LINK TO RURAL DEVELOPMENT AND A RENEWABLE FUTURE

a report by LUCAS NELSEN
and the CENTER *for* RURAL AFFAIRS

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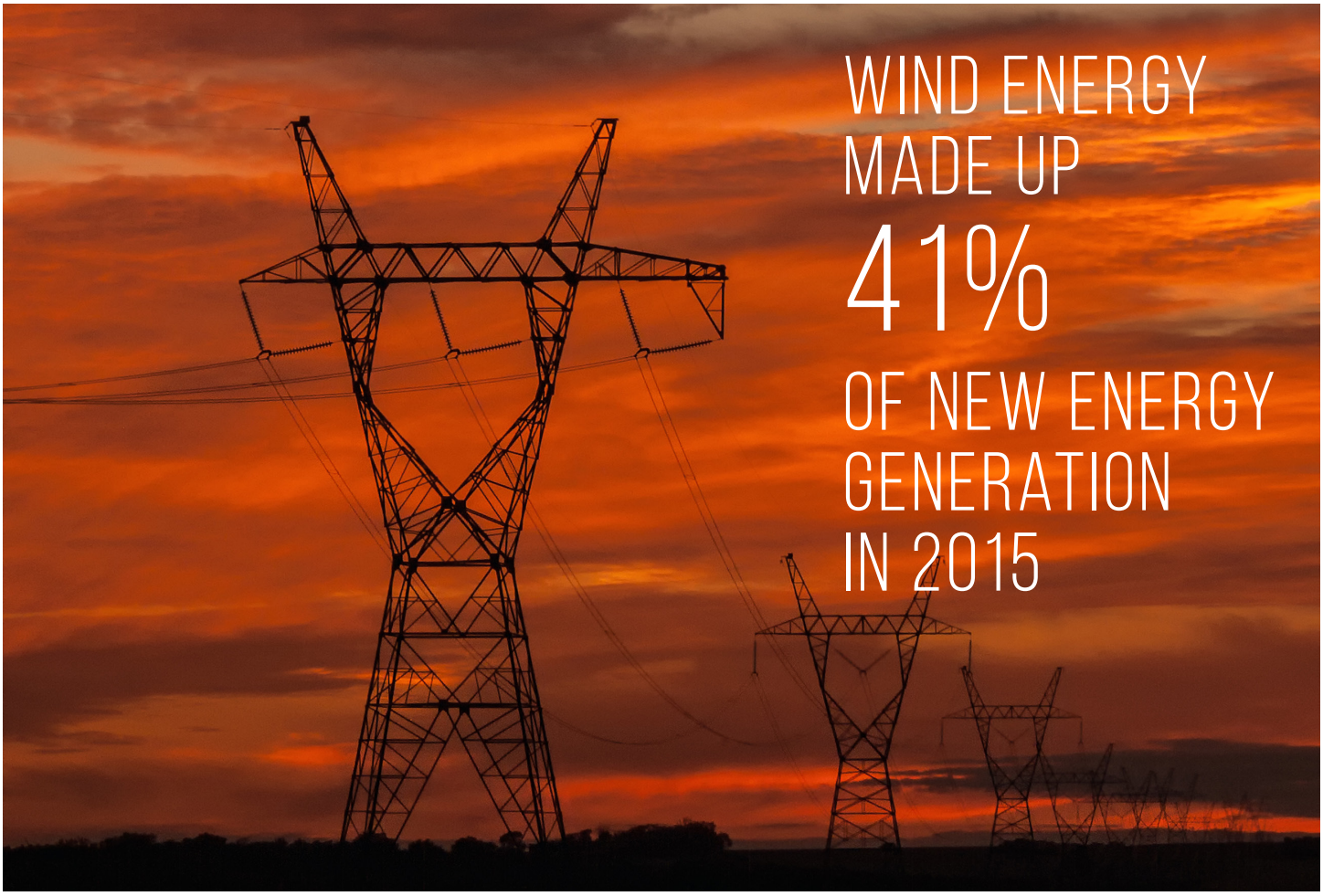

INTRODUCTION

The United States continues to develop new clean and renewable energy resources to replace aging, carbon-emitting generating facilities. Much of the new renewable energy generation can be found in lightly populated rural areas. These locations often host significant resources for renewable energy generation and provide ample space for new development, especially from wind energy.

Wind energy contributed a significant portion of new generation completed in 2015, making up 41 percent of a total 14,468 megawatts built last year[1]. Many of these new additions were located in the Midwest and Great Plains, regions of the country that boast some of the richest wind energy resources in the nation. Rural communities in these regions stand to benefit from new renewable development, as projects provide new economic activity and revenue for these areas.

Projects provide new tax revenue to rural communities and supply added income for landowners. Also, the building and operation of these facilities bring new jobs to the area. The Bureau of Labor Statistics noted that wind turbine technicians are the fastest growing profession in the country[2]. The Department of Energy estimates the wind energy industry could support up to 380,000 jobs by 2030[3], a significant increase over the

1 Walton, Robert. "Solar and wind comprise 61% of 2015 capacity additions, gas contributes 35%." Utility Dive. Jan. 11, 2016. http://www.utilitydive.com/news/solar-and-wind-comprise-61-of-2015-capacity-additions-gas-contributes-35/411813/

2 Bureau of Labor Statistics. U.S. Department of Labor. "Employment Projections - 2014-24." Dec. 8, 2015. http://www.bls.gov/news.release/pdf/ecopro.pdf

3 American Wind Energy Association. "US wind power jobs hit record, up 20 percent in 2016." April 12, 2016. http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=8736

THE WIND ENERGY INDUSTRY COULD SUPPORT UP TO 380,000 JOBS BY 2030

current 88,000 jobs[4]. However, while rural areas have significant potential to generate renewable wind energy, development has traditionally been hindered by a lack of means to transmit that power.

Without sufficient transmission, there is a limit to renewable energy development in rural places. Transmission infrastructure has been a persistent barrier to renewable energy in the Great Plains and Midwest, especially for rural areas. Electric transmission was traditionally built to service areas with sizeable populations or provide service directly to large individual generating units, leaving rural production areas without necessary transmission capacity.

Without improved electric transmission infrastructure to transport new renewable energy to market, developers are less likely to continue building renewable generation on pace with previous years. For the renewable energy industry to continue to grow, the transmission system must be updated to connect areas where projects are developed to the larger grid and to deliver renewable power to consumers.

4 U.S. Department of Energy. "Wind vision: a new era for wind power in the United States." Washington, D.C.: U.S. Department of Energy. 2015. http://www.energy.gov/sites/prod/files/WindVision_Report_final.pdf

NEED FOR TRANSMISSION

Much of the case for upgrades to the electric transmission system and more robust transmission planning is related to changes in how the nation generates electricity. This is especially true when considering the continued rise of renewable generation.

A full picture of the connection between renewable generation and transmission begins to form by examining the geographic distribution of renewable energy resources and generation. It's important to also consider existing capacity limitations of the current transmission system and the bottlenecking that can occur due to these constraints.

Additionally, it is important to consider current public policy goals that can be met by bringing new renewables onto the electric grid, the potential of widely available renewables to lower consumer energy cost, and the need for significant stakeholder engagement in the future planning of transmission expansion.

GEOGRAPHIC DISTRIBUTION OF RENEWABLES

While many communities have seen the benefits of wind and other renewable energy development, it is unclear how much new transmission capacity is required to continue growth.

It is estimated that considerable new improvements and capacity must be put in place as new renewable generation is added across a large geographic region. Wind energy offers an example – wind generation is often spread over large geographic areas, and developed in numerous locations rather than one centralized generation plant like fossil fuel-based energy resources. This distribution across a region helps to counter variability issues by accounting for different weather patterns. It also provides flexibility in our electric grid by allowing for power providers to purchase from a large pool of wind energy when it is being generated.

CAPACITY LIMITATIONS AND BOTTLENECKING

The National Renewable Energy Laboratory identified that the electric transmission system has traditionally been able to adapt to added generation, but this adaptation was due to extra capacity that was present in the transmission system.

As more renewables are developed across a broader regional area, the flexibility that was present in the electric grid becomes limited[5]. With limited transmission capacity, wind systems will have to be curtailed, limiting the amount of renewable energy available to consumers and decreasing return on investment for developers and the communities that benefit from projects.

For instance, there are currently 29,323.9 megawatts of active wind energy requests waiting in the Midcontinent Independent System Operator (MISO) Interconnection queue[6]. This bottlenecking of generation awaiting interconnection to the electric grid can have a significant effect on electric service.

A lack of investment in electric transmission and distribution capacity can lead to interruptions in service, and available resources may not be able to meet increased demand for service[7].

PUBLIC POLICY GOALS AND COST OF ENERGY

Flexibility provided by increased capacity is an important part of our power system, as it limits curtailment of renewable generation and allows developments to produce to their potential. A flexible electric grid can also keep costs low for energy consumers, as more available renewable energy on the market makes power prices more competitive on

5 Cochran, Jaquelin, Paul Denholm, Bethany Speer and Mackay Miller. "Grid integration and the carrying capacity of the U.S. grid to incorporate variable renewable energy." Golden, Colo.: National Renewable Energy Laboratory. April 2015. http://www.nrel.gov/docs/fy15osti/62607.pdf

6 Midcontinent Independent System Operator, Inc. "Interconnection Queue." 2010-2016. Web. Accessed Sept. 22, 2016. https://www.misoenergy.org/Planning/GeneratorInterconnection/Pages/InterconnectionQueue.aspx

7 Economic Development Research Group. "Failure to act: closing the infrastructure investment gap for America's economic future." Reston, Va.: American Society of Civil Engineers. 2016. http://www.infrastructurereportcard.org/wp-content/uploads/2016/05/ASCE-Failure-to-Act-Report-for-Web-5.23.16.pdf

the whole[8]. This flexibility is also essential to meet public policy goals of reducing carbon emissions from the electric sector by phasing out older carbon-intensive resources while bringing new renewable low-carbon sources online. An improved and robust electric grid will assist power providers in meeting these goals, and will possibly achieve cost savings for consumers of $47 billion annually[9].

With the introduction of the Environmental Protection Agency's Clean Power Plan, states are required to form State Implementation Plans that lay out steps to reduce carbon emissions from electric generation. While action has been deferred by a stay from the United States Supreme Court, state officials are faced with the reality that the current makeup of their generating resources will change over the next several decades.

A report from the Brattle Group noted that a more proactive and immediate approach to building a strong transmission grid will yield net savings in total generation. It will bring transmission investment cost savings ranging from $30 to $70 billion through 2030 for compliance with current regulations, as well as up to almost $50 billion in savings annually on consumers' bills in "an even more environmentally constrained future."[10]

To ensure that stakeholders have sufficient access to varied resources to meet new public policy goals, it will be essential to have an updated and robust electric grid that can connect new renewable generation to replace other resources.

8 National Renewable Energy Laboratory, University College Dublin, International Energy Agency, EPRI, Northwest Power and Conservation Council, Energinet.dk, VTT Technical Research Centre of Finland and Power System Operation Corporation. "Flexibility in 21st Century power systems." Golden, Colo.: National Renewable Energy Laboratory. May 2014. http://www.nrel.gov/docs/fy14osti/61721.pdf

9 MacDonald, Alexander E., Christopher T.M. Clack, Anneliese Alexander, Adam Dunbar, James Wilczak and Yuanfu Xie. "Future cost-competitive electricity systems and their impact on US CO_2 emissions." Nature Climate Change, 6, 526-531. Jan. 25, 2016. http://www.nature.com/nclimate/journal/v6/n5/full/nclimate2921.html

10 Chang, Judy W., and Johannes Pfeifenberger. "Well-planned electric transmission saves customer costs: improved transmission planning Is key to the transition to a carbon-constrained future." Wires and The Brattle Group. June 2016. http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Report_TransmissionPlanning_June2016.pdf

STAKEHOLDER ENGAGEMENT

As new renewable generation is planned or is prepared to come online, stakeholders must identify where updates to the grid are necessary and how much flexibility in the system is required.

Changes to the planning and cost-allocation process in the past five years – such as the Federal Energy Regulatory Commission's Order 1000[11] – have encouraged stakeholders to make a coordinated effort to plan for expansion and updates to the transmission network.

The requirement for regional planning has also been key in identifying areas of need and assessing which projects will provide the greatest benefits to the region.

IN 2011, MISO APPROVED ITS FIRST MULTI-VALUE PROJECT TO INCREASE TRANSMISSION CAPACITY & RELIABILITY

11 Federal Energy Regulatory Commission Industries. "Order No. 1000 - Transmission Planning and Cost Allocation." Aug. 25, 2016. Web. Accessed Sept. 22, 2016. http://www.ferc.gov/industries/electric/indus-act/trans-plan.asp

PLANNING AND MULTI-VALUE PROJECT PORTFOLIO

In order to address the need for new transmission infrastructure to service future renewable energy generation and reliability concerns, careful planning is required.

Identifying areas with potential for renewable development and locations where bottlenecking can occur is key to alleviating the current limitations of the electric transmission system. In an effort to address these infrastructure deficiencies, several Regional Transmission Operators have conducted planning efforts to identify where improvements and updates are needed.

In 2011, MISO – a Regional Transmission Operator consisting of over 30 transmission-owner members, and with a service territory that includes 13 midwestern states and parts of Canada – approved the first portfolio of projects identified as Multi-Value Projects (MVP). This portfolio was designed to provide value across the MISO region by meeting the need for transmission capacity for new renewable energy and addressing reliability concerns. The criteria used by MISO's board of directors for approving this portfolio are listed below[12].

- Provide benefits in excess of costs under all scenarios studied, with benefit to cost ratios ranging from 1.8 to 3.0.
- Maintain system reliability by resolving reliability violations on approximately 650 elements for more than 6,700 system conditions and mitigating 31 system instability conditions.
- Enable 41 million megawatt hours of wind energy per year to meet renewable energy mandates and goals.
- Provide an average annual value of $1.279 billion over the first 40 years of service, at an average annual revenue requirement of $624 million.
- Support a variety of generation policies by using a set of energy zones which support wind, natural gas and other fuel sources.

The cost of these upgrades are also allocated across the MISO region, meaning that customers in the region contribute to upgrades and benefit from them. This sharing of costs means that customers in any state within the region should avoid a

12 Midcontinent Independent System Operator, Inc. "Multi-value project portfolio analysis." 2010-2016. Web. Accessed Sept. 22, 2016. https://www.misoenergy.org/Planning/TransmissionExpansionPlanning/Pages/MVPAnalysis.aspx

MULTI-VALUE PROJECT STATUS AS OF QUARTER 2 2016

MVP No.	Project Name	State	Estimated In Service Date[1]		Status		Cost[1]	
			MTEP Approved	Q2 2016	State Regulatory Status	Construction	MTEP Approved	Q2 2016
1	Big Stone-Brookings	SD	2017	2017	●	Pending	226.7	226.7
2	Brookings, SD-SE Twin Cities	MN/SD	2011-2015	2013-2015	●	Complete	738.4	672.4
3	Lakefield Jct. - Winnebago-Winco-Burt area & Sheldon-Burt Area-Webster	MN/IA	2015-2016	2016-2018	●	Underway	550.4	541.1
4	Winco-Lime Creek-Emery-Black Hawk-Hazelton	IA	2015	2015-2018	●	Underway	468.6	464.3
5	N. LaCrosse-N. Madison-Cardinal (a/k/a Badger-Coulee Project) & Cardinal-Hickory Creek	WI/IA	2018-2020	2018-2023	◑	Pending	797.5	1046.1
6	Big Stone South - Ellendale	ND/SD	2019	2019	●	Pending	330.7	395.7
7	Ottumwa-Zachary	IA/MO	2017-2020	2017-2018	◑	Pending	152.3	191.9
8	Zachary-Maywood	MO	2016-2018	2016-2018	◑	Pending	112.8	153.4
9	Maywood-Herleman-Meredosia-Ipava & Meredosia-Austin	MO/IL	2016-2017	2016-2017	●	Underway	432.2	705.4
10	Austin-Pana	IL	2018	2016-2018	●	Pending	99.4	135.5
11	Pana-Faraday-Kansas-Sugar Creek	IL/IN	2018-2019	2016-2018	●	Underway	318.4	438.4
12	Reynolds-Burr Oak-Hiple	IN	2019	2019	●	Underway	271.0	388.0
13	Michigan Thumb Loop Expansion	MI	2013-2015	2012-2015	●	Complete	510.0	510.0
14	Reynolds-Greentown	IN	2018	2018	●	Pending	245.0	387.5
15	Pleasant Prairie-Zion Energy Center	WI	2014	2013	●	Complete	28.8	33.0
16	Fargo-Sandburg-Oak Grove	IL	2014-2019	2016-2018	●	Pending	199.0	219.3
17	Sidney-Rising	IL	2016	2016	●	Underway	83.2	90.6
						Totals:	***5,564***	***6,599***

State Regualtory Status Indicator Scale

- ○ Pending
- ◑ In regulatory process or partially complete
- ● Regulatory process complete or no regulatory process requirements

1. Estimates provided by constructing Transmission Owners. Costs stated in millions of nominal dollars.

significant rise in their utility bill for transmission and distribution from this portfolio. Transmission costs accounted for about 7 percent of a customer's bill at the time of portfolio approval. MISO estimated these initial costs would give way to annual savings of $996 million to $2.044 billion for production costs in the region[13].

As of the second quarter of 2016, three MVP projects have completed construction, and construction is underway for six other projects. The status of these projects is shown above in the figure.

REASSESSED IMPACT OF MULTI-VALUE PROJECTS

Analysis from the MISO Transmission Expansion Planning (MTEP) 14 Triennial MVP Review gives insight into how projections have changed since the initial assessment of the portfolio. Analysis also provides an updated view of the various benefits of the MVP portfolio[14].

13 Wolfram, Gary, Ph.D. "A brief analysis of the effects of multi-value projects in the Midwest Independent Transmission System Operator (MISO) region." June 6, 2011. Hillsdale Policy Group, Ltd. http://cleanenergy-transmission.org/wp-content/uploads/2010/02/Wolfram-Report-Final.pdf

14 Midcontinent Independent System Operator. "MTEP14 MVP Triennial Review." Midcontinent Independent System Operator. September 2014. https://www.misoenergy.org/Library/Repository/Study/Candidate%20MVP%20Analysis/MTEP14%20MVP%20Triennial%20Review%20Report.pdf

CURTAILMENT AND NEW WIND

As mentioned previously, lack of sufficient transmission capacity can lead to the curtailment of wind energy systems. Avoiding this curtailment allows these systems to produce energy in line with their potential, and allows consumers to access renewable energy from the larger region. This in turn decreases variability concerns for renewable energy resources like wind. One goal of the MVP portfolio was to limit curtailment and provide connectivity to new wind and other renewable resources developed in the region.

Updated analysis from MTEP14 found that without the MVP portfolio, 9,315 megawatts of wind in the year 2023 would be curtailed, along with an additional 1,212 megawatts of wind used to meet Renewable Portfolio Standards in the region. The analysis also showed MVPs would enable access to energy beyond the original state requirements and mandates identified when the portfolio was approved. The MTEP14 review determined that 4,335 megawatts of additional generation would be available to meet state energy mandates in 2028, when many of the requirements were set to be met or adjusted.

As states are faced with existing requirements and the likely reality of new regulations to reduce carbon emissions, access to renewable energy to meet public policy goals is essential. Combining analysis of avoided curtailment and wind enabled by MVPs, the results in MTEP14 show this portfolio would provide access to 43 million megawatt hours of renewable energy that could be used to meet public policy goals and renewable energy mandates through 2028.

FLEXIBILITY

As more utilities and power providers adopt a greater percentage of renewables into their energy mix, it is essential that the grid maintains enough flexibility to respond to the needs of stakeholders. The MVP portfolio was developed with this flexibility in mind, with attention paid to the ability of projects within the portfolio to deliver energy from a diverse range of sources in varied locations across the region.

Ensuring reliability was key in evaluating the benefits of the MVP portfolio, especially the portfolio's ability to diminish the risk of transmission system blackouts or similar events. MTEP14 noted the 2003 blackout in eastern and midwestern United States left more than 50 million people without power and had a negative economic impact between $4 and $10 billion. With the addition of projects from the MVP portfolio, the MISO region is less likely to experience a system blackout in the future.

Adding new pathways to a wide variety of resources in the region not only assists in limiting the impact of outages and other events that may affect reliability, but also aids in addressing variability concerns that relate to renewable energy generation. As wind energy generation is spread out over a wider geographic area, the average energy output from those systems tends to increase. A more robust system updated to serve new wind generation takes advantage of this quality. Therefore, it is advantageous for developers to build new wind generation in a wider range of locations, bringing the benefits of wind energy developments to more communities in the region.

ECONOMIC BENEFITS

In addition to the benefits of new wind development spurred by transmission expansion, development of new transmission itself provides benefits to local communities.

MTEP14 notes that previous review of the MVP portfolio estimated the projects could support between 17,000 and 39,800 local jobs and lead to $1.1 to $9.2 billion in local investment. As more MVPs complete construction and are put into service, a clearer picture of local economic benefits created by these projects will begin to form. Future analysis will also provide insight on the full impact of the MVP portfolio on expansion of wind development in the MISO region.

MISO IS LESS LIKELY TO EXPERIENCE A **BLACKOUT** IN THE FUTURE

Focus can be narrowed down to individual projects to get a clearer picture of local impacts of transmission expansion. One project to consider is CapX2020, a collaboration among 11 utilities that consists of several lines from the MVP portfolio in Minnesota, North Dakota, South Dakota and Wisconsin. Economic modelling conducted on CapX2020 showed several potential benefits, including $3.4 billion in construction-related sales across the four states, combined tax revenue of $149 million for the collaboration, and $1.93 for every $1 spent on the project returned to local economies due to direct and indirect spending. It was also estimated that in the peak year of construction for the project, nearly 8,000 construction and other jobs would be created or supported by the project[15].

Another example is the Thumb Loop project, a 140-mile 345-kilovolt line located in the wind-rich thumb region of Michigan. The line will add 5,000 megawatts of new capacity, allowing for new wind developed in the area to be connected to the grid and for the region to approach its maximum potential for producing energy from wind. This is significant for the state and region, as the cost of wind energy in Michigan fell to between $47 to $53 per megawatt hour, or about half the cost of coal in the state[16]. Project construction also provided direct benefits to the state, including 320 jobs supported by the line and $366 million added to local economy[17].

CONCLUSION

Although the full story of the first MVP portfolio is not yet finished, there is already evidence the portfolio will provide significant benefits to the region by the time it goes into service. An important consideration is the benefit of coordinated planning on transmission development, and the potential to bring in more stakeholders. Decentralized generating resources like wind and solar have made it even more important to carefully consider where upgrades to the transmission system will be required in the near-term.

It's also important to consider how the system should be planned to accommodate long-term changes to the way power is generated and consumed. Capturing the full range of benefits from new renewable and transmission development will require that a regional view continues to be the focus of transmission planning. This regional view will also ensure that public policy goals like increasing the role of renewable energy in meeting demand and reducing carbon emissions are achievable for states and utilities.

MVP ECONOMIC IMPACT: 17,000 TO 39,800 JOBS

ABOUT THE CENTER FOR RURAL AFFAIRS

Established in 1973, the Center for Rural Affairs is a private, nonprofit organization with a mission to establish strong rural communities, social and economic justice, environmental stewardship, and genuine opportunity for all while engaging people in decisions that affect the quality of their lives and the future of their communities.

15 University of Minnesota Duluth, Labovitz School of Business and Economics, and Bureau of Business and Economic Research. "The economic impact of constructing five electric power lines in Minnesota, North Dakota, South Dakota and Wisconsin, 2010-2015." CapX2020. November 2010. http://www.capx2020.com/projects/pdf/capx_economic_impact_study_revised_11.24.2010.pdf

16 Casey, Tina. "New 'Thumb Loop' is a big deal for wind energy." Clean Technica. May 13, 2015. https://cleantechnica.com/2015/05/13/new-thumb-loop-big-deal-wind-energy/

17 Aldridge, Chris. "Thumb's giant energy loop is complete." Huron Daily Tribune. April 20, 2016. http://www.michigansthumb.com/news/article/Thumb-s-giant-energy-loop-is-complete-7263144.php