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CHARGING FORWARD WITH NERC: AN INTERNATIONAL APPROACH TO SOLVING NORTH AMERICA'S GRID PROBLEM

Ryan Suit, Esq.*

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I. INTRODUCTION

[1] The energy grid in the United States is in need of repair.[1] The infrastructure is aging and it is time for the country to invest in new electricity generation and transmission,[2] but the United States is not in this alone. The electricity grid in the United States is connected with Canada's electricity grid.[3] In fact, Canada has historically exported five to ten percent of all of the electricity it generated to the United States.[4] Much of the electricity imported into the United States was from hydropower, as over 60% of Canada's electricity is generated from electricity-generating dams.[5] Some states in the Northeast imported this clean energy from Canada specifically to meet renewable energy requirements set forth in the Clean Power Plan (CPP).[6] However, with the CPP stayed by the Supreme Court

* Ryan Suit, Esq., earned his B.A. in economics and anthropology at the University of Virginia and earned his J.D. at the University of Richmond, T.C. Williams School of Law. He currently works as an Associate Attorney at Kalfus & Nachman, P.C. in Norfolk, Virginia.

[1] *See* GRETCHEN BAKKE, THE GRID: THE FRAYING WIRES BETWEEN AMERICANS AND OUR ENERGY FUTURE xi, xxvi–ii (2016).

[2] *See id.* at xiv ("More than 70 percent of the grid's transmission lines and transformers are twenty-five years old; add nine years to that and you have the average age of an American power plant.").

[3] *See* U.S. DEP'T ENERGY, QUADRENNIAL ENERGY REV.: ENERGY TRANSMISSION, STORAGE, AND DISTRIBUTION INFRASTRUCTURE 6-2 (Apr. 2015), https://energy.gov/sites/prod/files/2015/04/f22/QER-ALL%20FINAL_0.pdf, https://perma.cc/J2MK-CSFM.

[4] CANADIAN ELEC. ASS'N, THE NORTH AMERICAN GRID: POWERING COOPERATION ON CLEAN ENERGY & THE ENVIRONMENT 8 (2016), https://electricity.ca/wp-content/uploads/2017/05/CEA_16-086_The_North_American_E_WEB.pdf, https://perma.cc/JWL3-6SGK.

[5] *See id.* at 10.

[6] *See id.* at 11–12.

in 2016 and its future in doubt,[7] a new means of promoting the use of renewable energy to reduce greenhouse gas emissions is necessary.

[2] Conventional wisdom would assume that an electricity grid physically located within the boundaries of a country would be run by, and produce electricity for, that country. However, with the United States in need of new infrastructure for its energy grid, and both the U.S. and Canada in need of reducing their emissions to meet their stated goals,[8] now is the ideal time for the two bordering nations to work together to reduce carbon emissions by investing in an interconnected energy grid that can fully incorporate electricity generated from renewable energy resources.

[3] The legal schemas surrounding the interconnections of the electricity grid between the United States and Canada consist of numerous organizations, pieces of legislation, and treaties. Arguably the most important of the organizations is the North American Electric Reliability Corporation (NERC).[9] NERC is an international group that is overseen by the Federal Energy Regulatory Commission (FERC) and Canadian energy authorities.[10] NERC's primary responsibility is to set the reliability

[7] West Virginia v. EPA, 135 S. Ct. 1000, 1000 (U.S. Feb. 9, 2016).

[8] *See* Alessandra Potenza, *The US will need to expand its climate change plans to meet Paris Agreement goals*, THE VERGE (Sept. 26, 2016, 11:00 AM), http://www.theverge.com/2016/9/26/13035506/us-climate-change-policies-paris-accords-plan-fossil-fuels, https://perma.cc/3G8B-X342 (last visited Oct. 29, 2017).

[9] *See* NORTH AM. ELEC. RELIABILITY CORP., RELIABILITY CONSIDERATIONS FROM THE INTEGRATION OF SMART GRID i (Dec. 2010), https://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/SGTF_Report_Final.pdf, https://perma.cc/6RAW-SFZ7 (last visited Oct. 29, 2017).

[10] *See* NORTH AM. ELEC. RELIABILITY CORP., 2017 BUSINESS PLAN AND BUDGET 1 (Aug. 10, 2016), http://www.nerc.com/gov/bot/FINANCE/2017NERCBusinessPlanandBudget/NERC%202017%20BPB%20Final.pdf, https://perma.cc/BF84-ERAJ [hereinafter NERC BUSINESS PLAN].

standards for the electricity grid in both countries, but it is also responsible for overseeing regional transmission operators, conducting analyses of the grid, and ensuring the grid remains reliable in both the short term and long term.[11] Although NERC works extensively with the grid, it is not responsible for upgrading the grid with new infrastructure projects.[12]

[4] In fact, there is no single entity that has the sole authority to plan infrastructure projects on the grid in the United States and Canada.[13] This contrasts with the European Union (EU). The EU, a multinational union consisting of twenty-eight sovereign member states,[14] has a single organization in charge of streamlining grid infrastructure projects to more efficiently interconnect and upgrade Europe's grid.[15] The EU's system for upgrading its grid is superior to the way grid infrastructure is upgraded in North America.

[5] This paper will first discuss how the electricity grid works before examining what NERC does for the United States, Canada, and the electricity grids of the two countries. The paper will then explore how infrastructure upgrades, and specifically transmission projects, are undertaken in North America. Next, the paper will discuss the legal scheme the EU implements for improving its electricity grid. Ultimately, the paper will recommend that NERC needs to take on a role of streamlining grid infrastructure projects that is similar to how projects are streamlined in the

[11] *See id*. at 1–2.

[12] *See id*.

[13] *See* MATTHEW H. BROWN & RICHARD P. SEDANO, NAT'L COUNCIL ON ELEC. POLICY, ELECTRICITY TRANSMISSION: A PRIMER 11–12, 16 (June 2004).

[14] *See Countries*, EUROPA, https://europa.eu/european-union/about-eu/countries_en, https://perma.cc/88XU-76T9 (last updated Oct. 18, 2017).

[15] *See Projects of Common Interest*, EUROPA, https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest, https://perma.cc/8BB6-V5K6 (last visited Oct. 29, 2017).

EU. This legal reform will expedite infrastructure projects in the United States and Canada that will improve the grid by making it more capable of incorporating renewable energy on an international and continental scale. By improving infrastructure and incorporating more renewable energy resources for electricity generation, the United States and Canada will be able to take a major step towards reducing their greenhouse gas emissions.

II. WHAT IS THE GRID?

[6] The electricity grid in the United States and Canada is a massive web of power plants, transmission lines, and distribution centers that is regarded as "the world's largest machine."[16] The electricity grid consists of three segments: generation, transmission, and distribution.[17] Generation occurs at power plants, where most electricity is generated.[18] The electricity is then transmitted up to hundreds or even thousands of miles, through transmission lines before reaching a distribution point.[19] From the distribution point, electricity can be delivered for final consumption.[20] Seemingly simple at first, the grid is extremely complex and requires constant vigilance because of how it was stitched together over time.[21] The grid was not built in a day, nor was any plan for construction ever developed.[22] Instead, America's grid has been growing and evolving to

[16] BAKKE, *supra* note 1, at xii.

[17] JOEL B. EISEN ET AL., ENERGY, ECONOMICS, AND THE ENVIRONMENT: CASES AND MATERIALS 66 (Robert C. Clark et al. eds., 4th ed. 2015).

[18] *Id.* at 67.

[19] *See id.* at 68–9.

[20] *See id.* at 69–70.

[21] *See* MAGGIE KOERTH-BAKER, BEFORE THE LIGHTS GO OUT: CONQUERING THE ENERGY CRISIS BEFORE IT CONQUERS US 21 (2012).

[22] *See id.*

meet the electricity demand of consumers, as demand has grown over time.[23] The first grid was built in 1879 in San Francisco, and the first long-distance transmission of electricity happened in 1896 from Niagara to Buffalo, New York.[24] During the early years of the grid, inventors were still figuring out what electricity could be used for.[25] From those curious beginnings and as technology advanced, the grid expanded to eventually connect all of the United States and Canada.[26] Today, the United States electricity grid is divided into three parts: the East, the West, and Texas.[27] These sections are connected, but are mainly run independent of each other by regulatory authorities called Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), which manage the grid in different states.[28] The Canadian electricity grid is separated by province instead of RTOs.[29] Each province governs the grid that is located within its territory, but most are connected with neighboring provinces.[30] Despite the different regulatory authorities in Canada and the United States, the two nations share the infrastructure of the electricity grid.[31] To say there is a

[23] *See* BAKKE, *supra* note 1, at xiii.

[24] *See id.* at 27.

[25] *See id.* at 25.

[26] *See* U.S. DEP'T ENERGY, *supra* note 3, at S-22.

[27] *See* EISEN ET AL., *supra* note 17, at 68–9.

[28] *See* U.S. DEP'T ENERGY, UNITED STATES ELECTRICITY INDUSTRY PRIMER 13 (July 2015), https://www.energy.gov/sites/prod/files/2015/12/f28/united-states-electricity-industry-primer.pdf, https://perma.cc/J4X8-UVLK [hereinafter U.S. ELECTRICITY INDUSTRY PRIMER],.

[29] *See* Blake, Cassels & Graydon LLP, *Overview of Electricity Regulation in Canada*, 1, http://www.acc.com/_cs_upload/vl/membersonly/Article/946100_1.pdf (last visited Oct. 29, 2017).

[30] *See id.*

[31] *See* U.S. DEP'T ENERGY, *supra* note 3, at 6-2.

Canadian grid and a United States grid is to misunderstand what the "grid" really is, because the grid is fully interconnected between both countries.[32] There are over three dozen interconnections on the electricity grid between the United States and Canada.[33] Some of the major interconnections between Canada and the United States include British Columbia to Washington, Manitoba to Minnesota, Quebec to several states in the Northeast, and most recently between Alberta and Montana; but all of Canada's U.S.-bordering provinces are interconnected with states in America.[34] Another major interconnection is located near where electricity was first transmitted: on the New York-Ontario border near Niagara Falls.[35]

[7] The grid must always balance the amount of electricity being supplied with the amount being demanded.[36] If the amount of electricity being supplied does not match the amount demanded, the grid will crash.[37] A crash can result in blackouts if not enough electricity is available.[38] Alternatively, blackouts can occur if the grid must shut down to avoid an overload caused by the production of too much energy.[39] This means that our current grid requires a constant amount of electricity generation and consumption. When demand for electricity increases, which may be due to

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[32] *Id.*

[33] CANADIAN ELEC. ASS'N, *supra* note 4, at 16.

[34] *See id.* at 7.

[35] *See id.*

[36] *See* Fed. Energy Regulatory Comm'n v. Elec. Power Supply Ass'n, 136 S. Ct. 760, 768 (U.S. 2016).

[37] *See id.* at 769.

[38] *See id.*

[39] *See id.*

higher or lower use during different times of the day or different months of the year, then more electricity generation is needed.[40] The gist of the grid is this: "it is a complex just-in-time system for making, and almost instantaneously delivering, a standardized electrical current everywhere at once."[41]

III. ISSUES WITH THE GRID

[8] The grid currently faces several issues. For one, the grid is old, plain and simple. Most of the transmission infrastructure of the grid is at least twenty-five years old, and the average power plant is thirty-four years old and will need to be completely replaced by 2050.[42]

[9] The grid is also relatively inefficient. Power plants from all over the country are generating electricity that, because of the web of transmission lines, may be used by a consumer several states or provinces away.[43] Due to the distance that the electricity must travel to reach consumers, there is an average loss of 6% of the electricity generated.[44] Our grid is also not as reliable as the grids of other first-world nations.[45] A blackout in the United States occurs more often and lasts longer than blackouts in most developed

[40] *See id.*

[41] BAKKE, *supra* note 1, at 7.

[42] *See id.* at xiv.

[43] *See* Andrew Landrum, *El Niño and the Case for Microgrids*, AMERICAN SECURITY PROJECT (Oct. 8, 2015), http://www.americansecurityproject.org/el-nino-and-the-case-for-microgrids/, https://perma.cc/YVL6-PPUT (last visited Oct. 29, 2017).

[44] *See id.*

[45] *See* BAKKE, *supra* note 1, at xiv.

countries.[46] These blackouts are nothing to laugh at either. In 2003 a major blackout occurred in the Northeast.[47] One overgrown tree in Ohio plus one computer bug equaled a two-day blackout for 50 million people across eight states and Ontario.[48] That single event caused a loss of six billion dollars and created a visible dip on a graph of the U.S. GDP that year.[49] Our old grid leaves much to be desired.

[10] Arguably the most serious issue confronting the grid is the amount of carbon dioxide emissions produced by its coal-fired, and natural-gas-fueled, power plants.[50] Coal-fired power plants are the culprits for one third of all CO2 emissions in the world.[51] In the year 2014, 66.1% of the electricity consumed in the United States and 18.9% of the electricity consumed in Canada was generated by fossil fuels.[52] To Canada's credit, more than 60% of their domestic electricity was generated by clean, renewable hydropower.[53] Additionally, CO2 emissions in the United States

[46] *See id.* ("The average U.S. power outage is 120 minutes and growing, while in the rest of the industrialized world it's less than ten minutes and shrinking.").

[47] *See id.* at xv.

[48] *Id.*

[49] *See id.*

[50] *See Frequently Asked Questions: How Much Carbon Dioxide is Produced When Different Fuels are Burned?*, U.S. ENERGY INFO. ADMIN. (last reviewed June 8, 2017), https://www.eia.gov/tools/faqs/faq.php?id=73&t=11, https://perma.cc/PB23-39GQ (last visited Oct. 29, 2017).

[51] Jos G.J. Olivier et al., *Trends in Global CO2 Emissions: 2016 Report*, PBL NETHERLANDS ENVTL. ASSESSMENT AGENCY: EUROPEAN COMMISSION, JOINT RESEARCH CENTRE 14 (2016), http://edgar.jrc.ec.europa.eu/news_docs/jrc-2016-trends-in-global-co2-emissions-2016-report-103425.pdf, https://perma.cc/3D5W-7RXR (last visited Oct. 29, 2017).

[52] *See* CANADIAN ELEC. ASS'N, *supra* note 4, at 10.

[53] *See id.*

have decreased in recent years.[54] That being said, Canada and the United States are both among the top fifteen highest carbon dioxide emitting countries in the world, by volume and per capita,[55] and each country still produces more carbon dioxide emissions than they did in 1990.[56] Emissions from fossil fuels on the electric grid need to be decreased further in the United States and Canada.

[11] Carbon dioxide emission levels continue to be a problem in large part because the grid cannot incorporate renewable energy resources to produce all of its electricity.[57] This is due to the inherent variability in the amount of electricity those resources generate; solar power generation goes down if it gets cloudy or is dark, and wind power generation goes down when the wind stops blowing.[58] Because the grid evolved to meet demand, no planning was done for the future.[59] As such, the grid grew mainly with

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[54] *See* Olivier et al., *supra* note 51, at 23.

[55] *See CO2 Emissions (metric tons per capita)*, ACTUALITIX (Oct. 1, 2016), https://en.actualitix.com/country/wld/co2-emissions-per-capita.php, https://perma.cc/PR56-5J3C (last visited Oct. 29, 2017).

[56] *See* Olivier et al., *supra* note 51, at 23, 33.

[57] *See* Jon E. Jipping, *Renewable Power Future Needs Facilitative Power Grid*, RENEWABLE ENERGY WORLD (Aug. 18, 2016), http://www.renewableenergyworld.com/articles/2016/08/renewable-power-future-needs-facilitative-power-grid.html, https://perma.cc/G9LY-TVUS (last visited Oct. 29, 2017).

[58] *See* Mark P. Mills, *The Clean Power Plan Will Collide with the Incredibly Weird Physics of the Electric Grid*, FORBES (Aug. 7, 2015, 5:58 PM), https://www.forbes.com/sites/markpmills/2015/08/07/the-clean-power-plan-will-collide-with-the-incredibly-weird-physics-of-the-electric-grid/#72adf0a41e40, https://perma.cc/YV3X-BUXM (last visited Oct. 29, 2017).

[59] *See* KOERTH-BAKER, *supra* note 21, at 21.

coal, which historically was the resource most widely used to generate a constant amount of electricity.[60]

[12] Many in the industry during the early life of the grid thought electricity demand would always increase, and coal-fired power plants could be continually built to meet that demand.[61] There were never any concerns over climate change or greenhouse gas emissions, so those in the energy industry during that time did not foresee the need for renewable energy resources like wind and solar.[62]

[13] A possible solution to the grid's inability to use renewable energy sources is to upgrade the grid's transmission infrastructure. The grid must balance how much electricity is being supplied and consumed, but that amount of electricity is constrained by how much electricity can be transmitted on the grid at one time: if more electricity were to be produced and put onto the grid than can be transmitted, the grid would overload.[63] Increasing transmission capacity solves two problems. First, the raised constraint would allow more energy to be transmitted, meaning that more electricity could be produced by renewable energy resources.[64] Improved transmission would allow for the variability in the amount of electricity generated by renewable energy resources to be offset by simply having more generation from renewable energy resources elsewhere.[65] The

[60] *See* BAKKE, *supra* note 1, at xvi.

[61] *See id.* at xxvi.

[62] *See id.* at xvii.

[63] *See* BROWN & SEDANO, *supra* note 13, at 31.

[64] *See id*. at 19.

[65] *See* Puneet Kollipara, *Better Power Lines Would Help U.S. Supercharge Renewable Energy, Study Suggests*, SCIENCE (Jan. 25, 2016), http://www.sciencemag.org/news/2016/01/better-power-lines-would-help-us-supercharge-renewable-energy-study-suggests, https://perma.cc/5ET7-Z4WY.

example of a project connecting Spain and France in a following section will explain how this can occur. Second, fewer high-emission, fossil-fuel-powered power plants will need to be utilized. This will reduce carbon emissions because more renewable energy resources with low carbon emissions will be available for widespread use on the grid.[66] The sections below will show how the transmission sector works in North America, how countries in the EU are already implementing more transmission projects to improve the infrastructure of their grid, and that Canada and the United States should do the same.

IV. NERC AND THE GRID

[14] The U.S.-Canadian border is 5,525 miles long, and touches eight provinces and thirteen states.[67] The border has 37 grid interconnections across it, and between the two countries, there are approximately 450,000 miles of high voltage transmission lines.[68] The North American Electric Reliability Corporation (NERC) is responsible for the reliability of those transmission lines, for making sure there are enough power plants available to generate electricity to meet demand, and for ensuring that electricity is always available on the grid.[69] NERC is undoubtedly an organization that

[66] *See id.*

[67] *See* Dan Clavin, *Weird Facts About the Canadian Border*, WARPED SPEED, (May 10, 2016), http://www.warpedspeed.com/weird-facts-about-the-canadian-american-border/?ipp=3, https://perma.cc/S5UQ-4YHG.

[68] *See* Doug Vine, *Interconnected: Canadian and U.S. Electricity,* CENTER FOR CLIMATE AND ENERGY SOLUTIONS (Mar. 2017), https://www.c2es.org/docUploads/canada-interconnected.pdf, https://perma.cc/8YEY-XDQL.

[69] *See* NORTH AM. ELEC. RELIABILITY CORP., FREQUENTLY ASKED QUESTIONS 1 (Aug. 2013), http://www.nerc.com/AboutNERC/Documents/NERC%20FAQs%20AUG13.pdf, https://perma.cc/HCB6-4BTP [hereinafter NERC FAQ].

is critical to the reliability and security of the electric grid in both the United States and Canada.

[15] Founded in 1968, NERC is an independent group of ten to twelve trustees and hundreds of members that ensure grid reliability.[70] NERC was originally meant to develop voluntary rules and reliability standards for operation of the bulk power system.[71] The bulk power system is the entire connection of power plants and transmission lines for the United States, Canada, and Baja California in Mexico that make up the continental system of electricity generation and transmission, but does not include the local electricity facilities.[72] So, if the bulk power system were a roadway system, it would be like the country's highways, and would not include local streets.

[16] NERC also makes sure that the bulk power system has enough resources to provide electricity to customers at all times, and that electricity will be continuously delivered despite sudden or unexpected shocks to the system.[73] The reliability standards that NERC set forth were voluntary in the United States until Congress passed the Energy Policy Act of 2005.[74] The "EPAct" required that an electricity reliability organization be created to ensure and enforce reliability standards on the grid in the United States.[75] In 2006, FERC delegated NERC to be the Electric Reliability Organization (ERO) for the United States.[76] In 2007, owners, operators, and users of the

[70] *See id.* at 1, 3, 5, 6.

[71] *See id.* at 2.

[72] *See id.* at 1, 2, 5.

[73] *See id.* at 1.

[74] *See* NERC FAQ, *supra* note 69, at 2.

[75] *See* Energy Policy Act of 2005, Pub. L. No. 109-58, § 1211, 119 Stat. 594, 941.

[76] *See* N. AM. ELEC. RELIABILITY CORP., HISTORY OF NERC 4 (Aug. 2013), https://www.nerc.com/AboutNERC/Documents/History%20AUG13.pdf,

bulk power system in the United States became required by law to follow NERC's reliability standards.[77]

[17] In Canada, each province must ratify NERC's reliability standards on their own before they become official in each province.[78] However, the majority of Canadian provinces consider NERC's standards to be mandatory and enforceable, and all provinces in Canada have committed to NERC as being the ERO for Canada, and all of North America.[79] For all of the responsibilities that NERC has in maintaining the reliability of the grid's infrastructure, it does not have any authority to build new transmission infrastructure.[80] Instead, that authority is splintered between numerous organizations and levels of government in both the United States and Canada.[81]

V. NEW TRANSMISSION ON THE NORTH AMERICAN GRID

[18] There is no single organization in charge of siting transmission lines in the United States and Canada.[82] Instead, the process for building transmission lines is divided up between federal, state, and local regulators.[83] The current system aims to improve transmission, but the process is dragged through a planning and permitting gauntlet that requires

https://perma.cc/5C6L-S4Y2 (last visited Mar. 20, 2018). *See* NERC FAQ, *supra* note 69, at 3.

[77] *See* NERC FAQ, *supra* note 69, at 3.

[78] *See id.* at 6.

[79] *See id.*

[80] *See id.* at 2.

[81] *See id.* at 6.

[82] *See* Jipping, *supra* note 57.

[83] *See* BROWN & SEDANO, *supra* note 13, at 11.

the cooperation of all of the numerous parties involved.[84] If all parties do not agree, transmission projects can fall apart completely.[85] Even if the parties do agree, the process can take years, which delays new renewable energy resources from being incorporated onto the grid.[86]

[19] Transmission line projects in the United States are planned using a bottom-up approach. Such projects start with utility companies identifying a problem or shortage in transmission, and then planning with their RTO or ISO.[87] The utility company studies the costs of undertaking a new transmission project, and weighs alternative courses of action.[88] If the decision to build a new transmission line is made, then the utility company has to explore possible routes for the line to be built along.[89] Next, the utility company must get approval of the project from state and federal agencies.[90]

[20] Sometimes the utility must prove that new transmission is actually necessary via a "certificate of need."[91] Assuming the project is approved by

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[84] *See id.* at 13; Kelsey Jae Nunez, *Gridlock On The Road To Renewable Energy Development: A Discussion About The Opportunities & Risks Presented By The Modernization Requirements Of The Electricity Transmission Network*, 1 J. BUS. ENTREPRENEURSHIP & L. 137, 165 (2007).

[85] *See generally* Ill. Com. Comm'n v. Fed. Energy Reg. Comm'n, 576 F.3d 470, 473 (7th Cir. 2009) (discussing disagreement between the American Electric Power Service Corporation and the Public Utilities Commission of Ohio with PJM Interconnection regarding pricing of electricity transmission).

[86] *See* BROWN & SEDANO, *supra* note 13, at 11.

[87] *See id.* at 11, 13, 24.

[88] *See id.* at 13–15.

[89] *See id.* at 15.

[90] *See id.* at 16.

[91] BROWN & SEDANO, *supra* note 13, at 19.

all relevant government agencies, funding must then be sought and found for the project to be built.[92] In Canada, planning for transmission line projects undergoes the same type of process, but at the federal and provincial levels.[93]

[21] The slow, time-wasting process for siting transmission lines is detrimental to the grid.[94] The grid needs improved infrastructure immediately, but the current process for transmission line projects prevents that from happening.[95] The United States built only 668 miles of interstate transmission lines between 2000 and 2008, which does not do enough to connect renewable energy resources to the grid.[96]

[22] This dearth of new transmission lines can be attributed, at least in part, to the inordinate complexity of the transmission line siting process.[97] One of the problems with not building enough new transmission lines is that it can isolate renewable energy resources from the grid.[98] For example, the best place to build solar panels may be in the desert, far from population centers where electricity from the solar panels would be consumed.[99] If

[92] *See id.* at 14–15.

[93] *See* Blake, Cassels & Graydon LLP, *supra* note 29, at 1.

[94] *See* Jipping, *supra* note 57.

[95] *See id.*

[96] *See* Alexandra B. Klass, *Takings and Transmission*, 91 N.C. L. REV. 1079, 1085 (2013).

[97] *See* Nunez, *supra* note 84, at 171.

[98] *See id.* at 178.

[99] *See id.* at 163 (explaining that many areas with potential for new generation need "simultaneous development of associated transmission capacity" and further referring to the potential power sources that may be harvested should the government invest in the development of these areas).

there are not transmission lines going to the desert where the solar panels are, or if lines that do connect to the desert do not have the capacity to carry all of the electricity that the panels generate, then there is little incentive to invest in the solar panels in the first place. A lack of transmission capacity makes it difficult to transport electricity from where it is generated to where it is consumed, and this directly and negatively impacts the viability of renewable energy resources on the grid. [100]

VI. THE LEGAL SCHEME FOR EUROPE'S ELECTRICITY GRID

[23] Some believe that the U.S.-Canada grid provides an exemplar model to the rest of the world for how to operate an international grid system.[101] However, not all countries can follow their lead, especially because the North American grid mainly only connects two countries.[102] In Europe, for example, countries share borders with several other nations. European countries are now sharing their grids, too.[103] The EU is moving towards connecting the grids of its member states across the continent.[104] From solar power in Spain and Germany[105]; to wind power off the coasts of Denmark,

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[100] *See id.* at 156 (describing a situation in 2003 in which transmission capacity problems led to fifty million customers in New York and the Midwest without power).

[101] *See* CANADIAN ELEC. ASS'N, *supra* note 4, at 5.

[102] *See id.*

[103] *See* RENEWABLE ENERGY STATISTICS, EUROPA (Jan. 23, 2017), http://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics, https://perma.cc/5RER-GYXG.

[104] *See* Matt Ford, *Getting Connected: Europe's Green Energy 'Supergrid'*, CNN (Jan. 31, 2010, 6:50 PM), http://www.cnn.com/2010/TECH/science/01/26/eco.energy.grid/index.html, https://perma.cc/E5DT-73XF.

[105] *See id.*

Ireland, and the United Kingdom;[106] to hydropower reservoirs in Norway;[107] the EU is trending towards a single, interconnected grid with a heavy dose of renewable energy resources. The EU's permitting process for new grid infrastructure projects between countries "stands in stark contrast" to that of the United States and Canada.[108] The EU is facilitating new infrastructure construction by streamlining the permitting and funding processes for new projects.[109] This streamlining occurs when the European Commission (EC), which is the equivalent in the EU of the executive branch in the U.S., uses its grid-planning authority to designate infrastructure projects as Projects of Common Interest (PCIs).[110] A PCI is the label given to a project which has "a significant impact on the energy markets and market integration of at least two EU countries, boost[s] competition on energy markets and boost[s] the EU's energy security by diversifying sources, and contribute to the EU's climate and energy goals by integrating renewable[s]."[111] In order to become a PCI, a project is proposed to the EC and then assessed by authorities for its feasibility and benefits to the EU grid system.[112] Some of the benefits of a project qualifying as a PCI include "accelerated planning and permit granting, a single national authority for

[106] *See id.*

[107] Peter Fairley, *Norway Wants to Be Europe's Battery*, IEEE SPECTRUM (Oct. 21, 2014, 7:00 PM), http://spectrum.ieee.org/green-tech/wind/norway-wants-to-be-europes-battery, https://perma.cc/5RPW-DJVN.

[108] Brigham A. McCown, *An Energy (Dis)Union: Challenges and Opportunities in Europe's Emerging Energy Market*, 6 EUR. ENERGY J. 45, 52 (2016), http://www.aii.org/wp-content/uploads/2016/03/EEJ18-McCown.pdf, https://perma.cc/UNZ8-ZELZ.

[109] *See Projects of Common Interest*, *supra* note 15.

[110] *See id.*

[111] *Id.*

[112] *See id.*

obtaining permits, improved regulatory conditions, [and] lower administrative costs due to streamlined environmental assessment processes."[113]

[24] The EC has designated nearly 200 projects as PCIs to better integrate the European Energy market.[114] The PCIs are divided up by geographical areas known as priority corridors.[115] The priority corridors consist of clusters of bordering countries.[116] For example, the Northern Seas Offshore Grid consists of the U.K., Belgium, Denmark, the Netherlands, and Germany; the North-South Interconnections of Western Europe consist of Germany, Belgium, France, Spain, Portugal, and others; the North-South Interconnections in Central Eastern and South Europe consist of Austria, Italy, Germany, Bulgaria, Greece, Croatia, and more.[117] All told, there are eleven priority corridors in Europe with numerous PCIs in each.[118] Most PCIs are new international interconnections that increase transmission capacity or connect the grids of countries that had not been interconnected before, but also include energy storage projects, transformer improvements, and various other upgrades.[119] The PCIs aim to improve the EU's grid by reinforcing interconnections, increasing transmission capacity, and integrating renewable energy resources into the grid.[120]

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[113] *Id*.

[114] *See generally* Commission Regulation 2016/89, 2015 O.J. (L 19) 1 (EU) (established the framework for implementation of projects of common interest (PCIs) across the European Union).

[115] *See id.* at 1.

[116] *See id.* at 3.

[117] *See id.* at 4–5, 8.

[118] *See id.* at 19.

[119] *See* Commission Regulation 2016/89, *supra* note 114, at 3–11, 15, 18–9.

[120] *See id.*

[25] The EU is well-equipped to efficiently and cooperatively build a better, more reliable grid because it has a single entity that can coordinate planning of new infrastructure and interconnections between the grids of different countries.[121] By utilizing a system in which one organization can help promote improvements to grid infrastructure, more renewable energy sources can be used. The EC's ability to plan interconnections between neighboring countries and distant regions with transmission line projects designated as PCIs creates the potential for vast areas to be supplied with renewable energy resources.[122] These projects are not science-fiction; one study concluded that "an entirely renewable electricity supply [across Europe] is possible using current technologies."[123]

[26] In 2008, Spain and France began work on a PCI known as the Biscay Gulf Project, which involved building a new high-voltage direct current (HVDC) transmission line underground through the Pyrenees Mountains to connect the two countries.[124] After seven years of work, the underground interconnection was completed in 2015, and more than doubled the capacity

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[121] *See* Alok Jha, *Europe's Renewable Energy Supergrid*, OUR WORLD (Jan. 4, 2010), https://ourworld.unu.edu/en/europes-renewable-energy-supergrid, https://perma.cc/9EPS-FQPW.

[122] *See* Gregor Czisch, *Low Cost but Totally Renewable Electricity Supply for a Huge Supply Area: A European/Trans-European Example*, TRANSITIONAL-RENEWABLES.ORG, http://transnational-renewables.org/Gregor_Czisch/projekte/LowCostEuropElSup_revised_for_AKE_2006.pdf, https://perma.cc/BW6G-BXSE.

[123] *Id.*

[124] *See The President of the Spanish Government and the French Prime Minister inaugurate the electrical interconnection between Spain and France*, RED ELECTRICA DE ESPANA (Feb. 20, 2015), http://ree.es/en/press-office/press-release/2015/02/president-spanish-government-and-french-prime-minister-inaugurate-the-electrical-interconnection-Spain-France, https://perma.cc/YL47-ET3P [hereinafter PRESIDENT OF THE SPANISH GOVERNMENT AND THE FRENCH PRIME MINISTER].

for exchanging electricity between France and Spain.[125] The transmission line can switch the direction of the flow of electricity in a fraction of a second, which means that electricity generated in one country can be sent to the other almost instantly.[126] This means that if wind power generated in France is needed in Spain, the transmission line has the capacity to send as much electricity to Spain as Spain needs to import.[127] Alternatively, if solar power in Spain needs to be sent to France, the transmission line allows for the electricity from Spanish solar panels to be sent the other way to France.[128] Most importantly, if it gets cloudy in Spain so that Spain needs the wind power from France, the line can reverse the current direction and fulfill Spain's need for France's wind power, or vice versa, almost instantaneously.[129] The transmission line therefore allows both countries to utilize renewable energy that they would not otherwise have access to, and simultaneously makes their own renewable energy resources more viable because the problems caused by the variability of those resources, such as blackouts from changes in renewable resource output, can be completely offset.[130] By increasing the viability and potential of renewable resources, the electric interconnection between France and Spain "will allow a saving

[125] *See HVDC link between France and Spain: milestone along the road towards the single European energy market*, SIEMENS (Apr. 16, 2015), http://www.siemens.com/press/en/events/2015/energymanagement/2015-04-Inelfe.php?content[]=EM, https://perma.cc/YZB2-BL6E.

[126] *See* PRESIDENT OF THE SPANISH GOVERNMENT AND THE FRENCH PRIME MINISTER, *supra* note 124.

[127] *See id.*

[128] *See id.*

[129] *See id.*

[130] *See Electrical Interconnectors: The European Commission's Targets*, PLANETE ENERGIES (Feb. 22, 2016), http://www.planete-energies.com/en/medias/close/electrical-interconnectors-european-commission-s-targets, https://perma.cc/8FQB-LM3A.

of one million tonnes of CO2 per year."[131] More HVDC transmission line projects like this one are designated as PCIs, and are expected to be built in Europe in the near future.[132]

[27] The EU's policy for designating infrastructure projects as PCIs is a model for improving the infrastructure of a grid and interconnecting countries. This will continue to hold true as long as the EC maintains the ability to streamline projects such as the HVDC link between France and Spain by designating them as PCIs. The EC's ability to designate projects as PCIs will allow Europe's grid to be more reliable and secure, and will help the EU reach its goal of reducing CO2 emissions through the incorporation of renewable energy resources.[133] As Miguel Arias Canete, the EU climate and energy commissioner, said, "There cannot be an increase in renewables without an increase in interconnections."[134]

VII. AN INTERNATIONAL APPROACH TO NORTH AMERICA'S GRID PROBLEM

[28] The United States and Canada have a long history of reaching across their border to work together to make their shared energy grid serve the needs of the people, and the two countries share the responsibility of maintaining the grid.[135] The North American grid is in need of repair because it is old, inefficient, and creates an enormous amount of greenhouse

[131] PRESIDENT OF THE SPANISH GOVERNMENT AND THE FRENCH PRIME MINISTER, *supra* note 124.

[132] *See* Fairley, *supra* note 107.

[133] *See* Sonja van Renssen, *Where is Europe going with its grids?*, ENERGY POST WKLY. (Apr. 22, 2015), http://energypost.eu/eu-puts-grids-heart-energy-union/, https://perma.cc/43RV-HAKP.

[134] *Id.*

[135] *See* U.S. GOV'T AND GOV'T OF CAN., JOINT UNITED STATES-CANADA ELECTRIC GRID SECURITY AND RESILIENCE STRATEGY 4 (2016).

gas emissions.[136] The EU faces a similar problem with greenhouse gas emissions, but it has a single international body that streamlines grid upgrades and interconnections so that the EU can incorporate more renewable energy resources into their grid and reduce their emissions.[137]

[29] As explained above, NERC is the ERO for the United States, and sets the reliability standards for the North American grid, but it has no authority to permit new transmission infrastructure projects.[138] Building new transmission lines requires dealing with multiple groups such as electricity regulators, state and local authorities, and federal agencies, rather than a single organization with the authority to plan infrastructure projects.[139] This paper proposes that the United States and Canada need to have a single, international organization to plan infrastructure projects between the two countries, in a manner similar to that of the EC when it plans PCIs. For transmission line projects, that organization should be NERC.

[30] Some experts have claimed that North America needs a "Works Progress Administration for Energy" to solve its grid problems.[140] If such an organization existed, the bureaucratic processes that drag on and delay

[136] *See Fresh Air: Aging and Unstable, The Nation's Electrical Grid is 'The Weakest Link'*, NAT'L PUB. RADIO (Aug. 22, 2016) (Transcript available at http://www.npr.org/2016/08/22/490932307/aging-and-unstable-the-nations-electrical-grid-is-the-weakest-link, https://perma.cc/CQG7-BAK2).

[137] *See* van Renssen, *supra* note 133.

[138] *See* NERC FAQ *supra* note 69, at 2.

[139] *See* BROWN & SEDANO, *supra* note 13, at 16.

[140] Michal Moore, Professor of Energy Economics and senior fellow at the Institute for Sustainable Energy, Environment, and the Economy (ISEEE) at University of Calgary, Address at the Canada-United States Law Institute Conference: An Example of Cooperation and Common Cause: Enhancing Canada-United States Security and Prosperity Through the Great Lakes and North American Trade, Canada (Jan. 2010).

infrastructure projects on the grid could be accelerated, and the North American grid could be upgraded to better utilize renewable energy resources.[141] However, a new organization does not need to be created when an international corporation with years of expertise working on and managing the grid already exists. The next step in maintaining the grid to provide efficient, reliable, and clean electricity is to consolidate the process for new transmission line projects in the United States and Canada by turning the transmission-planning reigns over to NERC.

[31] NERC needs to have authority to site and build transmission lines. NERC's role has constantly changed since it was founded,[142] and increased authority to build transmission lines should be added to NERC's responsibilities. More transmission lines will increase investment into infrastructure projects for the grid, and will enable the grid to better incorporate renewable energy on an international and continental scale.[143] Giving authority to plan infrastructure projects between the United States and Canada to NERC will set the groundwork for both countries to invest in green energy, which will lead to the use of fewer fossil fuels, and therefore a reduction in greenhouse gas emissions.

[32] NERC already works hand in hand with authorities from Canada and the United States to manage reliability standards for the grid, and has done so since its creation in 1968.[144] In Canada, NERC works with the governments of the individual provinces to ensure that the grid maintains reliability standards.[145] In the United States, NERC works with FERC.[146]

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[141] *See* Jipping, *supra* note 57.

[142] *See* NERC FAQ, *supra* note 69, at 2.

[143] *See* Jipping, *supra* note 57.

[144] *See* NERC FAQ., *supra* note 69, at 1.

[145] *See id.* at 6.

[146] *See id.* at 3.

NERC's role has been evolving over time, and its responsibilities greatly increased when its reliability standards were made mandatory in the United States by FERC in 2006, and in Canada by the individual provinces over the past decade or so.[147] These moves were probably overdue. In the past, FERC and provincial governments ran into problems because of conflicting laws for Canadian utilities that produced and transmitted electricity to the United States.[148] For example, under the prior schema, a utility in Nova Scotia would have to jump through bureaucratic hoops to fulfill the requirements of Nova Scotian energy laws, and simultaneously to comply with FERC orders, even though FERC does not have jurisdiction over a Canadian utility.[149] This type of problem is on its way out, but the issue caused by multiple authorities regulating the grid shows that having a single authority regulate something as complicated as electricity could simplify things immensely.

[33] In order for NERC to have more authority for transmission line projects, some regulatory policies will need to be changed. For one, NERC's responsibilities will have to expand, and it will have to take on a larger role than just setting standards. NERC currently works with authorities in both the United States and Canada to oversee the grid and plan for electricity demand over the next couple of decades, but if it takes on infrastructure planning, NERC will have to work with those authorities and others to plan for the next century.[150] Second, the transmission planning authorities in the United States and Canada will have to relinquish some of their power. This means that FERC, state agencies, provincial governments, and public utilities will have less say about what transmission line projects

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[147] *See id.*at 3, 6.

[148] *See* In the Matter of the Pub. Utilities Act, 2011 CanLII 113, 7–8 (Can. N.S.U.A.R.B.), http://canlii.ca/t/fmcp5, https://perma.cc/P236-76WJ.

[149] *See id.*

[150] *See* BROWN & SEDANO, *supra* note 13, at 9, 38.

to pursue. However, that does not require all of those groups to exit the transmission process completely. In Europe, the proposed infrastructure projects are evaluated for their benefits by several groups that weigh in on whether the project is a qualified candidate for the label of PCI.[151] Likewise, all the current actors in North America would still play roles in the assessment of proposed transmission improvements.

[34] Some groups and organizations would benefit more from NERC having authority over transmission line projects than others. NERC would obviously benefit from increased power because they would have more control over the grid. Public utility companies would benefit from the ability to get permits from one organization, rather than having to appeal to state and federal authorities. Utilities would still need to propose projects to NERC to be streamlined, just as companies propose projects to the EC to be considered PCIs, but a faster process would allow utilities to build more transmission lines and increase their profits.[152] More transmission lines would mean more electricity capacity on the grid, which would benefit grid operators, like RTOs and ISOs, who would have an easier time managing the supply and demand of electricity. Most importantly, the environment would benefit from more renewable energy being used on the grid. Electricity generation from renewable energy resources would be more viable with increased HVDC transmission lines, so fossil-fuel powered power plants will not need to be relied on as much as they are now.[153] Less reliance on electricity from coal or natural gas fueled power plants will mean less carbon dioxide emissions in both the United States and Canada.[154]

[35] The groups that stand to lose the most from NERC taking on the authority of transmission line projects are those that are currently in charge.

[151] *See Projects of Common Interest*, *supra* note 15.

[152] *See* BROWN & SEDANO, *supra* note 13, at 24.

[153] *See* Jipping, *supra* note 57.

[154] *See* Olivier, *supra* note 51, at 14.

FERC would have to give up more power to NERC, and would no longer be the major party in the process. However, FERC would still be part of the project assessment process. RTOs, ISOs, and state and provincial authorities would also lose say in transmission projects. RTOs and ISOs have a lot of input into transmission projects, and used to be able to veto such projects, even if they were recommended by FERC.[155] States essentially have veto power over new transmission line projects that do not have certificates of need and can take them down single-handedly.[156] Increasing NERC's power would decrease the power of regional grid operators and individual states and provinces. However, the issues facing the North American grid need to be resolved, and the gains the entire grid could make outweigh the losses of single states.

[36] Giving NERC the authority to permit and streamline transmission projects for the grid would yield extensive benefits. In addition to solving issues that our grid already has, NERC's increased authority would come with other valuable gains for the economy and the environment. If NERC were given the power and authority to choose projects to pursue to improve the grid, the United States and Canada would be greatly rewarded. NERC would be able to increase HVDC transmission on the grid so that renewable energy resources would be the main source of electricity generation for North America, and NERC would be able to plan projects to increase the transmission capacity in North America. More transmission capacity makes electricity generation from renewable energy resources more viable, and more renewable energy resources being used means less dependence on fossil fuels, so carbon dioxide emissions from power plants would be greatly reduced.[157] Another benefit to improving the grid is that consumers

[155] *See* U.S. ELECTRICITY INDUSTRY PRIMER, *supra* note 28, at 25.

[156] *See* John S. Moot, *When Should the FERC Defer to the NERC?*, 31 ENERGY L.J. 317, 321 (2010).

[157] *See generally* THE NAT'L ACADEMIC PRESS, ELECTRICITY FROM RENEWABLE RESOURCES: STATUS, PROSPECTS, AND IMPEDIMENTS (2010) (discussing the 2007 study on "America's Energy Future" and the report on electricity and renewable resources).

would see lower electricity costs because there would be larger economies of scale, which leads to a more competitive market for electricity.[158] NERC's ability to plan grid infrastructure projects would ideally lead to more investment in renewable energy generation projects. Investment into those projects would improve renewable energy technology, and renewable resources such as wind and solar power would become increasingly viable.[159] An important issue is where the financing for investment into new infrastructure projects would come from. NERC could designate projects as a PCI, but that does not immediately create funding for a project. In the EU, PCIs have access to a €5.35 billion ($5.8 billion) fund from an organization that promotes infrastructure upgrades in Europe.[160] PCIs in North America would need something similar to bring the projects to life. Transmission is the least lucrative part of the grid, but this has not prevented some private actors from investing in international transmission lines.[161] Ideally, the governments of the United States and Canada would find a way to fund new transmission projects. There is a "chicken and egg" problem with transmission, as new transmission will not be built without a need to serve new generation, but new generation will not be built if there is not enough transmission.[162] If the government funds transmission projects, then

[158] *See* Nunez, *supra* note 84, at 142–43.

[159] *See* Int'l Renewable Energy Agency*, Smart Grids and Renewables: A Guide for Effective Deployment, International Renewable Energy Agency* 12 (Int'l Renewable Energy Agency, Working Paper 2013).

[160] *Projects of Common Interest*, *supra* note 15.

[161] *See* Bill Foote, *Will This Merchant Transmission Investment Pay Off?*, THE MOTLEY FOOL (Nov. 18, 2013, 1:18 PM), https://www.fool.com/investing/general/2013/11/18/montana-alberta-tie-line-merchant-transmission-inv.aspx, https://perma.cc/F7HL-DXBN.

[162] *See* Gene Wolf, *New Renewables Will Require Transmission Upgrades*, T&D WORLD (July 31, 2014), http://www.tdworld.com/renewables/new-renewables-will-require-transmission-upgrades, https://perma.cc/3RU2-Y2EY.

investments into renewable energy resource electricity generation would likely increase.[163]

[37] Down the line, giving authority to NERC to create infrastructure projects will set a precedent for more collaboration between North American countries. This will allow for a better grid with more reliability, and would lay the foundation for Mexico to be tied into the world's largest machine, too. Now is actually a good time to incorporate Mexico's grid, and its renewable energy resources, because Mexico is undergoing huge changes in its energy market, creating more opportunities for solar and wind power.[164] Eventually, with eyes set far enough into the future, investing in a more interconnected and higher-capacity grid could lead towards a global supergrid.[165] A supergrid could allow a country anywhere in the world to utilize renewable energy resources from anywhere else in the world.[166] This project is, of course, something that would take investment by most nations across the entire world,[167] but we cannot connect the globe without first interconnecting individual continents.

[38] NERC will need full recognition and commitment from the United States and Canada to reduce greenhouse gases or improve the grid. The

[163] *See* Kerry Schlichting, *Advanced Research Projects Agency-Energy Spurs Innovation and Market Growth*, PEW CHARITABLE TR., 9, 11–13 (2015), http://www.pewtrusts.org/~/media/assets/2015/02/cleanenergy_combined_fact_sheets.pdf?la=en, https://perma.cc/5C7C-7SHC.

[164] *See* Claudia Salgado, *Mexico - Renewable Energy*, INT'L TRADE ADMIN. (Sept. 16, 2017), https://www.export.gov/article?id=Mexico-Renewable-Energy, https://perma.cc/5SYE-X56G.

[165] *See* Clark W. Gellings, *Let's Build a Global Power Grid*, IEEE SPECTRUM (July 28, 2015, 11:00 AM), http://www.spectrum.ieee.org/energy/the-smarter-grid/lets-build-a-global-power-grid, https://perma.cc/V8JM-G8EA.

[166] *See id.*

[167] *See id.*

underlying reason for investment into the grid, and the warrant for NERC to take on a role in planning and streamlining infrastructure projects, is that the grid can be improved.[168] Whether they support reducing emissions, increasing reliability to consumers, or just improving for improvement's sake, the United States and Canada need to be on board with NERC's authority to plan transmission lines so that more renewable energy resources can be implemented on the grid for the purpose of decreasing carbon dioxide emissions.

VIII. CONCLUSION

[39] For the reasons stated above, NERC needs to take on the premier planning role for transmission line projects in and between the United States and Canada. If NERC becomes an authority that can streamline projects in a manner similar to that of the European Commission planning PCIs, then the North American grid will greatly benefit. By giving NERC this authority, more transmission line projects will be built, which will improve the infrastructure of a grid desperate for upgrades.[169] Improving the grid's infrastructure, specifically with HVDC transmission lines, will allow for more renewable energy resources to be used for electricity generation.[170] With new transmission and more renewable energy resources on the grid, the United States and Canada will be able to decrease their reliance on fossil fuels for electricity generation, and both countries will be able to lower their greenhouse gas emissions.

[168] *See id.*

[169] *See* U.S. DEP'T OF ENERGY: OFFICE OF ELEC. RELIABILITY & ENERGY RELIABILITY, GRID MODERNIZATION AND THE SMART GRID, https://energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid, https://perma.cc/ZJ8P-HN4W.

[170] *See id.*