



## Macro Grid Initiative

An ACORE Program

# Upgrading and Expanding the U.S. Transmission Grid: Case Studies of Recent Progress

Several states and regions have seen recent progress with transmission line development, illustrating potential best practices for expanding and upgrading the U.S. power grid. A few examples are cited below:

## REGIONAL TRANSMISSION PLANNING

### MISO LRTP Tranche 1

The MISO Long Range Transmission Planning (LRTP) Tranche 1 is the first phase of the largest transmission expansion underway in the U.S. today, with 18 new projects planned across nine states.<sup>1</sup> The lines approved in Tranche 1 are projected to create more than 330,000 jobs in the Midwest, unlocking over 50 gigawatts (GW) of low-cost wind and solar power.<sup>2</sup> In July 2022, the MISO Board of Directors gave its approval for this \$10.3 billion initial slate of projects, with all Tranche 1 lines expected in service by 2030.<sup>3</sup> The lines will leverage up to 750 miles of existing rights-of-way to offset the cost of replacing aging equipment and structures.<sup>4</sup>

The portfolio is an important first step toward addressing the increasing renewable energy demand and electrification growth MISO has identified. The successful approval of these lines was predicated on several conditions, but the calculation of the multiple benefits of proposed transmission lines was perhaps the most important factor.<sup>5</sup> MISO's process represents a best practice, as opposed to many regions' standard practice of putting transmission projects into economic, reliability, or public policy siloes and only evaluating benefits within that silo, ignoring the project's other benefits.<sup>6</sup> The lines in Tranche 1 are expected to deliver \$37.3 billion worth of benefits over a 20 year period, a 3.6 to 1 benefit-to-cost ratio.<sup>7</sup>

<sup>1</sup> MISO. MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary (2021), available at: <https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf>.

<sup>2</sup> Clean Grid Alliance. Renewable Energy & Jobs Impacts via MISO's New Portfolio of Regional Transmission Lines (n/d), available at: [https://cleangridalliance.org/uploads/\\_media\\_uploads/\\_source/RE\\_and\\_Jobs\\_impacts\\_-\\_MISO\\_Tranche\\_1-converted.pdf](https://cleangridalliance.org/uploads/_media_uploads/_source/RE_and_Jobs_impacts_-_MISO_Tranche_1-converted.pdf).

<sup>3</sup> MISO. MISO Board Approves \$10.3B in Transmission Projects (July 2022), available at: [https://www.misoenergy.org/about/media-center/miso-board-approves-\\$10.3B-in-transmission-projects/](https://www.misoenergy.org/about/media-center/miso-board-approves-$10.3B-in-transmission-projects/). See also MISO, MTEP21 Report Addendum at 2.

<sup>4</sup> See, e.g. Electrical Contractor, MISO Proposes \$10 Billion Transmission Upgrade in Northern States, available at: <https://www.ecmag.com/magazine/articles/article-detail/green-building-miso-proposes-10-billion-transmission-upgrade-northern-states>.

<sup>5</sup> ACORE, Grid Strategies, "Enabling Low-Cost Clean Energy and Reliable Service Through Better Transmission Benefits Analysis: A Case Study of MISO's Long Range Transmission Planning," (August 2022), available at: <https://acore.org/wp-content/uploads/2022/08/ACORE-Enabling-Low-Cost-Clean-Energy-and-Reliable-Service-Through-Better-Transmission-Analysis.pdf>.

<sup>6</sup> *Id.*

<sup>7</sup> *Id.*

Other regional transmission organizations should take similar steps to proactively plan, design, approve, and build new transmission capacity to accommodate the over 1.3 terawatts of low-cost clean energy resources waiting in interconnection queues across the country.<sup>8</sup>

## New York ISO

Several significant transmission projects have made headway in New York in recent years, including a nearly 100-mile, 345-kilovolt (kV) line initiated at the request of the New York Public Service Commission (NYPSC).<sup>9</sup> The project, known as the Central East Energy Connect upgrade, will replace existing lines and wooden poles - some of which are about 60 years old - with stronger steel monopoles in existing utility rights-of-way.<sup>10</sup> Construction activities commenced in early 2021 and will continue through 2023.<sup>11</sup> Once complete, the new line will represent the first large-scale, high-voltage, alternating current (AC) transmission facility constructed in New York State in over thirty years and deliver five times the capacity of the existing line.<sup>12</sup>

Stakeholder workshops held by the NYPSC during the line selection process helped build the necessary consensus for project approval. The robust stakeholder consultation process identified ways to reduce congestion, improve reliability, and access renewable resources through the most efficient and cost-effective transmission upgrades.<sup>13</sup> Current construction is the result of that engagement, which convened transmission experts, community leaders, and other interested parties to identify considerations that were later incorporated into the project.<sup>14</sup> By addressing local concerns, while revealing additional needs or potential obstacles, transmission developers and regional authorities facilitated the consensus building.

## MERCHANT TRANSMISSION LINES

### Western Spirit

Western Spirit is a 155-mile, 345-kV transmission project that will power approximately 590,000 homes with up to 800 megawatts (MW) of wind energy from Western Spirit Wind facilities in central New Mexico.<sup>15</sup> The line is also expected to deliver \$28 million in property taxes to New Mexico counties over the first four decades of the line's operation.<sup>16</sup> The Western Spirit line was developed jointly by Pattern Energy and the New Mexico Renewable Energy Transmission Authority

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<sup>8</sup> Berkeley Lab, Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection, available at: <https://emp.lbl.gov/queues>. See also, Yale Environment 360, Extreme Weather Events Have Increased Significantly in the Last 20 Years (Oct 2020), available at: <https://e360.yale.edu/digest/extreme-weather-events-have-increased-significantly-in-the-last-20-years>.

<sup>9</sup> NYISO, AC Transmission Public Policy Transmission Plan (April 2019), available at: <https://www.nyiso.com/documents/20142/5990681/AC-Transmission-Public-Policy-Transmission-Plan-2019-04-08.pdf>.

<sup>10</sup> T&D World, First 5-Mile Section of Central East Energy Connect Transmission Line Complete (June 2021), available at: <https://www.tdworld.com/overhead-transmission/article/21166855/first-5mile-section-of-central-east-energy-connect-transmission-line-complete>.

<sup>11</sup> Office of Governor Kathy Hochul, Governor Hochul Announces Significant Progress on Central East Energy Connect Transmission Project in Schenectady County (October 2022), available at: <https://www.governor.ny.gov/news/governor-hochul-announces-significant-progress-central-east-energy-connect-transmission>.

<sup>12</sup> *Id.*

<sup>13</sup> NYISO, AC Transmission Public Policy Transmission Plan at 5 (April 2019), available at: <https://www.nyiso.com/documents/20142/5990681/AC-Transmission-Public-Policy-Transmission-Plan-2019-04-08.pdf>.

<sup>14</sup> LS Power Grid New York LLC, Public Involvement (n/d), available at: <https://www.lspgridnewyork.com/public-involvement/>.

<sup>15</sup> NM RETA, Transmission Lines (n/d), available at: <https://nmreta.com/transmission-lines/>.

<sup>16</sup> *Id.*

(RETA), an agency established by the New Mexico state legislature in 2007 to accelerate the construction of high-voltage transmission and unlock the state's abundant renewable resources.<sup>17</sup>

The line is now operational, and RETA was key in moving it along expeditiously by coordinating various steps throughout its development, including the acquisition of state permits and facilitation of extensive public outreach.<sup>18</sup> The creation of agencies similar to RETA in other states could help facilitate the prompt completion of other critical transmission lines.

## SunZia

Approximately 550 miles in length, Pattern Energy's SunZia transmission project is a 525-kV, direct current (DC) transmission line that plans to deliver 3,000 MW of low-cost renewable energy resources across New Mexico and Arizona. The project, and the wind farm it will enable, will create 2,000 good-paying construction jobs and generate \$1 billion for communities in the two states.<sup>19</sup> After completing the permitting processes for both New Mexico and Arizona, SunZia is scheduled to begin construction in 2023 pending final project approval and right of way grants.<sup>20</sup>

Pattern also channeled investment toward nature conservation efforts, including identifying the most environmentally optimal route for the line.<sup>21</sup> Guided by environmental analysis and community feedback, SunZia's route avoids densely populated areas and, where feasible, is located near existing infrastructure, including transmission lines and roads.<sup>22</sup> In 2015, SunZia adjusted the route in collaboration with the Department of Defense and White Sands Missile Range, taking advantage of the opportunity to partially parallel the existing Western Spirit Transmission line.<sup>23</sup> This 35-mile improvement helped minimize environmental impacts.<sup>24</sup>

## SOO Green

The SOO Green project is a 350-mile, 525-kV line to deliver 2,100 MW of much-needed electric power and over \$2 billion in projected economic benefits across parts of Iowa and Illinois.<sup>25</sup> The line has been confronted with several regulatory challenges. In 2021, representatives of the SOO Green project filed formal complaints at the Federal Energy Regulatory Commission (FERC), arguing that its subjection to the PJM generation interconnection process, which is severely backlogged, was improper for a merchant transmission line and would result in the delay of

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<sup>17</sup> New Mexico, Minerals, and Natural Resources Department. New Mexico Legislature Adopts Comprehensive Clean Energy Legislative Agenda 2007 (2007), available at: [https://19january2017snapshot.epa.gov/sites/production/files/2014-06/documents/lrb2g\\_martinez\\_0.pdf](https://19january2017snapshot.epa.gov/sites/production/files/2014-06/documents/lrb2g_martinez_0.pdf).

<sup>18</sup> NM RETA. New Mexico Renewable Energy Transmission and Storage Study (June 2020), available at: [https://nmreta.com/wp-content/uploads/2020/07/072220-RETA-Executive-Summary-FINAL-APPROVED\\_online.pdf](https://nmreta.com/wp-content/uploads/2020/07/072220-RETA-Executive-Summary-FINAL-APPROVED_online.pdf). See also November 2018 New Mexico Oversight Committee Meeting presentation, available at: <https://www.nmlegis.gov/handouts/NMFA%20110818%20Item%201%20NM%20Renewable%20Energy%20Transmission%20Authority%20NMRET%20Update.pdf>.

<sup>19</sup> Pattern Energy. SunZia Transmission (n/d), available at: <https://patternenergy.com/projects/sunzia-transmission/>.

<sup>20</sup> Pattern Energy. Pattern Energy Acquires SunZia Transmission Project (July 2022), available at: <https://patternenergy.com/pattern-energy-acquires-sunzia-transmission-project/>.

<sup>21</sup> *Id.*

<sup>22</sup> Pattern Energy. SunZia Transmission. New Mexico and Arizona (n/d), available at: <https://patternenergy.com/projects/sunzia-transmission/>.

<sup>23</sup> Pattern Energy. Pattern Energy Acquires SunZia Transmission Project (July 2022), available at: <https://patternenergy.com/pattern-energy-acquires-sunzia-transmission-project/>.

<sup>24</sup> *Id.*

<sup>25</sup> SOO Green. Economic Impact (n/d), available at <https://soogreen.com/economic-impact/>.

construction for several years.<sup>26</sup> SOO Green developers returned to FERC a few months later to contend that PJM's rules for capacity imports were creating a significant market barrier.<sup>27</sup> Despite these challenges, the SOO Green line is on track to begin construction in 2023, which can be attributed to several best practices that may benefit other high-voltage projects:<sup>28</sup>

- *Use of existing rights-of-way:* The SOO Green project will lay lines underground and maximize territory along existing railroad corridors to avoid the time constraints associated with eminent domain disputes.<sup>29</sup> Leveraging existing rights-of-way also simplifies the permitting process, which has helped build far-reaching support.<sup>30</sup>
- *Political support:* Several members of the Iowa and Illinois congressional delegations have voiced support for the construction of SOO Green.<sup>31</sup> Alignment from members of Congress in both states could heighten accountability and urgency among key decision makers at the state and local levels.<sup>32</sup>
- *Landowner consultation:* To prevent local disruptions, SOO Green representatives have committed to proactively notifying landowners located near project activities, while conducting informational meetings at the county level to convey the benefits of the project's railroad rights-of-way approach, which could help to minimize environmental impacts.<sup>33</sup>

## Grain Belt Express

Chicago-based Invenergy is planning to build an 800-mile, high-voltage transmission line carrying 5,000 MW of power from Illinois to Kansas.<sup>34</sup> The project would create an estimated 22,300 direct jobs, while saving Midwestern consumers billions in electricity costs over the course of its operation.<sup>35</sup> Grain Belt Express developers announced an expansion to the route in July 2022, demonstrating the value of two additional best practices:<sup>36</sup>

- *Route flexibility:* Responding to market demands and requests from state leaders, Invenergy proactively updated the Green Belt Express application with the Missouri PSC to enhance the line's power delivery to Missouri residents.<sup>37</sup> Invenergy also established a significant grassroots network to communicate the line's benefits and compensation levels for easements on landowners' properties. This community-focused approach has helped build support at the local level, which is critical to the development of transmission infrastructure.<sup>38</sup>

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<sup>26</sup> Complaint and Request for Waiver of SOO Green HVDC Link ProjectCo, LLC Docket No. EL21-\_\_\_-000 (June 2021), available at: [https://legacy-assets.eenews.net/open\\_files/assets/2021/06/23/document\\_ew\\_03.pdf](https://legacy-assets.eenews.net/open_files/assets/2021/06/23/document_ew_03.pdf).

<sup>27</sup> SOO Green HVDC Link ProjectCo, LLC v. PJM Interconnection, L.L.C. Docket No. EL21-\_\_\_-000 (September 2021), available at: <https://www.pjm.com/-/media/documents/ferc/filings/2021/20210921-complaint-and-request-for-relief.ashx>.

<sup>28</sup> PR Newswire. PPL Corporation Acquires Ownership Interest in SOO Green HVDC Link Transmission Project (September 2021), available at: <https://www.prnewswire.com/news-releases/ppl-corporation-acquires-ownership-interest-in-soo-green-hvdc-link-transmission-project-301385257.html#:~:text=The%20innovative%20350%2Dmile%20project,take%20three%20years%20to%20complete>.

<sup>29</sup> SOO Green. Permitting (n/d), available at: <https://soogreen.com/permitting-process/>.

<sup>30</sup> *Id.*

<sup>31</sup> Howland, E. SOO Green transmission project faces PJM obstacles: Are grid operators hindering the energy transition? (January 2022), available at: <https://www.utilitydive.com/news/soo-green-pjm-grid-operators-helping-or-hurting-energy-transition/616966/>.

<sup>32</sup> Dennis, J. Transmission Buildout Requires State as Well as Federal Engagement (March 2022), available at: <https://blog.advancedenergyunited.org/transmission-buildout-requires-state-as-well-as-federal-engagement>.

<sup>33</sup> SOO Green. About the Project (n/d), available at: <https://soogreenhvdc/link-os.com/about/>.

<sup>34</sup> Invenergy Transmission LLC. An Energy Solution for America's Heartland (n/d), available at:

<https://grainbeltexpress.com/#:~:text=Grain%20Belt%20Express%20will%20deliver.%2C%20Illinois%2C%20and%20the%20Midwest>.

<sup>35</sup> *Id.*

<sup>36</sup> Invenergy Transmission LLC. Grain Belt Express Files to Bring More Power and Energy Savings to Missouri (August 2022), available at: <https://grainbeltexpress.com/grain-belt-express-files-to-bring-more-power-and-energy-savings-to-missouri/>.

<sup>37</sup> *Id.*

<sup>38</sup> Ansolabehere, S., Carley, S., & Koninsky, D.M. Are all electrons the same? Evaluating support for local transmission lines through an experiment (July 2019), available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6636722/>.

- *Federal financial support:* In December 2022, the Department of Energy Loan Programs Office (DOE LPO) issued a notice of intent to initiate the federal environmental review process for the Grain Belt Express, accompanied by a proposal to provide the project with loan assistance.<sup>39</sup> The notice also announced a series of public stakeholder meetings. By conducting an Environmental Impact Statement for the project as required by the National Environmental Policy Act and announcing a potential offer of financial support, DOE LPO has helped to increase the viability of the project, while ensuring greater public involvement in its development.<sup>40</sup>

## Gateway South

Berkshire Hathaway Energy's Gateway South project is a 416-mile, 500-kV alternating current (AC) transmission line anticipated to deliver wind power and other forms of clean energy throughout Wyoming, Utah, and the Southwest.<sup>41</sup> After years of review, the line received final construction approval from the Bureau of Land Management (BLM) in May 2022.<sup>42</sup> In addition, key certificates were secured from the Wyoming Public Service Commission and Public Service Commission of Utah to streamline completion of the remaining segments.<sup>43</sup> The scheduled in-service date of 2024 was achieved in part by ensuring environmental stewardship. BLM's review considered the line's effects on wilderness, including certain endangered species such as the sage grouse.<sup>44</sup> PacifiCorp, responsible for building Gateway South, worked collaboratively with BLM and other federal partners to establish construction approaches that would minimize the impact to surrounding wildlife and natural resources.<sup>45</sup> This willingness to explore innovative solutions helped to address local environmental concerns, which could expedite the line's development by reducing the risk of future court challenges, and motivated the necessary interagency collaboration to settle ongoing land disputes.<sup>46</sup>

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<sup>39</sup> DOE LPO. Notice of Intent to Prepare an Environmental Statement for the Grain Belt Express Transmission Project, DOE/EIS-0554 (December 2022), available at: <https://www.federalregister.gov/documents/2022/12/16/2022-27099/notice-of-intent-to-prepare-an-environmental-impact-statement-for-the-grain-belt-express>.

<sup>40</sup> DOE LPO. Grain Belt Express Transmission Line Project Environmental Impact Statement (December 2022), available at: <https://eis-grainbeltextpress.com/>.

<sup>41</sup> PacifiCorp. Gateway South (n/d), available at: <https://www.pacificorp.com/transmission/transmission-projects/energy-gateway/gateway-south.html>.

<sup>42</sup> BLM. Biden-Harris Administration Approves Construction of Energy Gateway South Transmission Line (May 2022), available at: <https://www.blm.gov/press-release/biden-harris-administration-approves-construction-energy-gateway-south-transmission>.

<sup>43</sup> PacifiCorp. Gateway South transmission line receives nod to proceed (June 2022), available at:

<https://www.pacificorp.com/about/newsroom/news-releases/utility-regulators-grant-certificates.html>.

<sup>44</sup> BLM. Biden-Harris Administration Approves Construction of Energy Gateway South Transmission Line (May 2022), available at: <https://www.blm.gov/press-release/biden-harris-administration-approves-construction-energy-gateway-south-transmission>.

<sup>45</sup> *Id.*

<sup>46</sup> Plautz, J. Interior approves big power line for renewables in U.S. West (May 2022), available at: <https://www.eenews.net/articles/interior-approves-big-power-line-for-renewables-in-u-s-west/>. See also Saul, J., Malik, N., & Merrill, D. The Clean-Power Megaproject Held Hostage by a Ranch and a Bird (April 2022), available at: <https://www.bloomberg.com/graphics/2022-clean-energy-power-lines-transwest-wind-maps-private-property/>.