AI AND TRANSMISSION LINES: BOLSTERING AMERICA'S ENERGY GRID WITH RENEWABLES

Creating a better energy future with AI

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Introduction

Hotter summers, colder winters, and unpredictable storms with unparalleled levels of strength– the climate change crisis is here. If greenhouse gas emissions continue to rise as expected, frequent natural disasters with never-before-seen levels of destruction will occur and dramatically change Earth's topography. A report from the World Health Organization (WHO) indicated that between 2030 and 2050, climate change will cause an additional 250,000 deaths per year.[1] To prevent unprecedented natural disasters and save lives, the Intergovernmental Panel on Climate Change (IPCC) concluded greenhouse gas emissions need to be decreased by 45% by 2030.[2] The United States accounts for 20% of all greenhouse gas emissions,[3] and America should take a leading role in combating climate change by quickly shifting to renewable energy sources.

To address Americans' concerns regarding climate change, President Biden has promulgated an energy agenda which aims to reduce greenhouse gas emissions by 65% by 2030. Through legislation like the Inflation Reduction Act (IRA), which provides a litany of tax incentives and grants to businesses and states that invest in clean energy technologies, President Biden hopes to steer the domestic economy away from fossil fuels and towards clean energy.[4] However, because America lacks a robust interstate electrical transmission network, which can carry energy from renewable sources across the country, many cities and states are still burning fossil fuels to keep providing power to their citizens. Renewable sources of energy like solar panels, hydroelectric dams, and wind turbines tend to be built in sparsely populated areas, but the largest demand for energy is in urban localities. Interstate transmission lines can transport energy from renewable sources to large cities where it is needed, but to meet the clean energy demands proposed by President Biden and significantly curtail greenhouse gas emission by 2030, the United States will need to construct 47,300 miles of additional transmission lines.

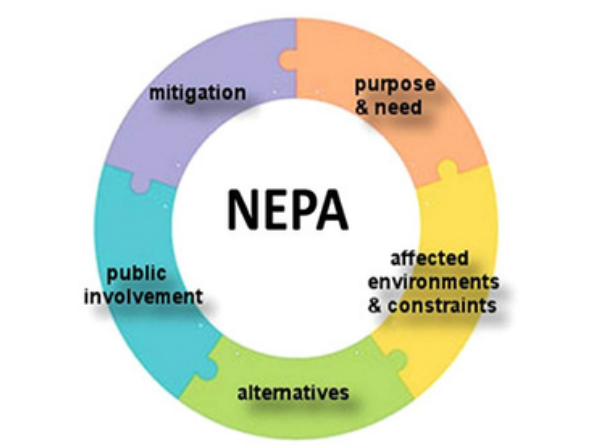
Long Review Times

Currently, the process of constructing an interstate transmission line can be extremely time-consuming. Electrical companies erecting interstate transmission lines often want to build on federal lands because they will not have to navigate multiple states' permitting processes. This means that electrical companies will be working with the Bureau of Land Management to gain a National Environmental Policy Act (NEPA) permit for their interstate transmission line projects. To be granted a NEPA permit, BLM must conduct an extensive environmental review on the federal lands where the transmission line will be built, and the average time it takes BLM to complete environmental reviews is five years.[5]

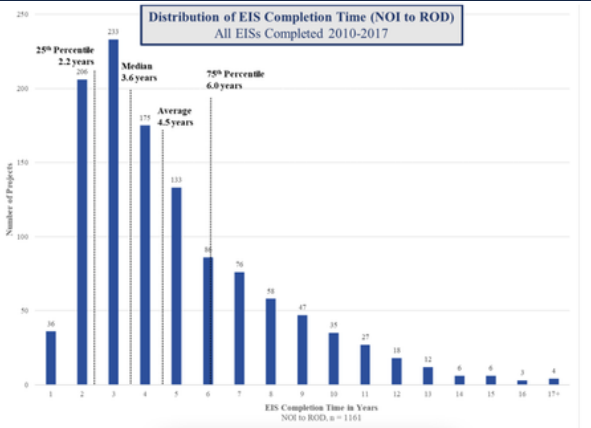
But it can take much longer than this for BLM to complete an environmental review and issue a NEPA permit. For example, Idaho Power, an electrical power utility company in the northwest, began navigating the permitting process for the construction of a 290-mile interstate transmission line in 2008; but BLM did not issue a NEPA permit for the line until 2017 when the environmental review was completed. This project would have shifted Idaho away from fossil fuels earlier than 2017, but a lengthy review process meant renewable energy could not be used for almost a decade in the state. If greenhouse gas emissions are not reduced by 2030, natural disasters will become more frequent, so it is imperative that BLM reduces the amount of time it takes to complete environmental reviews so transmission lines can carry more renewable energy across the country.

Policy Solution

The solution to these exceedingly long environmental reviews is the use of AI technology. When conducting an environmental review, agencies must prepare an Environmental Impact Statement (EIS) which includes a review of impacts to threatened or endangered species. Because of robust datasets from satellites, drones, and automatic cameras/sensors, scientists have detailed information about species population size, but currently, people have to examine these extremely large datasets. AI technology can be used to sift through this data quickly and make decisions about whether species in an area are threatened or endangered.



Taken from U.S. Department of Interior



Taken from Council on Environmental Quality

Bolstering Energy Grid

In addition to constructing new lines, AI can be used to help create a more resilient electrical grid. As weather disruptions start to become more frequent and the energy grid struggles to stay operational, the quick processing times of AI can be used to keep power flowing to consumers. Most utility providers currently use methods of fault detection that require humans to analyze threats to existing transmission lines. Machine learning algorithms could be used to quickly calculate the frequency and transient voltage of transmission lines to create less downtime for maintenance.[6]

AI can also be utilized to ensure equal distribution of energy to further aid in grid resilience, as many issues with the energy grid can be attributed to the complexity of the constantly expanding modern energy grid.[7] When these weather events occur, these crucial innovations must be utilized to create a fast, efficient, and fair allocation of energy that is delivered to the public.

Closing Remarks

Forward thinking with artificial intelligence can lessen the burden of the expanding energy grid in two ways. First, as computational power increases and AI models are able to withstand more inputs, understanding the energy grid and possible disruptions will become easier to predict and aid. The Oak Ridge National Laboratory has already set to the task of utilizing AI and supercomputers by being the first to utilize a computer capable of 1 quintillion operations per second to model and test energy grid disruption contingency plans.[8] Second, as many homes and businesses shift to producing their own energy via solar or wind, it becomes imperative that AI is implemented to help manage and predict energy usage in what has now become known as "the smart grid." The smart grid, defined as a "network that integrates energy distribution and digital communication technology in a two-way flow of electricity and data," utilizes AI in various different ways that a human operator and current computation models can not.[9] With regards to energy transmission, data meters have been improved with AI in order to give operators and customers advanced warning in the event of an impending outage.

As the climate crisis continues to impact our daily lives, both directly and indirectly, new methods must be developed and implemented to solve these new issues.

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