NAVIGATING AN ENERGY TRANSITION

Dr. Sarah Mills – April 10, 2025

Christophe Courchesne:

Welcome to the 20th Annual Norman Williams Distinguished Lecture in Land Use Planning and the Law. I am Christophe Courchesne, the interim director of the Environmental Law Center and the director of the Environmental Advocacy Clinic here at Vermont Law & Graduate School. Today we are delighted to welcome members of our community here in South Royalton, as well as those joining us online. We have a wonderful turnout here on a Thursday evening. On behalf of the Environmental Law Center, we are pleased to host the Williams Lecture each spring. Norman Williams came to Vermont Law School in 1975 after a long and distinguished career in public service and teaching, particularly in the area of land use planning. Professor Norman Williams played a key role in founding Harvard Law and Graduate School's Environmental Law Center. The Norman Williams Distinguished Lecture in Land Use Planning and the Law series is a gift of Francis Yates, trustee of Vermont Law School, in memory of both Norman Williams and Anya, J.D. '94, and Charles Yates, J.D. '93.

We would like to extend a very warm welcome to this year's special guest, Dr. Sarah Mills. Dr. Mills is the Director of the Center for Empowering Communities at the University of Michigan's Graham Sustainability Institute and an associate professor of practice in the Urban and Regional Planning program. Her research looks at how renewable energy development impacts rural communities positively and negatively, the disparate reactions of rural landowners to wind and solar projects, and how state and local policies can facilitate and hinder renewable energy development. Her current research projects include studying the adoption of zoning ordinances in rural communities across the Midwest, and the economic impacts of solar on agricultural communities including land-ownership trends. She also has funding from Michigan's State Energy Office in the Department of Environment, Great Lakes, and Energy to develop tools and resources to help communities across the state. These tools incorporate clean energy into their planning and zoning and provide direct technical assistance to communities in setting these policies. Dr. Mills received her doctorate in urban and regional planning at the University of Michigan where her dissertation looked at the intersection of farmland preservation and wind energy development. She has a master's in engineering for sustainable development from the University of Cambridge and a bachelor's degree in mechanical engineering from Villanova University. She grew up on a farm in Monroe County, Michigan, and now lives in Ann Arbor where she's served on the City Planning Commission since 2014.

Her talk today is on navigating an energy transition. Please join me in welcoming Professor Sarah Mills.

Dr. Sarah Mills:

Thanks a lot! Thank you so much for having me. It is really an honor to be here; it's been a great visit. I got here this afternoon, and I have gotten to meet with faculty and students. I have never been to this part of the state, so thank you again for having me. I am going to talk about navigating an energy transition. First, I'll talk about how this energy transition is really a rural energy future for the United States. Second, I am going to talk about what I spend most of my time on, which is studying community acceptance of renewable energy. I will draw from the academic literature, but I am also going to pull in a bunch of stories from being around those rural communities, largely in Michigan, who have been approached by a developer. I'll share more on helping them understand the pros and cons and how rural communities can use energy development to advance quality of life in their place. That is the mission of the Center for EmPowering Communities that I direct. Finally, I want to close by thinking more about policy, and how we can shape policy in light of what we know about public acceptance.

All right, so the first question is: are we in an energy transition, and, if so, how much energy do we need in that transition? Right now, it is really tricky to know what the future trends are. I'm a planner, but I do not have a crystal ball on where things are going. But I'm going to show you two different slides to suggest that there will be an energy transition, and it's going to implicate rural places. This set of graphs (Figure 1) is from the Energy Information Administration (EIA), and largely they're looking at the current policy in place and the economics of different kinds of energy sources to determine the demand for energy technologies all the way to 2050.[1] This

1. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK (2023) https://www.eia.gov/outlooks/aeo/pdf/aeo2023_narrative.pdf.

data is from 2023, and the EIA is supposed to come out with their next forecast in a couple of months.

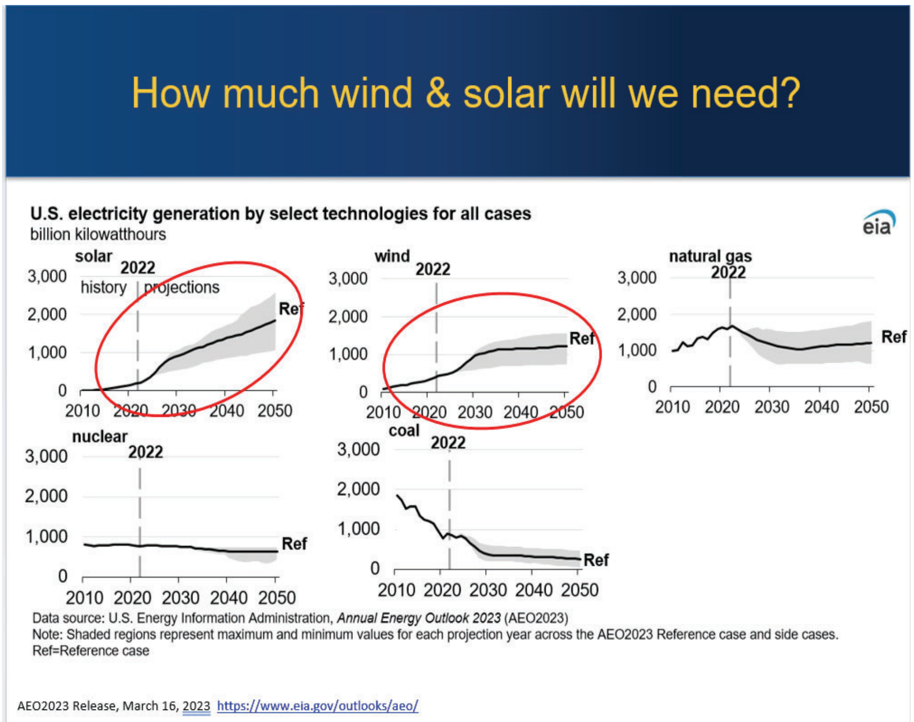


Figure 1: *EIA Electricity Generation Projections.*[2]

The first thing I want you to notice is, for solar, you can see that on the low side of those projections (the bottom of that gray area), shows effectively a quintupling of our current amount of solar in the country, from less than 250 billion kilowatt hours today to over a thousand billion kilowatt hours in 2050.[3] On the high side, it could be three times that much.[4] So the EIA is projecting—just based on economics—that there's going to be a whole lot more solar. The projections for wind over the next 25 years are slightly less rosy but are still doubling from the amount of wind energy that we have right now, and it could be two times that much.[5] That's only looking at the economics. We know that in a lot of parts of the country, wind and solar are the cheapest forms of energy.

2. *Id.*
3. *Id.*
4. *Id.*
5. *Id.*

If you put this in the context of decarbonization plans, which a lot of states have, these graphs look quite different. This (Figure 2) is pulled from the Net-Zero America study that Princeton conducted a couple of years ago.[6] I circled the reference case on the left because this is effectively a business-as-usual strategy, and it's more or less matching what the EIA would suggest. The little yellow sliver is solar, and they expect that the business-as-usual case for wind is bigger than what the EIA suggests but more or less the same order of magnitude. One of the things that you'll see overall is that in all of these scenarios we have more electricity in the future, and even this may be an underestimate since the study was done before the recent growth in demand from AI. The rest of these graphs are effectively showing what happens if we electrify everything, what happens if renewables get super cheap, and what happens if we try to shift to 100% renewables, shown on the very far right for the figure. And what you can see is that these scenarios show five to twenty times the amount of renewable energy that is currently built if we effectively double down on decarbonization, so quite a bit more.

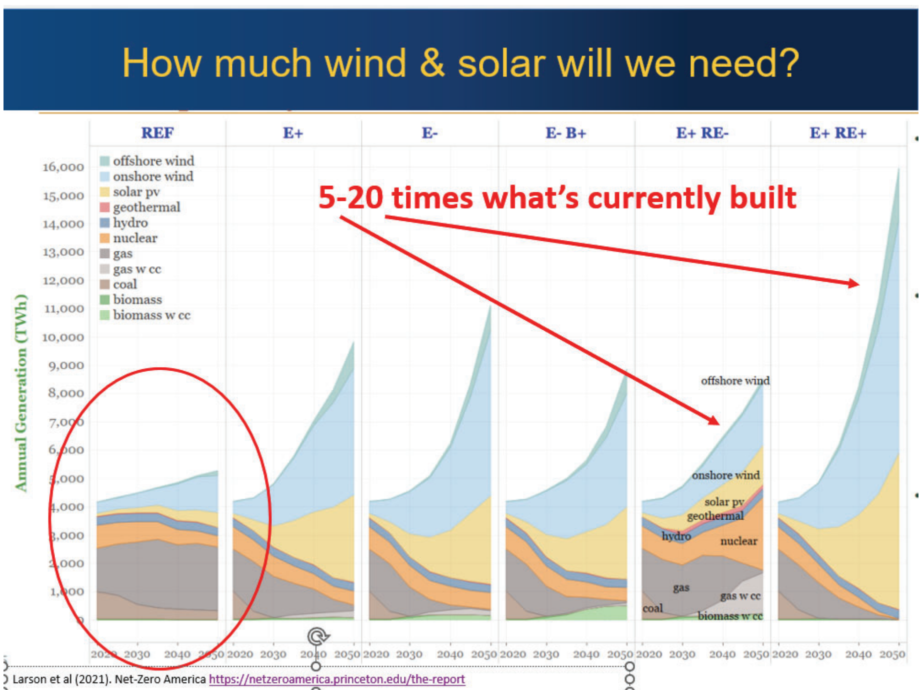


Figure 2*: Net-Zero America Projections.*[7]

6. ERIC LARSON ET AL., PRINCETON UNIV., NET-ZERO AMERICA: POTENTIAL PATHWAYS, INFRASTRUCTURE, AND IMPACTS 25 (2021).

7. *Id.*

As a land use planner, I love that the Net-Zero America study also includes a map of where we might get this energy and an annex that has some land use calculations.[8] Figure 3 shows a map from one of the net-zero scenarios, and what you can see pulled out in red is the low and the high end of what is expected from those projections in Figure 2. Five to twenty times more wind is resulting in 60 million to 247 million acres of land, and that's for the entire wind farm—that's not for individual wind turbines.[9] The direct impact of a wind turbine, and the access road to get there, accounts for 1% of that acreage. Since those wind turbines have to be spaced out, it could be as much as 247 million acres.[10] For solar, these scenarios would require 3.5 million to 15 million acres.[11] And if you're a Midwesterner like me, what

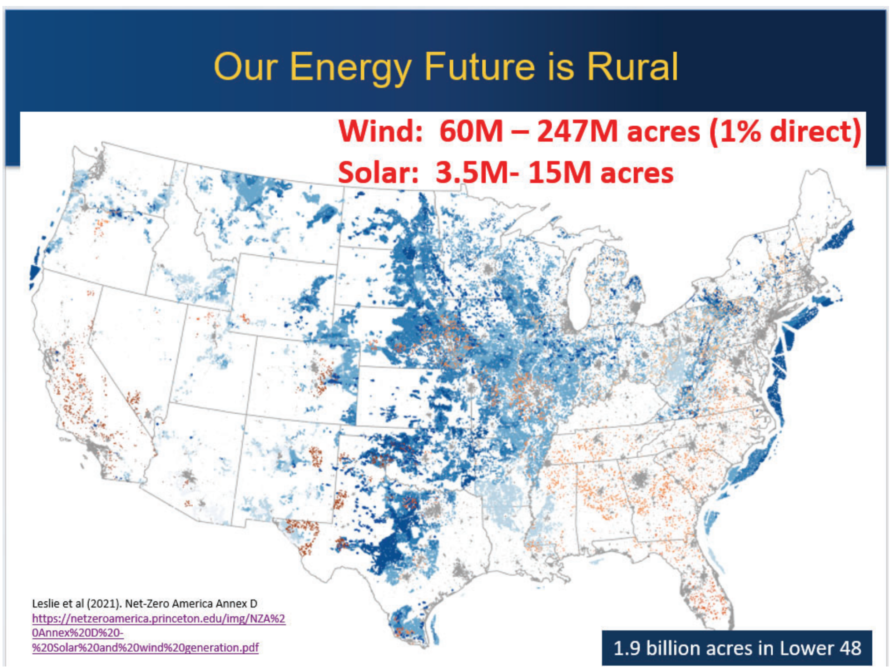


Figure 3: *Net-Zero America E+ RE+ Constrained 2050 Scenario.*[12]

8. *Id.*
9. *Id.* at 56.
10. *Id.* at 28–29.
11. *Id.*
12. EMILY LESLIE ET AL., PRINCETON UNIV., PRINCETON'S NET-ZERO AMERICA STUDY ANNEX D: SOLAR AND WIND GENERATION TRANSITIONS (2021).

you see from that map is that there's a lot of that development happening in the center of the country, where there are lots of farms and ranchland, and fewer people. What I want you to take away from this map is that our energy future will be rural, even more so than our energy generation past.[13]

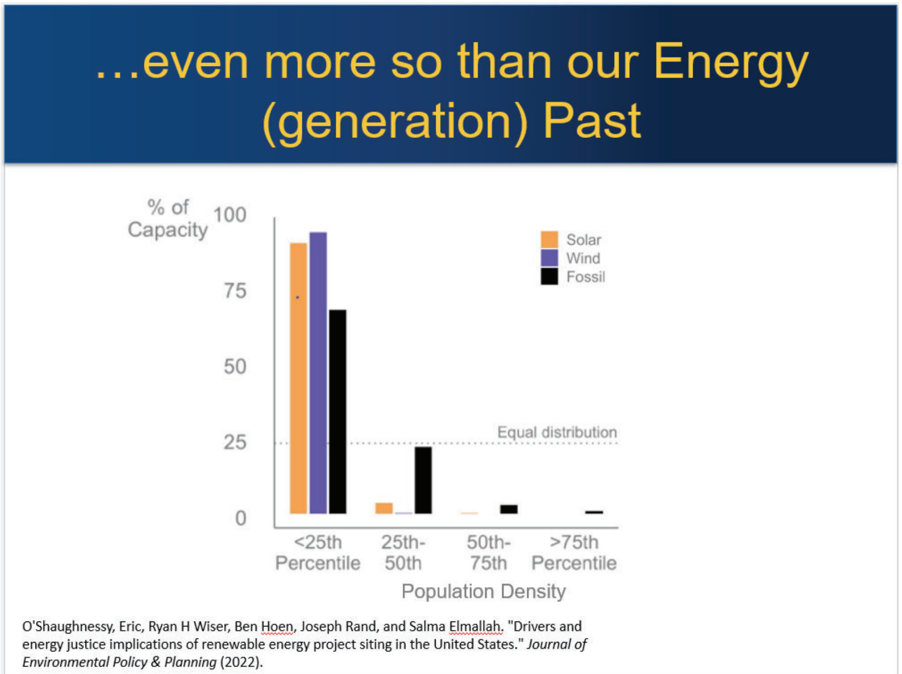


Figure 4: *Location of existing solar, wind, and fossil fuel generating facilities, by population density percentiles.*[14]

And to make that point, I have one more graph (Figure 4). This is a study that came out a couple of years ago looking at the existing solar (in orange), wind (in purple), and fossil energy generation facilities (in black). This is a nationwide study that breaks down each project's location based on population density. The vast majority of solar and wind are in the lowest population density places—the most rural places.[15] The majority of our fossil fuel plants are too—70% are in that lower quartile in terms of population density. But, we do have some fossil fuel infrastructure that is closer to population centers on the fringe of cities.

13. Eric O'Shaughnessy et al., *Drivers and Energy Justice Implications of Renewable Energy Project Siting in the U.S.*, 25 J. ENV'T POL'Y & PLAN. 258, 269 (2023).
14. *Id.* at 258, 269.
15. Eric O'Shaughnessy et al., *supra* note 12, at 265 fig.4.

Yes, there are some old power plants that are closing, and yes, we are replacing them with cleaner sources. But most of what we're doing and what we will do for the next few years is expand the amount of electricity we are generating. Our clean energy infrastructure isn't just matching the geography of our old energy infrastructure: it's energy additions rather than transitions. But the other reason is because of power density.

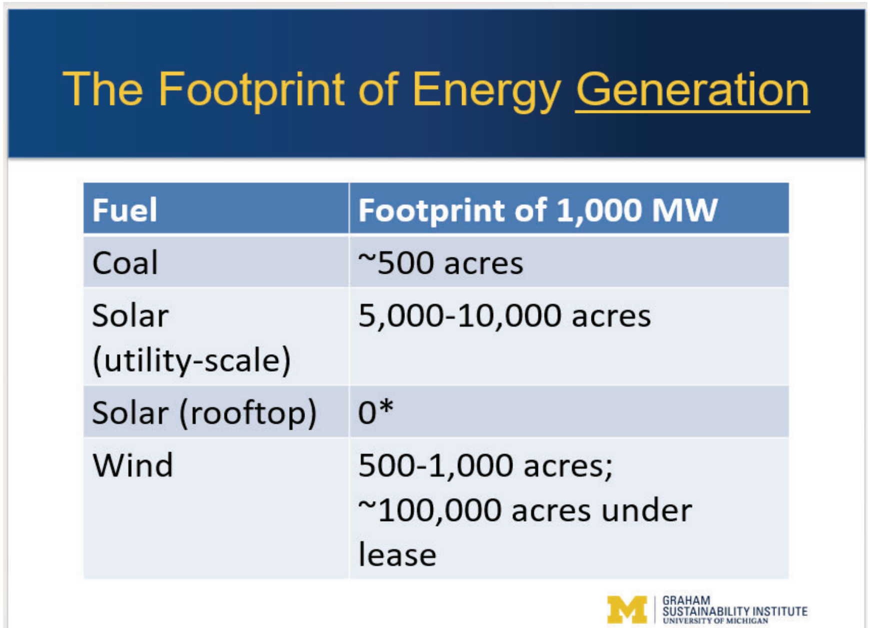
For the energy nerds in this room, I don't have to explain a megawatt to you, but for those non-energy nerds, I'm not going to explain a megawatt to you. All you need to know is that in this table (Figure 5) I am holding the capacity of that power plant constant. This is for a gigawatt, a thousand megawatts of energy.[16] For a coal plant, generally speaking, a gigawatt requires about 500 acres for the power plant itself.[17] This does not count mining, but the generation part of it, more or less, is five hundred acres.[18] To get that same one gigawatt capacity from a utility scale solar project you need 10 to 20 times as much land—5,000 to 10,000 acres.[19] This is why you can't just close a coal-fired power plant, bring in solar panels to the site, and have the same amount of power going to the grid.

16. Vasilis Fthenakis & Hyung Chui Kim, *Land Use and Electricity Generation: A Life-Cycle Analysis*,13 RENEW. & SUSTAIN. ENERGY REV. 1465, 1466 (2009).

17. *Id.* at 1467; *see* Jessica Lovering et al., *Land-Use Intensity of Electricity Production and Tomorrow's Energy Landscape*, 17 PLOS ONE, Jul. 2022, at 1.

18. Fthenakis & Kim, *supra* note 16, at 1467.

19. *Id.*



The Footprint of Energy Generation

Fuel	Footprint of 1,000 MW
Coal	~500 acres
Solar (utility-scale)	5,000-10,000 acres
Solar (rooftop)	0*
Wind	500-1,000 acres; ~100,000 acres under lease

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Figure 5: *Comparison of the footprint of electricity generation facilities, by fuel.*[20]

Now, because I'm a planner, I put rooftop solar on the table too. If you've already got a house there, or some kind of commercial building, and you're putting solar panels on the roof or over the parking lot, does that count as using up the land? I would say maybe not. That's not a new consumptive land use, and I'll say that I think we should be doing more of this. Also, we still don't have enough rooftops in the country to get us to where we need to go with rooftop solar alone.[21] There's also economies of scale. That's one of the reasons why, at least for solar, we need to imagine that it's going to take up some land. For wind, there's a difference between total project footprint and turbine footprint. I've got 500 to 1,000 acres for that gigawatt of wind—that's for the turbine itself and the access road to get to it—which is typically no more than 2 acres per turbine. If we're talking about a gigawatt of wind, we're probably talking about 300–400 wind turbines, because modern wind turbines are two and a half to three megawatts a piece.[22] But you can't line all those turbines up cheek to jowl. The way that I explain it to my non-

20. *Id.*

21. PETER GAGNON ET AL., ROOFTOP SOLAR PHOTOVOLTAIC TECHNICAL POTENTIAL IN THE UNITED STATES: A DETAILED ASSESSMENT, NAT'L RENEWABLE ENERGY LAB'Y vii (2016), https://docs.nrel.gov/docs/fy16osti/65298.pdf.

22. OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, LAND-BASED WIND MARKET REPORT 27 fig.24 (2023).

engineering students is that they steal wind from each other, so you have to space them out so the wind can recuperate going from one to the next. And so that gigawatt of wind is probably going to extend over an area of about 100,000 acres.[23]

This is why our energy geography is shifting, why we have new sites of energy generation, and why the places that have the land for this are rural. This is where the ruralists among you have a lot of work to do in the future because the energy future is rural.

As I was driving here today, I thought it would be helpful to think about my frame of reference. I come from the Midwest, and wind farms and solar farms in the Midwest look different than they do here in New England. What is considered a big project here in New England is not considered big in the Midwest. It is common for us in the Midwest to have wind farms of 50 to 200 turbines spreading over tens of thousands of acres. One solar farm, Prairie Wolf Solar in Illinois, for example, is 200 megawatts.[24] That's normal for my part of the country. Prairie Wolf Solar is on 1600 acres.[25] Another project, Sunfish Solar, is soon to start construction in my home state[26]. This is a gigawatt solar project which lists its acreage as 6,000 acres, but I think that's just the panel area. There's a similarly-sized project (1.2 gigawatts) in Indiana called Mammoth Solar—named after wooly mammoth bones found nearby—but it literally is mammoth at 13,000 acres.[27] For those of you who don't think in acres, that's like 20 square miles. That is the scale of stuff that I'm going to spend the rest of this lecture talking about.

Now, let's move into Part Two of my talk which is about community responses. I have spent the last ten years trying to understand why we see such different responses to renewable energy projects in rural communities. Here, I am showing two papers that are the ones to read if you wanted a big survey of what's known about 30 years of North American wind energy acceptance research.[28] My colleagues and I just put out data and got a paper

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23. LARSON, *supra* note 6, at 27.

24. *Prairie Wolf Solar, LLC*, U.S. GEOLOGICAL SURV., https://energy.usgs.gov/uspvdb/viewer/#13.21/39.55408/-87.97711 (Apr. 2025).

25. *Prairie Wolf Solar*, RES, https://res.us/projects/prairie-wolf-solar/ (last visited Dec. 13, 2025).

26. *Location of Sunfish Solar Farm*, HECATE ENERGY, https://sunfishsolarfarm.com/about/location/ (last visited Nov. 3, 2025).

27. Chris Young, *The $1.5 Billion Mammoth Solar Farm Will Be the Largest in the US*, INTERESTING ENG'G: CULTURE (Nov. 16, 2021), https://interestingengineering.com/culture/15-billion-mammoth-solar-farm-the-largest-in-the-us.

28. Joseph Rand & Ben Hoen, *Thirty Years of North American Wind Energy Acceptance Research: What Have We Learned?*, ENERGY RSCH. & SOC. SCI., July 2017, at 20, 23 (2017).

accepted[29] on perceptions of large-scale solar project neighbors from a nationwide survey that we did on solar energy.[30] What we know from both wind and solar is NIMBYism (not in my backyard) is too simple of an explanation. One of the reasons that we say that it's not NIMBYism is that some of the closest people to these projects have very mixed reactions. It's not like everybody next door is really upset about it. One explanation for this reaction leads into the second bullet, which is that socioeconomic impacts—particularly an individual's financial relationship to the project—matters a lot.

People who have turbines on their property, or people next door to a wind farm who get a check in the mail for free access to the wind that blows over their property, have more positive perceptions of the project. The positivity stems not just from those direct payments, which are included when we talk about socioeconomic impacts. Socioeconomic impacts also include community benefits agreements, donations that developers make, or—we're going to talk a little bit more about this because it's one of my favorite subjects—the property taxes that developers pay for building wind or solar farms. Throughout the literature we find that these socioeconomic impacts are really important. Equally or maybe even more important though are the perceptions of the process: was the process that led to that wind or solar farm being built fairly; did people have an opportunity to participate; did they feel like they were heard when they participated; and also, do they trust the developer, and do they trust the government officials who are making the decisions about that project? These questions are just as important to public acceptance. I'm going to delve into each of those a little bit more in my six observations from my experience in rural communities who are in the process of making decisions about wind and solar, as well as some of the research that we have conducted along the way.

The first observation: energy is rural economic development.[31] My research career started with understanding what people with wind turbines on their property do with the revenue that they receive from hosting those turbines. What I found is that they take that money and they reinvest it in

29. Joseph Rand et al., *More Power to Them: U.S. Large-Scale Solar Neighbors' Support for Additional Solar*, FRONT. SUSTAINABLE ENERGY POL'Y, June 17, 2025.

30. JOSEPH RAND, KARL HOESCH, SARAH MILLS, BEN HOEN, ROBI NILSON, DOUG BESSETTE & JAKE WHITE, BERKELEY LAB., PERCEPTIONS OF LARGE-SCALE SOLAR PROJECT NEIGHBORS: RESULTS FROM A NATIONAL SURVEY 6 (2024).

31. Elizabeth Weise, *Wind Energy Gives American Farmers a New Crop to Sell in Tough Times*, USA TODAY (Feb. 20, 2020), https://www.usatoday.com/story/news/nation/2020/02/16/wind-energy-can-help-american-farmers-earn-money-avoid-bankruptcy/4695670002/.

their farm.[32] They are buying new farm equipment and additional land, and the dollars that go back into their farm are recirculating in the farm economy. This is also true for solar.[33] And, actually, the people who host solar on their property receive checks that are even larger than for wind turbines. In most cases, deciding to host wind or solar on your land or in your community is really an economic development proposition. I have had interviews with people who host wind and solar panels on their property who say, "I do not believe in climate change; I am doing this for economic reasons." Actually, this is a statistic from my dissertation: 69% of the people in Michigan who host wind turbines on their property do not believe that it impacts climate at all.[34] They are hosting because it makes financial sense for their farm.

On the economic development side, though, you'll see this other headline from the Washington Post, that there is not unanimity that solar is good for farmers.[35] Some of the research that I've been doing recently is trying to understand what impact a large-scale solar farm has, not just on the people who host the turbine or the solar panels on their property, but on their neighbors. My colleagues and I have a study that we're wrapping up[36] on understanding whether folks who get those checks in the mail are reinvesting in their farm—like people with wind turbines do—or if they're retiring.[37] And if they're retiring, are they doing what many Michiganders do and going to Arizona or Florida in retirement, or are they staying in place? This matters because we want to know if they are taking their solar lease money with them to Florida or Arizona or if it is recirculating in the local economy. The reality that we find is it's a little bit of both: some farmers use solar lease revenue to diversify farm income and some use solar lease revenue to exit farming. Our next study is digging in even further to understand who owns the land that

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32. SARAH MILLS, WIND ENERGY AND RURAL COMMUNITY SUSTAINABILITY, HANDBOOK OF SUSTAIN. AND SOC. SCI. RSCH. 220 (Walter. Leal Filho et al. eds., 2018).

33. Genevieve Bookwalter, *The Next Money Crop for Farmers: Solar Panels*, WASH. POST, (Feb. 22, 2019), https://www.washingtonpost.com/business/economy/the-next-money-crop-for-farmers-solar-panels/2019/02/22/2cf99e8c-3601-11e9-854a-7a14d7fec96a_story.html.

34. Sarah B. Mills, Preserving Agriculture Through Wind Energy Development: A Study of the Social, Economic, and Land Use Effects of Windfarms on Rural Landowners and Their Communities, 84 n.19 (2015) (Ph.D. dissertation, University of Michigan).

35. Alison Knezevich, *Proposed Solar Energy Developments Draw Opposition over Loss of Farmland*, WASH. POST (Jan. 19, 2019), https://www.washingtonpost.com/local/proposed-solar-energy-developments-draw-opposition-over-loss-of-farmland/2019/01/19/f2f6acfa-1b72-11e9-8813-cb9dec761e73_story.html.

36. Michael Craig, Sarah Mills, Papa Yaw Owusu-Obeng, Gilbert Michaud, Hongli Feng, *Bridging Knowledge Gaps in Solar Energy's Impact on Rural Economies*, GRAHAM SUSTAINABILITY INST. UNIV. OF MICH. (July 2025), https://graham.umich.edu/media/files/Bridging-Knowledge-Gaps-Solar-Rural-Economies.pdf.

37. *See id.*; Sarah Mills, Here Come the 1200 Acre Solar Farms. Should We Celebrate or Worry?, Presentation at the University of Michigan (Apr. 12, 2022).

solar projects are on. This is part of an active discussion about what happens when you take 2,000 acres out of agricultural production. Our research interests include whether tenant farmers are involved, how much grain is processed at the grain elevator, if there is less milk getting processed at the dairy co-op, and if incrementally fewer tractors are sold. The last point I want to make about energy being a rural economic development proposition is that it's not just individuals who benefit from renewable energy development; there are also community-wide economic benefits. And I already mentioned the key example of this is property taxes.

This leads us to the second observation I have about community response to large-scale renewables: these tax benefits are rarely visible to residents. Local officials absolutely understand what revenues they are receiving from wind and solar developers—the average resident does not. This observation is based on some research that I did in Michigan[38] where the property taxes that wind developers pay sometimes go to support local schools, but always fund township services and county services.[39] For each of these services I asked residents who live in communities with existing wind farms: did these services improve (in blue in Figure 6), worsen (in orange), or neither (in grey).[40] And most people said there was no change to any of these services as a result of wind development, even though in these places wind developers pay millions of dollars in property taxes each year.[41]

38. Sarah Mills, Rio Mizuno, Natalie Fitzpatrick & Zachary Pritchard, The Invisibility of Wind Turbine Property Tax Benefits in Michigan (Nov. 13, 2020) [hereinafter Wind Tax] (presenting at APPAM Fall Research Conference Panel).

39. Matthew Appel, *Local Property Tax Impacts of Large-Scale Wind and Solar Projects*, UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST. (May 2025), https://graham.umich.edu/media/files/Michigan-Property-Tax-Final.pdf.

40. SARAH MILLS, UNIV. OF MICH.: CTR. FOR LOC., STATE, & URB. POL'Y, VIEWS OF WIND DEVELOPMENT FROM MICHIGAN'S WINDFARM COMMUNITIES (2017).

41. Wind Tax, *supra* note 37.

So what is going on? I care so much about property taxes that you get two more slides on this finding, so buckle up.

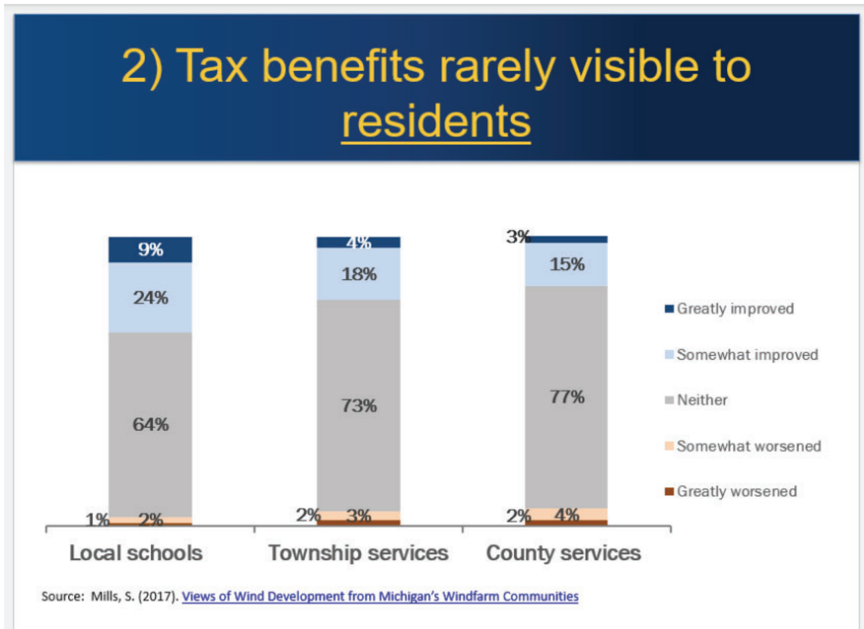

Figure 6*: Percentage of residents of windfarm communities who said local schools, township or county services improved as a result of wind development*[42]

Figure 7 is drawn from the same survey as Figure 6, but hones in on the percentage who said their township services improved.[43] Remember from Figure 6, it was 22% of the sample overall who said township services improved, but now I've taken the data and broken it down by township.[44] Property tax revenue in Michigan largely scales to the number of turbines, so I've arranged this data from Township A and B over on the lefthand side (Figure 7), which each have 5 turbines, all the way over to Township J that has 88 turbines. In Township J, the property-tax revenues quintupled as a result of wind development, and even so, only 28% of people said that they thought township services improved.[45] But what is happening in Township F? Any guesses? We are not passing around the microphone, but you can shout it out.

42. MILLS, *supra* note 39, at 3.
43. *See* Wind Tax, *supra* note 37 (noting that the author rounded the figures to account for minor discrepancies with the source tables).
44. *Id.*
45. *Id.*

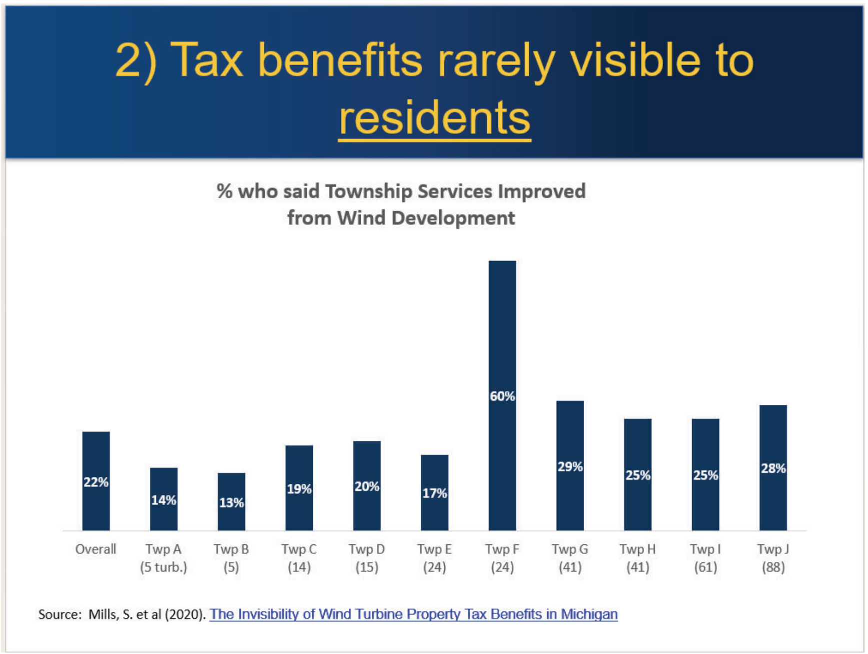

***Figure** 7. Percentage of residents who said township services improved as a result of wind development, by township.*[46]

Audience Member:

Community benefits agreements?

Dr. Sarah Mills:

Community benefits agreements isn't the right answer, but it's a good guess though, in part because this kind of predates community benefits agreements just a little bit. Community benefits agreements are a newer thing. I'll tell you: Township F introduced trash collection. It was a new service that they did not have before, so it was easy to answer my question of whether township services improved or worsened.

Let me tell you though why I think this is complicated. First of all, I think it's human nature that people just don't understand what it costs to keep local government services operational. It's just human nature: do you know what it costs to pave a mile of road, or to apply dust mitigation to dirt roads? Unless you are on the county board or the township board, you probably

46. *Id.*

don't. But the other thing that is likely playing a role is that Michigan has an *ad valorum* tax structure—a structure that is common in a lot of states—where the value that a developer pays taxes on is subject to a depreciation schedule. In Michigan, the local government can tax 100% of the wind farm's value in year one, but by year ten you're down to only being able to tax 30% of its value.[47] If you're introducing a new service like trash collection, adding that service only makes sense so long as you've got enough money in year ten to cover the cost of the service. Otherwise, you're going to have to raise everybody's taxes or cancel that service, which is an unpopular move. So in some ways, Township F might have needed to do some additional math; they could definitely afford trash collection in year one and two of the windfarm's operation, but maybe not in those years further out. And if anybody is wondering what the other townships did, they reinvested it in their roads, effectively doing more of what they were already doing. They were applying dust mitigation to their dirt roads a couple more times a year.

Another very nerdy thing—but maybe some of you are interested in this—the county was taking its tax money from wind energy and paying off their OPEB (Other Post-Employment Benefits) liabilities—like retiree healthcare. OPEB accounts are underfunded in a lot of local governments and are problematic. Most people would not see a change in services when the county shores up their OPEB account, but it's putting that county in a much better financial position. It just has the drawback of being invisible to residents. The other thing that happened in Michigan that led to a lot of non-visible services is that this *ad valorem* depreciation table changed three times in four years. And every time local governments got a little bit less from the developer than they did the year before. It was really hard for local government to plan on how to spend the money since they weren't sure what they might receive next year or if they might need to refund taxes to the developer.

The third observation is that the fit of an energy project in a community is linked to why people live there. Michigan has a tourism campaign called "Pure Michigan." On the left you see one of the Pure Michigan ads with wind turbines in the background, and then this is from Facebook: "Is this pure Michigan to you? This is what a Fortune 500 wind company would do to your community." Very different visions of what energy infrastructure means. My colleague Doug Bessette and I have written on this in "Farmers

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47. See MICH. DEP'T OF TREASURY, FORM 4565, 2025 WIND ENERGY SYSTEM REPORT (2024); see also Matthew Appel, *Local Property Tax Impacts of Large-Scale Wind and Solar Projects*, *in* UNIV. OF MICH: CTR. FOR EMPOWERING CMTYS., RENEWABLE ENERGY TAX SERIES (May 2025).

vs. Lakers."[48] And what we were trying to do is see if we could explain the different community responses to wind energy. We found you could explain an awful lot of this through looking at data from the U.S. Census and the USDA Census of Agriculture. In places where there are more full-time farmers, you have less opposition to wind energy. Wind energy is just another way for them to make money off of their land. On the other side, the "lakers" are from places that are high on USDA's natural amenity scale.[49] It's a higher natural amenity county if it is not flat and nearer to bodies of water. Much of the Midwest is relatively flat, but in Michigan you are always within six miles of a body of water. This is where people have cottages and cabins and vacation homes: places that are higher on the natural amenity scale. What our research found is that wind energy was much more contentious in these places. This was a change to the visual amenity of their landscape. And we see lots of clashes in Michigan because we have farmers right next to those "lakers," not just those along the Great Lakes, but all of the inland lakes as well.

Now the fourth observation: it's hard to get a straight story on energy. This is what I heard from township supervisors when I was interviewing them for my dissertation. They would have a developer and potentially the landowners who would profit from a proposed wind farm showing up talking only about the positives that this would bring to them. And then they would have residents, and people not even from their community, talking only about how the sky is going to fall, and all the bad things about a wind project.[50] This actually is what started me on what I originally called my wind energy roadshow now funded by the state of Michigan.[51] Blessedly, I've also enlisted other people to come along with me to go and talk about both the positives and the negatives of renewable energy. I'm going to say this now, because I'm going to say it again later, but I think it's really important: every energy source has positives and negatives at the local level, and it makes sense that the people that show up to meetings only want to talk about their side. But the reality is everything comes with trade-offs. In most of the places that I speak, everybody in the room is riled up because usually people are

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48. Douglas L. Bessette & Sarah B. Mills, *Farmers vs. Lakers: Agriculture, Amenity, and Community in Predicting Opposition to United States Wind Energy Development*, 72 ENERGY RES. & SOC. SCI., Feb. 2021, at 1, 9.

49. *Id.*; *see* Laura Paul, *Natural Amenities*, USDA: ECON. RSCH. SERV. (May 8, 2025), https://www.ers.usda.gov/topics/rural-economy-population/natural-amenities.

50. Dan Gearino, *The Choice for Rural Officials: Oppose Solar Power or Face Revolt*, INSIDE CLIMATE NEWS (Sept. 30, 2022), https://insideclimatenews.org/news/30092022/solar-power-williamsport-ohio-rural-leaders/.

51. *Renewable Energy Academy*, UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST., https://graham.umich.edu/rea (last visited Nov. 16, 2025).

there with an opinion about wind or solar: either they love it or hate it. And so usually when I come and talk to communities, I end up upsetting everyone in the room because I talk about both the positives and the negatives, so I don't fully support opinions on either side.

The fifth observation is that engagement is critical in both the short and the long term. Within the social science literature, there's this idea of a U-curve of public acceptance. Before construction or before a wind farm or solar farm is proposed, attitudes about the technology are pretty high. Then once a farm is proposed, and people start to think about what it means and where it's going to go, attitudes get lower and lower.[52] When the wind project is under construction, this is when you are at the bottom of that U-curve because there's big, noisy construction activity, fields are ripped up, and there's big equipment on the roads. Then, the theory of the U-curve suggests that once the wind farm or solar farm is up and operational, attitudes return to the initial level. In fact, Doug Bessette and I found that's not the case. We found that instead there are diverging U-curves.[53] More recently, this has also been found in Europe, and authors have created a nice graphic that articulates this.[54] On the one hand, when a project is proposed, it can start out and be so negative that it reaches the valley of death and never gets built. But once a project is built, there are a couple of options. If people have a great experience, they realize that the sky didn't fall, they grow accustomed to the technology, and maybe they're actually even more positive about the technology. On the other hand, if the project gets approved and starts to be constructed, people may learn about negative things that they didn't expect going into it. Or the developer or governmental-approving body didn't do the thing that they said they were going to do and break their promise. If these happen, the public can actually lose trust, not only in the project, but in the technology overall.

Oftentimes in the social science research, we think about how engagement is really important for getting communities to not go in that valley of death—to not reject the project approval. But what we've found is that engagement is also really important, even after the project gets an approval from a local government or from the state government, and throughout construction. What happens once a project is approved can determine the shape of the curve, which is really important if the developer

52. Søren Krohn & Steffen Damborg, *On Public Attitudes Towards Wind Power*, 16 RENEWABLE ENERGY 954, 957–58 (1999).

53. Sarah Banas Mills, Douglas Bessette, & Hannah Smith, *Exploring Landowners' Post-Construction Changes in Perceptions of Wind Energy in Michigan*, 82 LAND USE POL'Y 754, 761 (2019).

54. Geraint Ellis et al., *Dynamics of Social Acceptance of Renewable Energy: An Introduction to the Concept*, 181 ENERGY POL'Y, 2023, at 1, 5.

wants to repower that project. It's also important if the developer wants to send other communities to see an existing project to see if they want to host something similar in their community. You would want host communities to have a good experience. We have mounting evidence here that the U-curve is too simple of an explanation; we shouldn't assume people will learn to live with renewable energy projects.

My sixth and final observation is that bigger is not always better. This is a heading from the Department of Energy's blog post named "Wind Turbines: The Bigger the Better,"[55] and here is another headline announcing the 1.5 billion dollar Mammoth Solar project as the largest in the U.S.[56] I have to tell you that I cringe when I see headlines like these, because I have never been in a community that says: "You know what would make us want this wind farm more? Taller turbines!" Or "You know what, we don't like this solar project you proposed that's one square mile, instead we want you to triple its size." That's not how most communities respond. To be clear, the reason that we're seeing taller turbines and larger solar farms is because there's economies of scale. Taller turbines are able to make wind economically viable in more places because they can access steadier wind speeds higher up. There are economic reasons to do that, but it's not necessarily a community acceptance reason. Unless the economic benefits are shared more with communities, it's dangerous, I think, to assume that bigger is better from a community's perspective.

So I've laid out six observations about community acceptance of renewable energy. What can be done to address these observations, and where does policy fit in? You are all in law school, so you look at laws. I'm not a legal scholar, but I do teach a class about the web of state policies that affect renewable energy deployment. Much of our scholarly policy attention at the state level has been on what I call climate policy: renewable portfolio standards or carbon taxes. But as I see the world, these policies are just a small subset within a web of state policies that effects deployment, and some policy areas—such as tax policy and siting authority—may have an even greater impact on community acceptance of these projects.

What do you do policy-wise with the first observation that energy is rural economic development? First of all, you need to center rural communities in your policymaking. Tactically, you should be thinking about whether a policy reduces local benefits. If it does, it's probably not the right policy. A non-economic way of thinking about this is: does this policy polarize the

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55. Liz Hartman, *Wind Turbines: The Bigger, The Better*, U.S. DEP'T OF ENERGY: OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY (Aug. 21, 2024), https://www.energy.gov/eere/articles/wind-turbines-bigger-better.

56. Chris Young, *supra* note 26.

issue, or how do people in the rural communities that we're going to need to host this infrastructure feel about the policy? A couple of years ago, I published a paper where we looked at renewable portfolio standards that had been put before voters as ballot initiatives in seven different states. [57] We pulled county-level results, and effectively what we found is that the places that have the best potential to host renewable energy projects are the least supportive of a state requirement. That's something that should be kept in mind as we're making policies.

Toward the second observation that tax benefits are rarely visible to residents, there are three key policy takeaways. The first is that federal-style tax cuts don't work. You don't want to cut taxes that would benefit local services. Shifting which taxing units benefit so that the benefits stay as local as possible is something that you might want to consider. For example, if there are any taxes that go to the state government, maybe those are the taxes that you cut or that you funnel back to the local governments, but you don't want to cut local taxes. You could also think about policies that increase tangible local benefits. Some of these may be providing money to local government services that people care about: schools, for example. But it could take a different form, like community benefits agreements or local policies that incentivize the developer to include more neighbors in direct payment schemes.

To address this invisibility issue, my students and I are doing deep dives on the property tax policy in eight Midwestern states right now.[58] We will be posting very nerdy explainers and tax calculators where people can estimate which units of government benefit and by how much. Finally, I also just want to plant the seed that while I've been talking a lot about wind and solar, there are other energy technologies coming—battery storage for example—that states haven't sorted out how they're to be taxed. This is problematic if the key benefit for local governments is in the economic benefits.

To the third observation that fit is linked to why you live here: people who are next to brownfields may view this renewable energy project as a benefit—cleaning up a blighted site. And I actually have a colleague at the University of Michigan Law School, Alexandra Klass, who's talked about repurposed energy and brownfields.[59] I think it's a good idea, but I'm going to give the caveat that we should not assume that a person who has lived near

57. Zachary D. Pritchard & Sarah Mills, *Renewable Energy Requirements on the Ballot: An Analysis of County-Level Voting Results*, 148 ENERGY POL'Y, 2021, at 1, 3.

58. *Local Property Tax Impacts of Large-Scale Wind and Solar Projects*, UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST., https://graham.umich.edu/project/renewable-energy-tax-impacts (last visited Nov. 16, 2025).

59. Alexandra B. Klass & Hannah Wiseman, *Repurposed Energy*, 109 MINN. L. REV. 219, 267 (2024).

a site of pollution in the past wants to live next to another industrial activity. We have public polling data that suggests that this is seen as a generally more feasible, socially acceptable approach.[60] But particularly if brownfield sites are in communities that have borne the burden of pollution in the past, we should not make assumptions of what they want on that site in the future. Beyond brownfield policies, you can take this idea that some communities may be more welcoming than others to inform grid expansion and think of extending transmission to welcoming places. We're going to need to build the grid out in order to have this energy transition, and we often think about building the grid to the places with the best wind and solar resources, which is reasonable and important. But I think we would be even more successful if we also considered expanding the grid in places where we're going to find more farmers and fewer lakers.

To the fourth observation that it's hard to get a straight story about energy, one of the things that we need to do is find and fund trusted voices to provide this information. That might be folks within land-grant extension services, it could be state energy offices, or it could be local government associations. This is a picture from a meeting that I had with extension folks a couple of years ago who were gung-ho because they knew that they were trusted in rural communities; farmers have been turning to them for help on agricultural activities for years.[61] But they also wanted to make sure that they continued to be seen as neutral. For them, that meant that the end goal was not necessarily renewable energy but rural prosperity and the role that renewable energy could play in advancing rural prosperity. Thinking about how these folks—who are trusted in rural communities but may not actually have tons of expertise on energy—can incorporate energy into their work in an authentic way I think is really important.

The fifth observation was that engagement is critical in the short and long-term. I confess that this very much shows my bias as a planner. I think processes must be designed to get negative input early when it can actually influence the project.[62] Whether we're talking about processes for energy or other land uses at the state or local level, usually our required public input comes way too late to actually make a difference, well after the project has already been designed. We need to get that input much earlier so it can change the design of a project. We need to exceed notice requirements. You

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60. *Perceptions of Large-Scale Solar Project Neighbors*, *supra* note 29, at 77.

61. *Extension & Renewables Convening*, UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST. (Oct. 2022), https://graham.umich.edu/media/files/Extension-and-Renewables-Convening.pdf.

62. DOUGLAS L. BESSETTE ET AL., UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST., SUPPORTING COMMUNITY-CENTERED SOLAR DEVELOPMENT: A GUIDE TO HOSTING COMMUNITY CONVERSATIONS ABOUT LARGE-SCALE SOLAR DEVELOPMENT 1 (Dec. 2024).

might only be required by law to send notice to people within 300 feet, but in a rural place, sending postcards to everyone doesn't cost that much and lets everyone know what's going on or what's being proposed. I'll just say to this end, I have serious qualms about state-level siting reform and if it reduces local input, which some of it does. It's not just me who has concerns. The National Academy of Sciences did a report at the end of 2023 called "Accelerating Decarbonization in the United States," and I'm going to read this quote to you just in case you can't read this in the back of the room:

> Research demonstrates that the *character and quality* of the process of engaging the public in the context of siting and permitting projects *will affect the pace and scale* of decarbonization . . . . If permitting reform includes significant reductions in meaningful opportunities for public engagement, then such reform would *create a real risk of slowing, rather than hastening*, the process of building out a net-zero infrastructure. [63]

So it's not just me, it's some of the smartest scientists in the country who say this. The emphasis in the quote, though, is mine.

Finally, let's return to the observation that bigger is not always better. We really need policies to take pressure off gigantic projects. We need to make it much easier to build smaller projects and have them get into the grid. We need to compensate them more fairly. This means opportunities not only for distributed generation like rooftop solar, but also for small solar farms that would connect into the distribution grid, like through proposed community solar programs.

My students know I have lots of crazy ideas. My craziest idea right now is this idea of a fair-share model.[64] This is in response to siting reform, which a lot of states are undertaking to try to allow for more renewable energy projects to be built. In most of the proposals, state preemption kicks in only for large projects, so local governments can do kind of whatever they want for small projects, but the largest projects are reserved for the state to make the decisions on. The problem is that the largest projects are the ones that often have the biggest local impact. A project is considered "large" once it

63. NAT'L ACAD. OF SCIS., ENG'G, & MED., ACCELERATING DECARBONIZATION IN THE UNITED STATES: TECHNOLOGY, POLICY, AND SOCIETAL DIMENSIONS 272, 275 (2024).

64. Sarah Banas Mills, *Principles for Siting Clean Energy in Michigan to Reach MI Healthy Climate Goals*, UNIV. OF MICH.: GRAHAM SUSTAINABILITY INST., https://graham.umich.edu/media/files/Principles-for-Siting-Clean-Energy-in-MI-Climate-Goals-16.pdf (last visited Nov. 16, 2025).

hits a certain threshold, usually 50 megawatts or 100 megawatts, but there is no cap on how big those projects can be. The idea of a fair share is that everybody's got to take some sort of energy infrastructure. If we want to keep our lights on, and if we want to keep data centers operational so we can Google things better, all communities have a part to play, whether they are urban or rural. Everyone should be asked to do something, but no community should be asked to bear the whole burden of keeping the lights on. The concept of a fair share enables a community at some point to say, "We've done our share, and we don't have to take the next project."

I want to close with two final thoughts. The first, I already shared: all energy sources have trade-offs at the local level, and I think that we really need to be realistic and honest about those. The second is that I consider myself a ruralist, and I think that an energy transition is an opportunity to expand urban-rural partnership rather than stoking divides. But I think that how state and federal leaders respond to local opposition and communities saying, "We're not sure about this," is going to be critical to determine whether we achieve that partnership or make that divide larger.