easements, unique from other types of easements, are nearly equivalent to having a fee interest in the land, or owning it outright.

- **Resolving unclear property rights helped to move the project forward.** Initially, SOO Green sought to resolve issues from ambiguous railroad easements without the use of eminent

[31] Loomis, David G., Bryan Loomis, and Chris Thankan. *Economic Analysis of the SOO Green HVDC Link Transmission Project on the State of Iowa*. Strategic Economic Research, LLC. Accessed January 7, 2025. https://iowa5.sharepoint.com/:b:/s/IUB-EFS-PROD/EW1NQjcvCFhLsBF466RrSSUBB0JqAtY58XMyt0VvhoKV_A

[32] Colloquially known as "squatter's rights," adverse possession refers to ownership of a piece of land without a legal title through continuous use and occupancy.

domain. SOO Green did not ask IUC for eminent domain authority in its original petition. Instead, SOO Green offered compensation to the landowners in question through a Cooperation Agreement and Mutual Release, while maintaining that SOO Green had secured the necessary property rights from CPKC with or without the agreements. However, in the end, five landowners continued to object to the petition before the IUC. In response to the objection and to finally resolve the matter, SOO Green amended their petition to request eminent domain authority from IUC to clear title for the parcels in question, which was granted.

Co-located utilities can complicate future work in the right-of-way. Future potential relocations, realignments, or expansions of railroads or highways present a major challenge to advancing transmission projects in transportation rights-of-way. From the perspective of a railroad company or state DOT, a high-voltage transmission line in the right-of-way could make future projects more costly or logistically complicated. From the developer's perspective, potential relocations raise the risk of future costs or service disruptions beyond their control.

- **SOO Green agreed to pay the cost of relocating the transmission line, if necessary.** From early in the planning process, SOO Green reached an understanding with the railway company and with the state DOTs that they will pay a fee to occupy the right-of-way; they do not seek an easement in the right-of-way which could restrict the owners' rights to manage their own property. To mitigate their own risk, SOO Green selected right-of-way segments that are less likely to be expanded or relocated.

Adjacent property owners sometimes encroach on railroad right-of-way. Accommodating landowners adjacent to the right-of-way proved to be a challenge for SOO Green. Many neighboring landowners had encroachments into the right-of-way, some documented and others undocumented, including fences, unmarked utilities, and drain tile, or underground pipes that limit flooding on farmland.

- **SOO Green was prepared to address conflicts underground.** Most transportation rights-of-way have underground conflicts, such as utility crossings, that could impede a co-located transmission line. However, the nature of underground conflicts depends on the regional context. In the case of SOO Green, adjacent farmers' drain tile proved to be the major underground conflict. Engaging with landowners at the beginning of the process, before it was required, allowed SOO Green to anticipate this conflict, develop a solution, and assure landowners along the route that their concerns would be addressed prior to construction.

SOO Green also developed a methodology to minimize the impact to drain tile in the right-of-way. During construction, they plan to cut and cap drain tile while digging the trench and replace the cut portion before moving on, or they will leave the tile intact and insert the conduit underneath. SOO Green further limited impacts to farmland by acquiring or leasing abandoned parking lots rather than farmland for construction staging. The splice vaults will also prevent the need to open the trench for maintenance of the transmission line, minimizing future impacts on surrounding farmland and wildlife habitat within the rail corridor. Despite these challenges, siting the transmission line within existing right-of-way has much less impact on private landowners compared to siting the line on private land. Furthermore, the process has proven easier and faster than negotiating easements with potentially thousands of individual landowners.

Like many states, Iowa regulations prohibit co-located utilities on freeways. SOO Green sought to co-locate portions of the transmission line on Iowa DOT's right-of-way to optimize the route, avoid particularly sensitive habitat, and avoid portions of the rail corridor with exceptionally difficult terrain. Although Iowa DOT does not permit co-located transmission lines on freeways, including interstate highways and other controlled-access highways, it does allow utility co-location within other DOT rights-of-way.[33] SOO Green initially considered routing the line along freeway portions of U.S. Highway 18 in Cerro Gordo and Floyd counties, but this plan was revised due to Iowa DOT's prohibition on high-voltage transmission lines in freeway rights-of-way.

- **SOO Green and Iowa DOT worked to find alternate alignments for the transmission line**. Co-locating the transmission line on U.S. Route 18, which is an undivided road with no control of access in Clayton County, complies with Iowa DOT's policies. Additionally, Iowa DOT's regulations for utility crossings primarily consider crossings of alternating current (AC) transmission lines, which are more common in utility transmission and distribution systems. For example, Iowa DOT's voltage thresholds do not distinguish between AC and DC transmission lines. As a result, the SOO Green HVDC Link required waivers as a much higher-voltage DC line. Other states have resolved this barrier by passing legislation to remove co-location prohibitions; for example, Minnesota did so in 2024.[34]

The public may not understand the benefits of HVDC technology or merchant transmission lines. The general public did not initially understand SOO Green's business model because the transmission line will not directly serve any local customers. Some municipalities along the route questioned the benefits and impacts of the project when the town or city council discussed SOO Green's petition for an electricity franchise.

- **SOO Green clearly communicated the effects on the local electricity market.** Local stakeholders also wondered whether the project would influence local electricity prices. SOO Green emphasized in public meetings that the project would have no immediate, direct benefit to local customers, but it would improve the MISO grid and eventually have a downward effect on wholesale electricity prices for the region. SOO Green focused their external communication on their efforts to minimize impacts to scenery, the natural environment, private property, and neighboring landowners.

Transmission projects in the right-of-way can be slowed by siloing between transportation agencies and energy agencies. Transportation agencies may not fully appreciate the importance of HVDC lines to grid resilience and environmental goals; likewise, energy agencies may lack a full understanding of how infrastructure owners manage their right-of-way to ensure safety.

- **Cross-disciplinary teams help to advance transmission projects in a siloed regulatory environment**. For SOO Green, hiring a railroad safety expert with 35 years of experience helped to ensure smooth, early communication with the railway to ensure the project met its needs,

[33] Iowa DOT. Section 115.16(2), "Prohibitions on longitudinal occupancy," in *Policy for Accommodating and Adjustment of Utilities on the Primary Road System.* Accessed January 7, 2025. https://iowadot.gov/rightofway/pdfs/UtilityPolicy.pdf.
[34] Minnesota Session Laws - 2024, Regular Session, Chapter 127—H.F. 5247, Sec. 17. Accessed January 7, 2025. https://www.revisor.mn.gov/laws/2024/0/Session+Law/Chapter/127/

alleviate concerns about the risk to railroad operations, and express the value proposition to CPKC. Similarly, Iowa DOT participated in early meetings with IUC, well before their formal involvement, to understand the project and anticipate its needs and challenges. Iowa DOT staff also found one-on-one meetings with the developer to be helpful in anticipating the regulatory needs of SOO Green. They also designated one staff member to be the overall project point of contact to facilitate communication between their two organizations.

Lessons Learned

Explaining the safety of HVDC transmission lines to the public is important. Safety is a top priority for SOO Green, according to the firm, and several features of the project minimize safety risks for the railroad and homes and businesses nearby. Unlike AC current, SOO Green's DC current does not produce induced currents, which can cause harm to individuals and objects in its electric field. SOO Green's current will not cause stray voltage that sometimes occur in AC systems when they are not properly grounded. Furthermore, because the SOO Green HVDC Link will have two underground cables with current flowing in opposite directions, the cables' magnetic fields will cancel each other out. As a result, the residual magnetic field experienced above ground will be weaker than most household appliances, according to SOO Green. The project's cables are insulated and grounded on the outside of the cable, so no electric field will exist outside of the cable. Together, these characteristics will allow SOO Green HVDC Link to operate without interfering with CPKC's critical communications and monitoring systems.

Establishing appropriate pricing for occupancy fees necessitates a careful balance. Iowa regulations set an annual occupancy fee for using Iowa DOT's right-of-way. In 2024, the fee was $21,700 per mile of cable, and it increases by 3 percent each year. An occupancy fee provides an incentive for right-of-way owners such as railroads or state DOTs and a method for them to recoup expenses associated with transmission line co-location. However, if the fee is too high, it can become cost prohibitive to developing new projects. Separately from occupancy fees, Iowa charges real property taxes on transmission lines at the rate of $7,000 per pole mile. This tax revenue will be allocated to county governments, community colleges, school districts, fire departments, municipal governments, and other taxing entities along the route. SOO Green intends to negotiate payment in lieu of taxes (PILOT) agreements with entities in Illinois, because Illinois does not have a state-level property tax on power transmission assets.

State environment and energy goals helped to motivate the project. In Illinois, state environmental goals set by law and executive order have been helpful as SOO Green seeks approval of project permits. The Illinois Department of Natural Resources has set a climate goal of achieving net-zero greenhouse gas emissions by 2050, and Climate and Equitable Jobs Act, passed in 2021, sets a goal of 100 percent clean energy by 2050. In Iowa, the Renewable Electric Generation Law (Iowa Code § 476.53A) identifies renewable power development, transmission capacity development, and exporting wind power as legislatively defined goals. As a new and complex type of transmission project, the connection to executive-level goals helped to justify the project through different agencies' permitting processes. SOO Green cited state-level goals in permit applications as one way to justify the public benefit of the project, and elected officials cited them in letters of support. Utilities' decarbonization goals also proved helpful to cite in SOO Green's discussions with legislators and utilities.

Burying transmission lines avoids impacts to right-of-way owners, adjacent landowners, the natural environment, and cultural resources. Locating nearly the entire route underground and in existing right-

of-way avoids impacts that cause many infrastructure projects to become tied up in lengthy review processes.

Proactive communication fosters productive stakeholder relationships. SOO Green established relationships through proactive communication with municipalities, ratepayers, and neighboring landowners at the outset of the project to secure permits and preempt potential conflicts before construction.

Conclusion

The SOO Green HVDC Link demonstrates how innovative approaches to transmission infrastructure can overcome traditional development challenges. By installing underground within railroad and highway rights-of-way, the project addresses common obstacles like land acquisition, visual impacts, and environmental concerns that often hinder transmission projects. The project's success in securing permits and stakeholder support highlights the importance of proactive engagement, cross-disciplinary expertise, and alignment with state climate goals. As the U.S. seeks to enhance grid reliability and expand its clean energy infrastructure, the SOO Green HVDC Link serves as a valuable model demonstrating how developers, utility regulators, and right-of-way owners can collaborate to advance critical energy infrastructure while minimizing environmental and community impacts.