

Solar in the Shadows: Expanding Access to Clean Energy in Forgotten America

Authors:

Laura Zapata, Clearloop Corporation

Henry Richardson, WattTime

Joey James, Downstream Strategies

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Contact: hello@clearloop.us

Executive Summary:

Voluntary corporate investment in renewable energy has been a powerful force in decarbonizing our electricity grid and reducing greenhouse gas emissions in the fight against climate change. However, limits in the options available to companies has resulted in the majority of this investment being concentrated in certain parts of the country—leaving entire communities behind from experiencing a clean energy revolution.

By shifting the focus of corporate investments in renewable energy to regions of the country with disproportionately carbon-intense electricity production (i.e., dirty grids), we can achieve deeper, faster emissions reductions per installed MW capacity, bring good-paying clean energy jobs, and spur economic investment in regions of the country that vitally need them.

In the absence of federal government action, the private sector has been at the forefront of climate action and this paper is intended to highlight more tools to help them fight against climate change.

We are releasing research that maps out the American communities getting left behind from decarbonization efforts as the most fertile ground to support innovative ways to spur new clean energy infrastructure investments. We hope the maps we are sharing, help illustrate for other innovators the best places in the country to build new clean energy capacity by overlaying two simple factors—the solar potential across the country and the marginal CO2 emissions of the grid.

With companies looking to build a cleaner economy in the wake of COVID-19, there is a great opportunity for more innovators like Clearloop to help disrupt the carbon and clean energy markets by opening it up to investments from businesses of all sizes with a focused goal: decarbonizing our grid and expanding equitable access to clean energy across our country.

Introduction

The science is clear on climate change and it is not hard to go outside to experience this crisis for ourselves: record heat, wildfires, hurricanes, and flooding are leading to destruction, famine, and continued health and economic disparities. We all know what we need to do to end our climate crisis: slash greenhouse gases (GHGs) at scale. This is within reach. The top polluters in our economy—the transportation and power sectors—have the technology to help us decarbonize at scale. The electrification of our cars, trucks, and even scooters, will continue to place even more emphasis on the power sector, as the two will go hand in hand. But as the U.S. economy decarbonizes, many cleantech solutions—including new renewable energy projects—are benefiting some communities and states while overlooking others.

This paper is intended to showcase the great potential that exists in the communities that are often left behind to not only clean up our grid and reduce GHG, but invest in the forgotten places with new clean energy infrastructure.

Clear need for accelerating the greening of the grid

Our power sector is still responsible for more than a quarter of the country's carbon footprint because 63% of the electricity in the country is generated by carbon-heavy fossil fuels like coal and, increasingly, is dominated by natural gas.¹ The good news is that U.S. renewable energy generation surpassed coal for the first time in over 130 years in 2019,² so we're making measurable progress on cleaning up the coal from our electricity grid.

However, studies show that although annual emissions from power plants decreased by 24% between 2000 and 2018, committed emissions decreased by only 12%, as coal plants at the end of their operating lifetime were replaced by new gas plants with long operating lifetimes.³ This means that even as the transportation sector overtook the power sector in carbon emissions intensity in recent years, the power sector's emissions reductions were primarily driven by transitioning from one fossil fuel (coal) to another (natural gas) and those new natural gas plants are set to be operational for a long time.

We need clean energy capacity to catch up even faster. Despite the 100%+ growth in renewable energy from 2000 to 2018 in the United States, only 8% of the electricity consumed in the United States comes from wind and solar power, with less than 2% of electricity produced from solar power.³ Essentially, while we should celebrate the uptick of renewable energy sources powering our electricity grid, we have a long way to go to replace the increased number of new natural gas plants and stop burning fossil fuels for electricity.

¹ "Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA)," Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA), accessed September 13, 2020, <https://www.eia.gov/tools/faqs/faq.php?id=427>.

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<https://www.eia.gov/todayinenergy/detail.php?id=43895#:~:text=May%2028%2C%202020-,U.S.%20renewable%20energy%20consumption%20surpasses%20coal%20for,time%20in%20over%20130%20years&text=In%202019%2C%20U.S.%20coal%20consumption,the%20lowest%20level%20since%201964.>

³"Renewable Energy," Center for Climate and Energy Solutions, April 27, 2020, <https://www.c2es.org/content/renewable-energy/>.

Fortunately, the sun is the most abundant renewable resource across the country and we have continued improving technology to harness it. In order to meet the IPCC's report on the latest science in climate change, the United States will need to accelerate the greening of the grid and will need help from the private sector to get it done.

Options for decarbonizing the grid are limited

In the United States, private enterprise is at the forefront of the battle against climate change, investing in a record number of renewable energy deals. Over the past decade, major companies have worked alongside utilities and independent power producers to pioneer financing mechanisms to build new clean energy capacity across the country. They successfully proved that there is demand for more clean energy sources.

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Many companies have found that investing in solar panels, whether for their roofs or on their campus, is not only a cleaner way to take care of their electricity needs, but it's also a money saver. Right when demand for electricity is higher is often when the sun is shining the brightest and those panels are most at work—shaving off hundreds of dollars from a company's utility bills every month. However, there are both some physical (not enough real estate, etc.), as well as bureaucratic limits to how much a company can invest in on-site solar projects.

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Although unbundled Renewable Energy Certificates (RECs) account for the majority of green power sales, it's commonly understood today that purchasing unbundled RECs does not incent new renewable energy capacity to be built. Corporate purchasing of unbundled RECs has sometimes been criticized as "greenwashing," because every REC does not have the same carbon emissions reduction value. That is why the market for leading corporations looking for impact is moving to more direct renewable energy engagement models.⁴

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The most common and effective approach for leading corporations has been to sign Power Purchase Agreements (PPAs) with electric utilities and independent power producers. These PPAs are long-term agreements where a company commits to purchase power at an agreed-upon rate for 10 to 30 years. A power producer can then take that agreement and use it as the basis for securing the financing to build a project. In 2019, thanks to this financing structure, companies signed a record number of contracts to build 13.6 GW nameplate capacity of renewable energy, which would represent roughly 1% of electricity generation at 2019 levels when it comes online.⁵

⁴ O'Shaughnessy, Eric, Jenny Heeter, and Jenny Sauer. 2018. Status and Trends in the U.S. Voluntary Green Power Market: 2017 Data. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-72204. <https://www.nrel.gov/docs/fy19osti/72204.pdf>

⁵ "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis," New electric generating capacity in 2020 will come primarily from wind and solar - Today in Energy - U.S. Energy Information Administration (EIA), accessed September 14, 2020, <https://www.eia.gov/todayinenergy/detail.php?id=42495>.

Leveraging the private sector to help decarbonize the grid is working, which means we have to ensure we have more ways to lean into these efforts and help spur more innovation to address their limitations.

The case for expanding the clean energy market to more companies and geographies

How can we expand the clean energy market to more companies and geographies?

One of the limitations to building more clean energy capacity is that the market for financing these projects relies heavily on wealthy companies with sophisticated finance teams that are willing and able to sign long-term agreements to purchase power. Bloomberg estimates that worldwide, only about 100 corporations entered into PPAs in 2019.⁶ For every Amazon, Facebook, Microsoft, or Google driving this development, there are thousands of corporations who want to help but don't have the right risk profile to make PPAs work well.

For the PPA approach to work, the purchaser of the power must be willing to enter into a long-term agreement, with implications for its financial statements and capacity to undertake other financings needed for its business. Although there have been some recent efforts to aggregate smaller companies into these long-term virtual power deals, these complicated financial structures primarily serve a group of top-tier corporations.

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As more renewable energy projects are built, we've seen other structural constraints driving them to be built in specific parts of the country. Although solar projects have been growing quickly in the United States, this growth has not been distributed equally across the country. Nor has the growth been necessarily proportional to the amount of solar irradiance across the country.

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Of course, the availability of the resource—like wind and sun—is fundamental to building more renewable energy infrastructure to create electricity. Wind projects have grown rapidly in the country's wind belt. However, even though the sun is the most available resource across our entire country, solar projects are not following this pattern. Ironically, the "Sun Belt" of the United States has some of the lowest penetration of solar energy capacity.

There is not a linear correlation between potential solar electricity generation and the actual utility-scale solar capacity of a state. This means that solar development is not based on a state's potential to produce power, but on other factors.

When digging into this startling fact a little further, we get an even clearer picture of how lopsided the clean energy revolution in our country really is and why we need new and better ways to invest in new clean energy infrastructure that takes advantage of the sun's abundant resources.

⁶ "Corporate Clean Energy Buying Leapt 44% in 2019, Sets New Record," BloombergNEF, January 28, 2020, <https://about.bnef.com/blog/corporate-clean-energy-buying-leapt-44-in-2019-sets-new-record/>.

There is a lopsided clean energy revolution in the United States

Today, more than 85% of solar development in the United States is concentrated in 10 states, including some common-sense sunny states like California, Nevada, and Texas, but also some of the top solar producers are unusual states like Massachusetts, Minnesota, and New Jersey.⁷ What's driving this uptake in new clean energy capacity is not the availability of the sun for electricity generation, but rather structural incentives—like regulations or an open wholesale electricity market—that make it easier for companies to invest in clean energy infrastructure.

This is particularly evident in the Southeast, as the region is dominated by regulated utilities and there is no competitive market place to incentivize the construction of more renewable energy capacity. The Renewable Energy Buyers Alliance (REBA) recently illustrated the point that these regions of the country are getting left behind by putting it this way, "80% of contracts to add new renewables to the system by large energy buyers have been in organized competitive wholesale markets."⁸

American communities getting left behind without access to clean energy

The PPA financing model works best in an unregulated power market where the wholesale price of energy is high and developers are more likely to build with more incentives. This introduces a structural barrier because the majority of the country has a regulated electric grid. That means that new clean energy development has been concentrated in certain parts of the country, leaving entire regions behind, like the Tennessee Valley, which was home to the country's largest electrification efforts following the Great Depression.

These limitations mean that clean energy infrastructure is not being built to keep the pace with the decarbonization efforts necessary to defeat climate change. To put the acute need into context, if the Southeast states were a country, they alone would be the 6th largest polluter in the world.⁹ We can't afford to leave any community behind.

As REBA put it so clearly in a recent report, "transitioning away from dirty fossil fuels is not just a question of fair competition for clean energy power providers, it's a matter of justice for communities disproportionately burdened by pollution."¹⁰

Mapping out the Communities Getting Left Behind As Best Opportunities for Investment

⁷ EIA. Detailed State Data. Net Generation by State by Type of Producer by Energy Source, 2018 (EIA-906, EIA-920, and EIA-923)1, <https://www.eia.gov/electricity/data/state/>

⁸ Energy Innovation, "To Rid The Grid Of Coal, The Southeast U.S. Needs A Competitive Wholesale Electricity Market," Energy Central, September 4, 2020, <https://energycentral.com/c/ec/rid-grid-coal-southeast-us-needs-competitive-wholesale-electricity-market>.

⁹ Vandenbergh, M.P. & Gilligan, J.M.. (2017). Beyond politics: The private governance response to climate change. 10.1017/9781316848555.

¹⁰ Energy Innovation: Policy and Technology, "To Rid The Grid Of Coal, The Southeast U.S. Needs A Competitive Wholesale Electricity Market," Forbes (Forbes, August 28, 2020), <https://www-forbes-com.cdn.ampproject.org/c/s/www.forbes.com/sites/energyinnovation/2020/08/25/southeaster-n-us-competitive-electricity-market-could-save-384-billion-spur-massive-clean-energy-growth-create-400000-new-jobs/amp/>.

The uneven distribution of clean energy projects across the country means that the environmental and health impact of flipping on the lights are starkly different depending on where in the country you live.¹¹ Given that the driving force behind building more renewable energy capacity in the United States is to reduce greenhouse gases and decarbonize our grid, it makes sense to measure the carbon emissions from our electricity grid more closely to understand where the greatest opportunity for reductions exist.

Embracing Emissionality for Equitable Access to Clean Energy

WattTime has introduced a new quantitative concept to help measure the positive impact a new clean energy investment can have on carbon emissions reductions: emissionality.

The idea is straightforward: Although renewable energy itself is emissions-free, *where* such projects get built greatly influences their true net impact on overall grid emissions—because it matters what existing generation they’re displacing. For example, yet another wind farm in a region of the country already saturated with—and perhaps even curtailing surplus—wind energy isn’t going to reduce total electricity sector emissions as much as a solar farm built in a region of the country where its output will displace coal-fired electricity.

According to WattTime’s research, using the practice of emissionality when citing new renewables projects can help us avoid up to 380 percent more greenhouse gas emissions.¹²

¹¹ Kyle Siler-Evans et al., “Regional Variations in the Health, Environmental, and Climate Benefits of Wind and Solar Generation,” PNAS (National Academy of Sciences, July 16, 2013), <https://www.pnas.org/content/110/29/11768>.

¹² Richardson, H. (2019, October 21). Could 'Emissionality' Be the Next Big Thing to Disrupt Corporate Sustainability and Renewable Energy Procurement?. *WattTime*<https://www.watttime.org/news/could-emissionality-be-the-next-big-thing-to-disrupt-corporate-sustainability-and-renewable-energy-procurement/>.

Turning on the lights has a different measurable environmental impact depending one where you do it

There is a wealth of research in scholarly articles that have figured out how to measure the avoided emissions of a renewable energy project. They conclude that “the avoided emissions resulting from an intervention in the electricity system will depend on the generators that are displaced, which vary depending on the timing and location of the intervention. Marginal emissions factors give a consistent metric for assessing avoided emissions”¹³. In other words, looking only at the generation of a renewable project does not take into account the real-world emissions impacts of the project. By applying the marginal emissions rates to a potential project’s generation, a project developer can get the full picture of impact and pick a location that optimizes for emissions reduction, while holding financial returns and other decision making factors constant. Even without realtime, temporal data, you can start getting a picture of the most fertile ground for carbon reductions in the grid by looking at the annual marginal emissions rates by eGRID region.

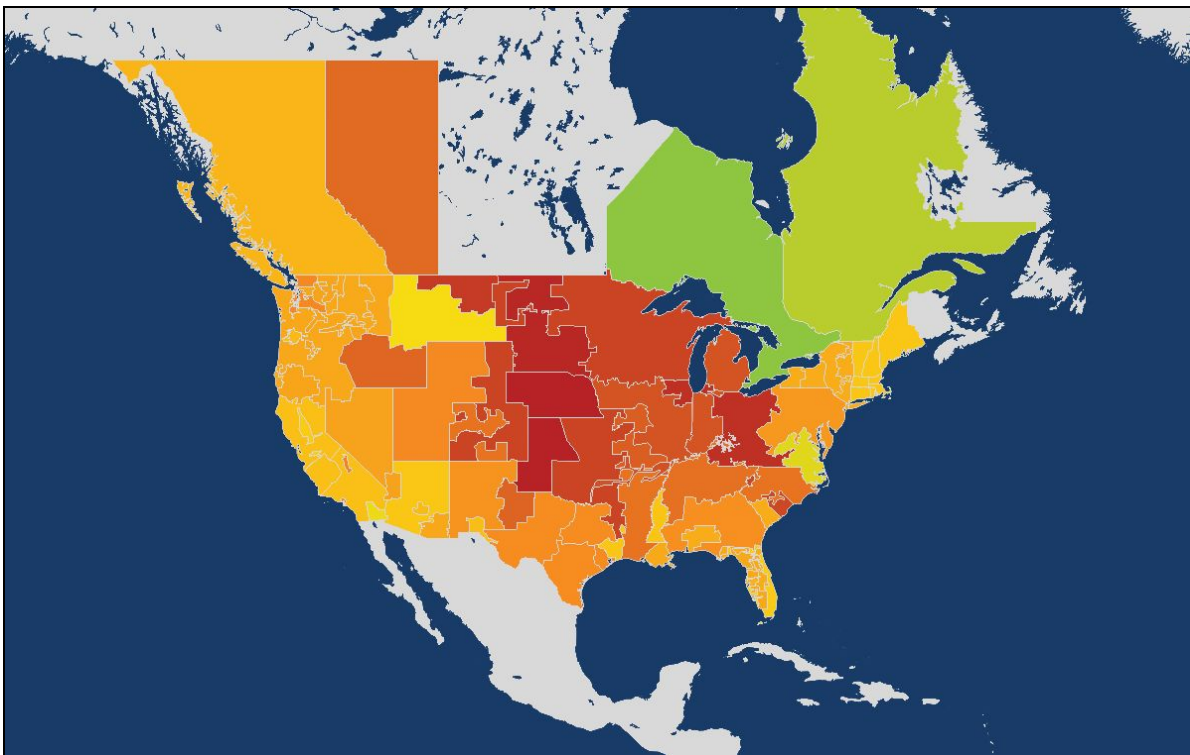


Figure 2. Snapshot of marginal emissions by electric grid, provided by WattTime. Emissions change as often as every 5-minutes. The emissions intensity here is shown within a colored range, low in green to high in red. interval

¹³ Kyle Siler-Evans, Inês Lima Azevedo, and M. Granger Morgan, “Marginal Emissions Factors for the U.S. Electricity System”, *Environmental Science & Technology* 2012 46 (9), 4742-4748 DOI: 10.1021/es300145v

Harnessing the sunshine across the country

Maximizing greenhouse gas reduction based on fossil fuel displacement is one part of the equation. Another is recognizing the generation capability of a project based on natural climate and environment factors. The National Renewable Energy Laboratory (NREL) has mapped out the solar potential across the country and even built a tool that estimates the potential electricity output for a particular solar energy system in a particular location.

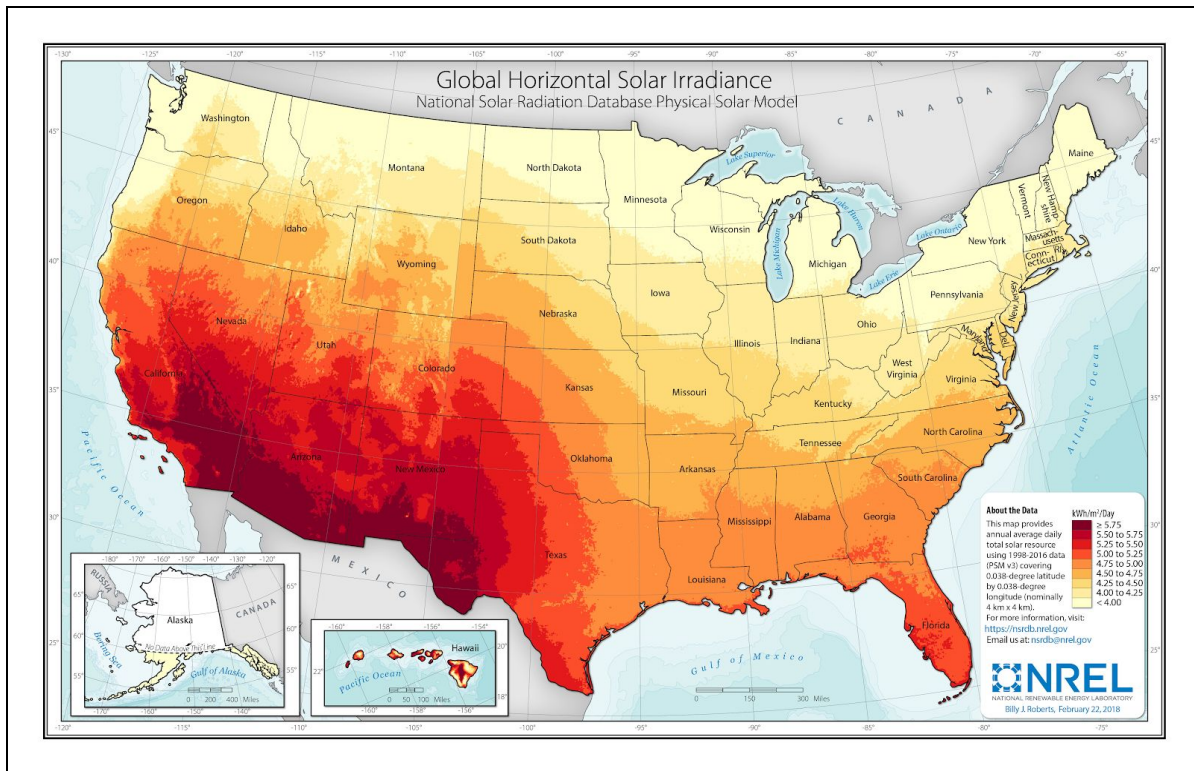


Figure 3. Map of solar power production potential across the U.S., showing that the Southeast, from Texas to Virginia, receives roughly the same amount of solar radiation. Credit: NREL

Pioneering innovative clean energy financing models and charting investment opportunities

We overlaid these two measurable factors—grid emission dirtiness and solar potential—to map out the best targets to build new solar capacity in the United States. Building on the thesis that we need more investment in clean energy capacity to clean up our grid, we're illustrating that the communities that are getting left behind today have the greatest potential for investment in new clean energy infrastructure.

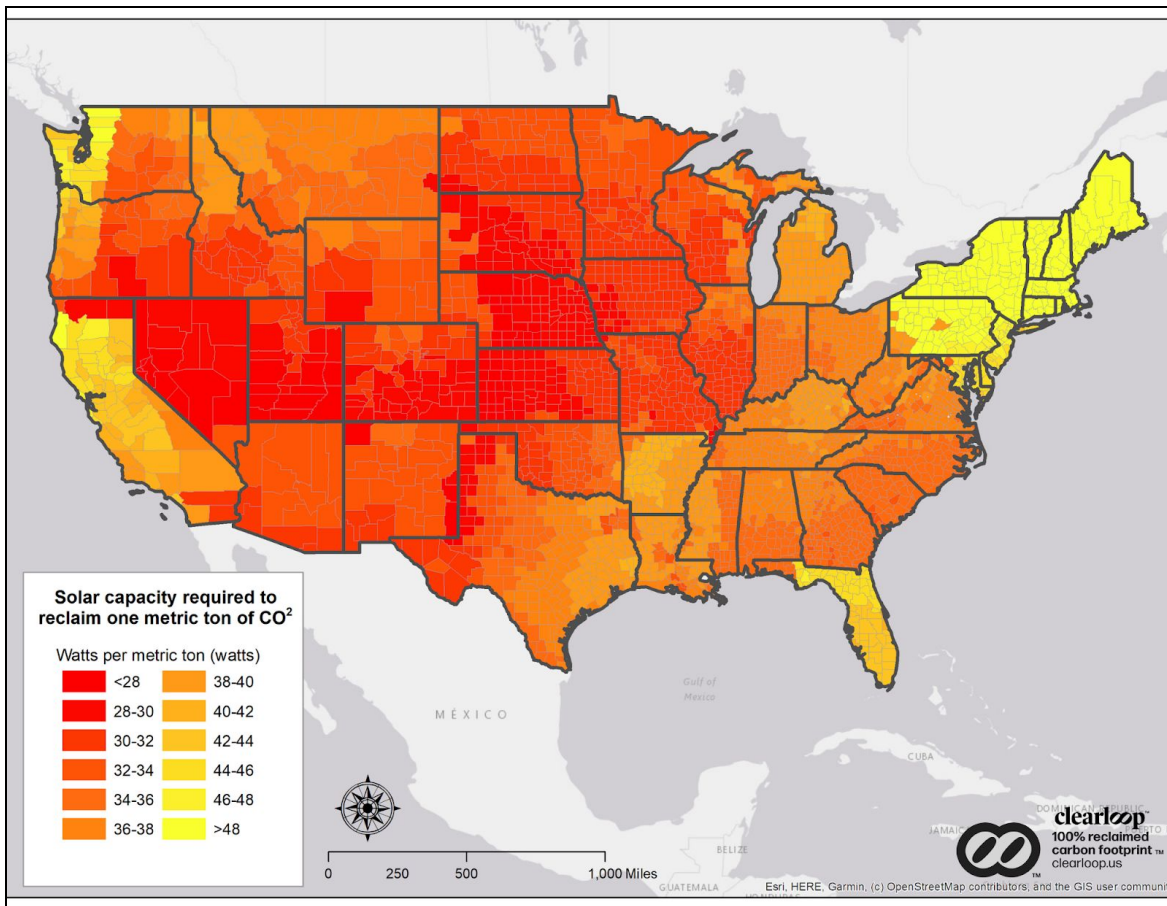


Figure 4. Map of solar capacity required to reclaim one metric ton of CO² with sequential coloring

Case study: Clearloop is putting concepts into action to expand pool of companies and capacity across regions of the country

Clearloop is a new company that works with companies of all sizes to help them reclaim their carbon footprints by building new solar projects across the United States. With Clearloop, companies are taking out the carbon they put into the environment by building new solar capacity that will clean up our grid by helping to replace dirty electricity producing power plants.

The Tennessee-based startup developed a new way of financing new clean energy projects that don't require a long-term contract to purchase power, but instead puts the focus back on carbon reductions—responding to the limitations of the current way solar is developed today and focusing on investment in the communities in the middle part of the country that are getting left behind.

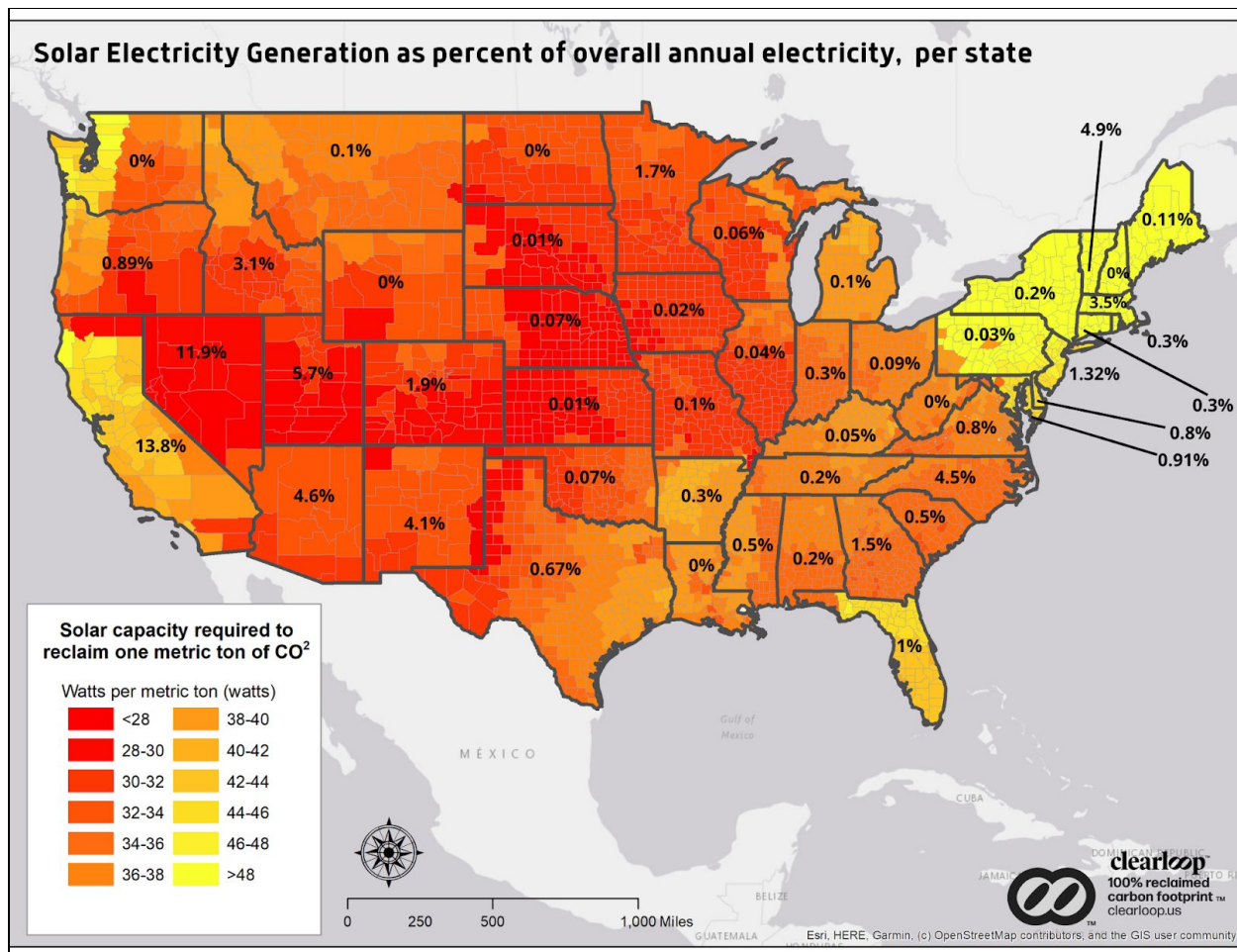


Figure 5. Map overlaying the percent of electricity generated by solar sources per state to illustrate the opportunity to build more clean solar energy infrastructure across the country and in particular the Midwest and Southeast¹⁴

¹⁴ EIA. Detailed State Data. Net Generation by State by Type of Producer by Energy Source, 2018 (EIA-906, EIA-920, and EIA-923)1, <https://www.eia.gov/electricity/data/state/>

By introducing this way of looking at new solar capacity as a way to achieve carbon reductions, instead of just generating power for companies, Clearloop is focusing on the communities with the dirtiest grids and opening up the investment opportunity to small and medium sized companies that would otherwise not have direct access to decarbonizing the grid.

Clean energy infrastructure investments spur economic growth in areas that need it the most

In fact, when we dig into the opportunity to build new clean energy infrastructure in the places where the grid mix continues to be dominated by fossil fuels, we are embracing economic development and investment in communities that are often forgotten or who've had to trade off their health for economic opportunity.

To illustrate the great potential for environmental, health, and economic impact of clean energy infrastructure investment in economically-distressed communities, we mapped out the Treasury Department's designated Opportunity Zones,¹⁵ which only scratch the surface of where we can make a difference.

¹⁵An Opportunity Zone is an economically distressed community that has been identified by the Treasury Department where new investments, under certain conditions, may be eligible for preferential tax treatment. Localities qualify as Qualified Opportunity Zones if they have been nominated for that designation by a state, the District of Columbia, or a U.S. territory and that nomination has been certified by the Secretary of the U.S. Treasury via his delegation of authority to the Internal Revenue Service (IRS). "U.S. Department of the Treasury," Treasury Releases Proposed Regulations on Opportunity Zones Designed to Incentivize Investment in American Communities | U.S. Department of the Treasury, September 12, 2020, <https://home.treasury.gov/news/press-releases/sm530>.

