

Research & Policy Brief Series

Challenges of Large-Scale Solar Electric Siting in New York State*

By David Kay, Roberta Nilson, and Richard Stedman, Cornell University

What is the Issue?

New York State's new Climate Leadership and Community Protection Act (CLCPA), which took effect in January 2020, officially sets the goal of a 100% carbon-neutral economy by 2050. It further mandates that at least 70% of electricity be produced from renewable sources—including solar—by 2030.¹ In order for New York State (NYS) to meet these ambitious goals, an acceleration of renewable electricity production needs to take place. This brief examines the extent and location of solar electricity generating capacity already installed or planned, with a focus on Large-Scale Solar (LSS) projects; most of the State's solar electricity needs are expected to be met by solar facilities significantly larger than 5 MW "nameplate capacity", rather than the smaller or "distributed" solar installations already existing or known to be "in the pipeline".² Many factors influence the siting of LSS projects, contributing to facility development on upstate rural, and especially agricultural, land—a situation not devoid of controversy.

Proposed Solar Electricity Generation

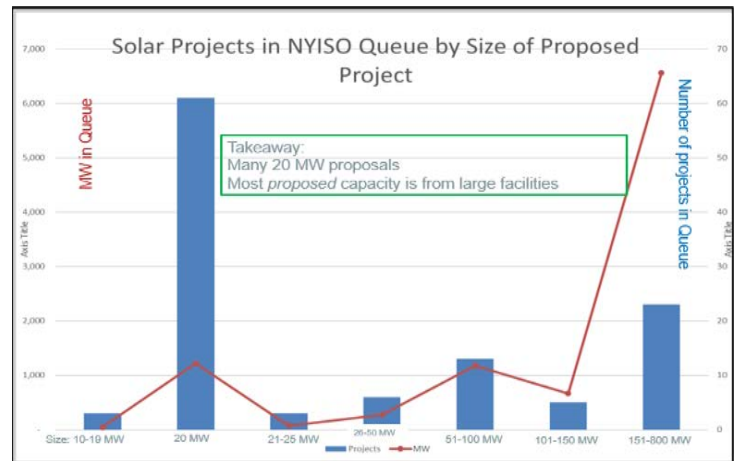
The NY Independent System Operator (ISO) manages NYS's electricity grid and maintains a queue of LSS (and other) proposed projects. As of early 2020, these proposed solar projects total almost 9 GW of new capacity.³ Figure 1 shows that while many of the proposed facilities range between 10-25 MW, most of the planned capacity is associated with much larger facilities. It should be noted, however, that many of the proposed projects will never be built (economic viability, inability to get permitted, etc.). Moreover, no proposed facilities larger than 25 MW have completed the current permitting process; few have progressed past the third stage of a six-stage process. The slow pace of permitting is one reason a new "accelerated" process was recently adopted by the legislature.⁴

Figure 2 highlights the location of the subset of 40 large solar facilities actively under state-level permit review as of March 2020. Most LSS capacity is concentrated in a "NY Solar Belt" stretching along the north and central part of the state, reaching from western NY to the margins of the Adirondacks; many are located in low population density, rural areas far from the state's largest downstate centers of electricity consumption.⁵

Factors Influencing Solar Facility Location

Information provided by developers, regulators and other stakeholders highlights factors which influence solar location decisions. Some factors apply regionally, while others emphasize site-specific characteristics. Important

Figure 1. Solar Projects in NY Independent System Operator Queue by Size of Proposed Project



factors include proximity to three phase electricity lines, the location-influenced price paid for electricity, and the amount of solar radiation available (insolation) at a particular site due to favorable slopes, yearly cloud cover, and more. Developers and regulators must consider additional factors such as whether forested land will be cleared, wildlife habitat altered, or wetlands impacted.⁶ The local policy environment and expectations of community support are also important.

The cost of solar land leases and related difficulties of assembling mostly contiguous large acreages⁷ are additional factors clearly important for any facility requiring a large site. Thus, even as residential and other small-scale solar development has concentrated downstate in more densely populated areas, proposals for LSS are more common in

*This work is supported by funding from a joint research and extension program funded by the Cornell University Agricultural Experiment Station (Hatch funds) and Cornell Cooperative Extension (Smith Lever funds) received from the National Institutes for Food and Agriculture (NIFA) US Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of NIFA or the USDA. 1. In 2016, electricity accounted for 40% of the State's total energy use. Fossil fuels (overwhelmingly natural gas), generated more than one-third of the electricity produced in-state, while hydro power provided 17%. Less than 5% came from other renewable sources, primarily wind. The State imports 16% of its electricity. See <https://www.nysed.gov/About/Publications/EA-Reports-and-Studies/Patterns-and-Trends>. 2. Distributed installations add up to approximately 3 GW of capacity. 1 gigawatt (GW) = 1,000 megawatts (MW) = 1,000,000 kilowatts (KW). For current technology, 1 MW of solar generating nameplate capacity (maximum output under optimal conditions) typically requires 5-7 acres or more of land. In New York, 1 MW serves roughly 150-200 homes. A typical residential solar installation is about 5KW, or 0.005 MW. See <https://www.seja.org/initiatives/whats-megawatt>. 3. One source estimates NYS will need 23 GW of solar electric capacity, including 15 GW not yet formally contracted or mandated. See <https://pv-magazine-usa.com/2019/06/20/new-york-state-is-going-to-need-15-gw-of-solar-power>. 4. See <https://www.nysed.gov/About/Newsroom/2020-Announcements/2020-04-03-NEW-YORK-STATE-ANNOUNCES-PASSAGE-OF-ACCELERATED-RENEWABLE-ENERGY-GROWTH-AND-COMMUNITY-BENEFIT-ACT-AS-PART-OF-2020-2021-ENACTED-STATE-BUDGET>. 5. Note a related seeming paradox: the NYISO 2019 Power Trends Report indicates that the upstate portion of the grid is already only 11% dependent on fossil fuels for current generation, whereas downstate is 70% dependent on fossil fuels. At the same time, there are bottlenecks in moving electricity to the downstate load centers. Projects designed to remove the bottlenecks are in the works.

rural upstate areas, often impacting farmland. Consider an example contrasting cost and land assembly indicators in two NYS counties, Orange and Livingston:

Land Cost: The average full (market rate) assessed value of parcels in Orange County is more than six times that of Livingston County, about four-fold for large parcels (>50 acres).

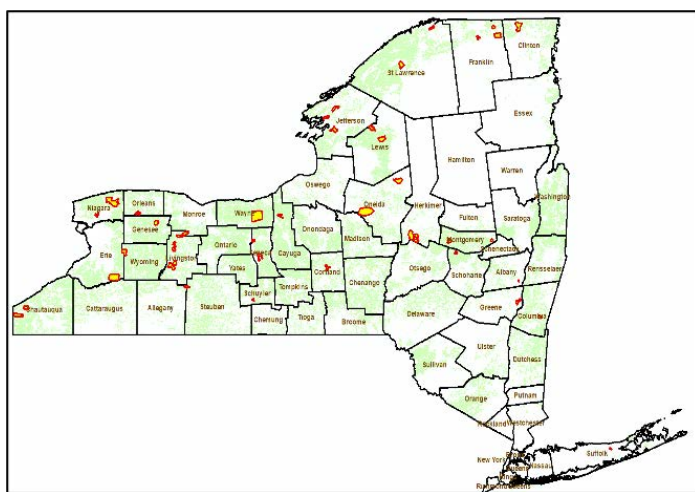
Assembly: While Livingston County has only one-fifth the population density of Orange County, the average parcel size is almost four times greater.



Both land lease costs as well as the “transaction costs” (need to negotiate and sign leases with more owners), would be considerably higher in Orange County. While Livingston is in line to host several very large projects, none at this scale are planned for Orange.⁸

Solar Siting and Agricultural Land

Large solar facilities tend to be proposed in upstate landscapes – especially those featuring flat, cleared land – where agricultural land is prevalent. A higher proportion of land is in agricultural districts within the counties in which the 40 LSS projects are currently under state review (33%) compared to other counties (24%).⁹ These county level results inform our understanding of land actually within the project boundaries we mapped in Figure 2.¹⁰ We found that 46% of the parcel acreage within project boundaries was classified as agricultural by the assessor.¹¹ Significant acreage was concentrated in two other categories: 16% on “vacant land” parcels, and 14% on parcels categorized as “rural residence with acreage”. Of the agricultural land, 39% was considered vacant, 33% in field crops, 18% in dairy farming, and the remaining 10% in ‘other’. Soil analysis within the project boundaries (Figure 3) found that 77% of

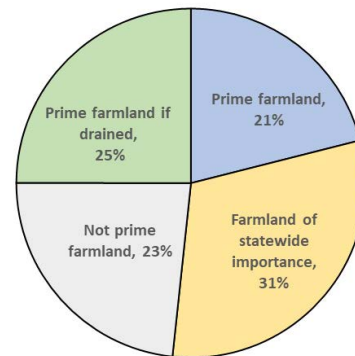
Figure 2. Location of 40 solar projects (36-450 MW) under currently active State (Article 10) review, New York State.



 Solar projects under Article 10 review
 NYS Agricultural Districts

the acreage was on soils with agricultural potential – 21% of it considered “prime”.¹² However, this acreage represents only a very small fraction of the land suitable for farming within the projects’ host counties. Finally, we analyzed the “land use/land cover” composition of the area within these solar project boundaries.¹³ Agriculture, according to this measure, summed to 48% of the acreage, closely mirroring the result derived from assessment data. Most of the remaining acreage was classified as forest land (33%) or woody wetlands (12%), neither of which is optimal for solar development.

Figure 3. Approximate distribution of soil types within current Article 10 project boundaries



Conclusion

Assembling 1,000 or more acres for a moderately large solar facility is challenging. The facility footprints of the LSS sites proposed to date often involve significant amounts of agricultural land. NYS’s new siting legislation laudably incentivizes a nearly universal first priority: “re-use or adaptation of sites with existing or abandoned commercial or industrial uses”. While research is underway on creative options for “co-location” of solar facilities and farming, results are not yet conclusive. The compatibility of LSS facilities with agriculture production has already become a point of friction in NYS. Ultimately, the way communities, farmers, developers, researchers and the State resolve such concerns will determine the extent to which NYS will be able to depend on solar energy to meet its climate and electricity generation goals. Given NYS’s pioneering and ambitious energy policies, its ability to navigate these challenges and meet these goals will set the stage far beyond the state’s borders.

6. We estimate the project areas – not the smaller solar panel footprints that will be permitted – of the 40 facilities undergoing state review intersect more than 30,000 acres of wetland on NYSDEC freshwater wetland maps. Of this acreage, only 22% is not also partly or wholly in a NYS Agricultural District. 7. At 5+ acres per MW, a 20 MW proposal would require 100 acres or more; a 100 MW proposal 500 acres or more; a 350 MW proposal 1,750 acres or more. 8. Similar contrasts emerged from a parallel analysis comparing parcels in all counties hosting solar facilities under Article 10 review vs. all other counties. 9. The proportions are greater for 50+ acre parcels: 55% in LS counties vs. 26% of acreage in these large parcels in other counties. However, the general comparison holds even more strongly when comparing parcels designated as “agricultural” by assessors. Comparing Livingston v. Orange: 53% v. 14% of county acreage for all assessor designated agricultural parcels, 68% v. 19% considering only large parcels of 50+ acres. Comparing all LS versus non LS counties: 21% v. 12% for all assessor designated agricultural parcels, 26% v. 15% for only the large parcels. 10. We used the most recent publicly available estimated facility figures as of the end of March 2020 for the 40 projects under state review at this time, analyzing parcels with centroids within the boundaries. An important caveat: projects usually involve much larger acreages, especially in early stages of review, than will actually be covered by solar panels or otherwise disturbed. The review process in part considers where on the site disturbance can and should be avoided. The project areas mapped averaged 39 acres per MW, whereas 5-10 acres per MW is typically involved. Projects more advanced through Article 10 phases involved smaller acreages: 31, 27, and 18 acres per MW on average for Phases 1, 2 and 3 respectively. Only a couple of projects have advanced past these phases. 11. For estimation purposes, the “involved” parcels had centroids within the mapped project boundaries. We also found that agricultural parcels comprised 14% of the total parcels in number, with 16% of the total assessed valuation. 12. For a technical definition of so-called “soils of statewide importance” in NYS, see <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B5E8EE899-E422-4F37-895F-78DCC8BDAE84%7D>. Based on NLCD 2016 data and land cover categories. See <https://www.mrlc.gov/data>

