

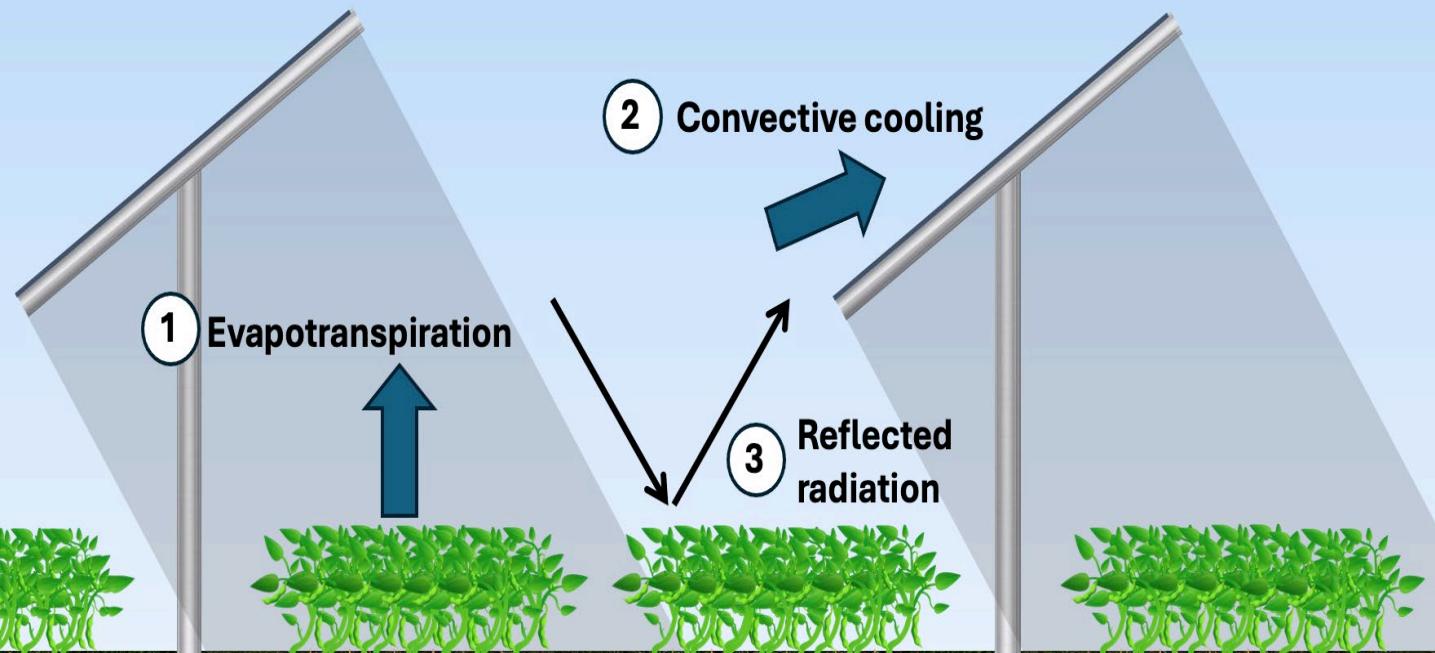
Featured Research: Agrivoltaics

The value that people attach to undeveloped land may come from its suitability for growing food and other products, habitat that it provides wildlife, the sense of place and cultural context that it gives communities, and the local and global ecosystem services that it provides. Land can also provide space to convert sunlight to electricity without generating climate-warming greenhouse gases. NYSERDA's environmental research program funds projects that investigate the interactions of large scale solar energy development on the other valuable characteristics of land, including land currently dedicated to agriculture.

This article highlights research from the Energy and Environmental Research Lab at Cornell University, led by Dr. Max Zhang, which was selected through PON 4270 - a competitive research solicitation for projects on PV design, information gaps, and mitigation opportunities. Zhang's research team developed a computational-model, utility-scale solar site to understand the drivers and dynamics behind the cooling benefits from growing agricultural crops underneath and between the panels, which can increase panel energy conversion efficiency. The Cornell research

Henry J. Williams and K. Max Zhang

Three modes of passive cooling for solar panels with agrivoltaics



(Article Highlight, continued...)

team recently published [a study](#) that teases apart three major contributors to this overall cooling: evapotranspiration, albedo, and convective cooling as modulated by raising panel heights to accommodate crops. Evapotranspiration is the evaporative cooling enhanced by plants as they draw soil moisture up into their roots and out of their leaves. Crops like soybeans also have higher albedos than bare earth, meaning that they reflect more incident sunlight back into space and emit less absorbed sunlight as heat. Using computational fluid dynamics, the study authors showed that cooling provided by these two effects isn't strictly additive, nor is the impact of the third variable, the enhanced convective cooling by wind that is possible when panel heights are raised above the typical 0.5 m to 2.5 m or 4.5 m. Higher panel heights allow more sunlight to reach the areas underneath panels and are a solar design accommodation that could be made to increase the total area suitable for crops. However, this and the passive cooling that is made possible by higher panel heights comes at the expense of more racking materials and increased visibility of the solar panels. One potential application of this model will be to enable site-specific comparisons of different crops and panel arrangements to understand whether there is a net benefit to PV efficiency or lifespan. Additional work is underway to study tracking systems, bifacial arrays, and the impact of panel row spacing on the availability of direct and diffuse solar radiation below and between panels, so they can be optimized for dual-use agricultural and solar installations.

Other solar projects funded by NYSERDA will be highlighted as they are completed. These include research on local perceptions of solar development on agricultural land, the suitability of solar developments as bird and pollinator habitat, and the influence of agrivoltaics on soil health and pasture grazing by sheep.



Land Based-Renewables

- RFI Issued for Agrivoltaics:** NYSERDA collected insights from a broad group of stakeholders through the Agrivoltaics Research and Demonstration Request for Information 5397, that will assist NYSERDA in developing a future project solicitation process that aligns with the unique needs and challenges of both the solar and agricultural industries in New York State for agrivoltaics.

Fawn in Solar Farm



Photo Credit: Many Klehr at DNV

(Land Based-Renewables, continued...)

Sheep in Solar Farm



Photo Credit: Many Klehr at DNV

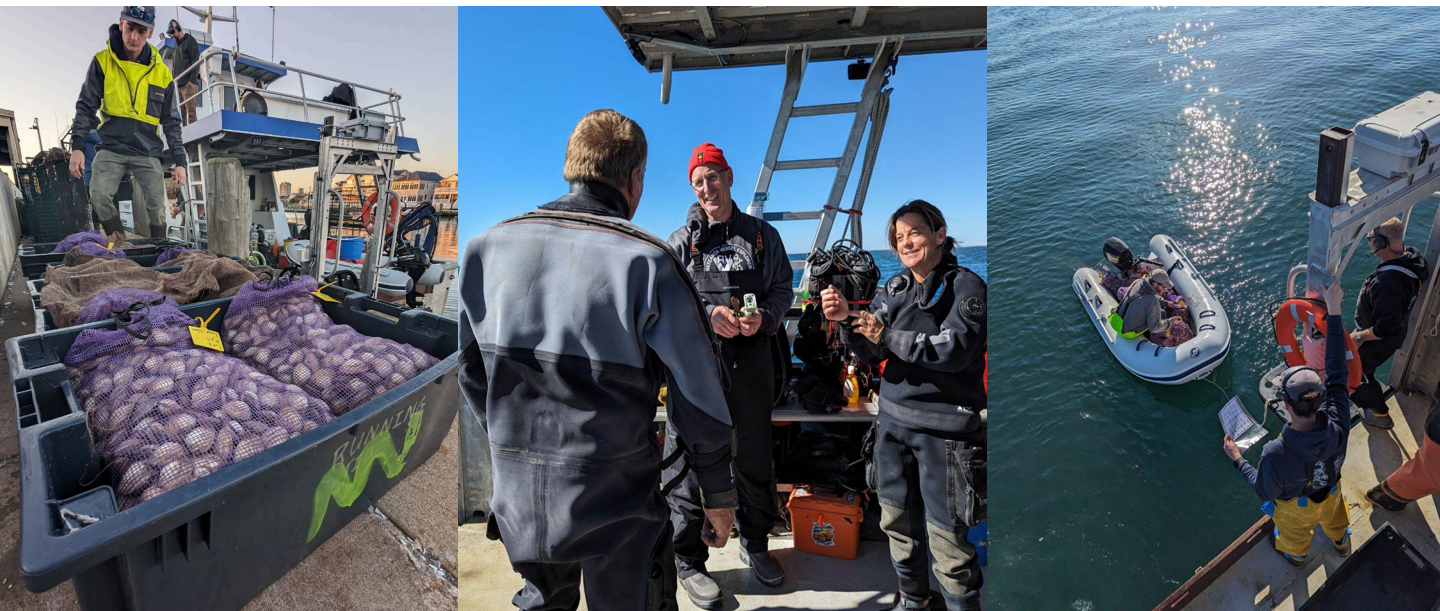
- **Agricultural Technical Working Group:** The Agricultural Technical Working Group (A-TWG) capped off 2023 with a December meeting. It covered updates to the [new solar scorecard](#) for the Renewable Energy Standard Request for Proposals (RESRFP23-1). Notably, the scorecard incorporated a new framework to measure a proposed projects' forest carbon stock estimates developed for [the New York Forest Carbon Assessment](#). Mandy Klehr, a biologist with DNV, presented her research on the abundance and diversity of birds observed at solar sites. Professor Max Zhang of Cornell presented his lab's work on the microclimate impact of solar array geometry and design. The November Agrivoltaics Specialist Committee hosted a presentation by Anne Sapienza, a former tax assessor from Genesee County for her perspective on the agricultural assessment program's methods. Relatedly, NYSERDA released the report [Growing Agrivoltaics in New York State](#).
- **Solar Research Presentations:** Mandy Klehr, a biologist at DNV, presented her research as a panelist in the Avian-Solar Interactions session of the [solar symposium hosted by Renewable Energy Wildlife Institute \(REWI\)](#) in November. Ted Nitza of Walden Environmental also presented research that he and his collaborators at State University of New York (SUNY) New Paltz are doing to understand how solar development and habitat creation at a capped landfill will influence bird and pollinator abundances at the site. Both projects were funded by NYSERDA's environmental research Public Opportunity Notice (PON) 4270 on photovoltaic (PV) Site Design, Information Gaps, and Mitigation Opportunities.



Offshore Wind

- Regional Fisheries Compensation Fund:** The Multi-State effort to advance a regional fisheries compensation fund has continued to make significant progress. As of January 1, 2024, the States have issued a letter of continued support to American Clean Power, a trade organization that represents the offshore wind developers involved in this process. This letter triggers financial commitments to be set aside by the developers, states, and private foundations to launch a NYSERDA-sponsored RFP for the selection of an entity for the design and development of a claims-based compensation fund and associated policies and procedures. The RFP is expected to be launched in early Q1 of 2024. The letter and further details on the program can be found here: <https://offshorewindpower.org/fisheries-mitigation-project>
- Surfclam Deployment:** Taking advantage of a perfect offshore weather window, Rutgers University began deploying juvenile surfclam in late October to evaluate growth and survival rates of hatchery raised clams to determine if stock enhancement projects could provide for a valuable mitigation option to further promote co-existence between offshore wind and fishing industries. This is one of the projects funded through PON 5226 that allocated up to \$2.5 million for environmental and fisheries research topics that include the enhancement of sustainable fisheries and changes in biological environments of benthic habitats.

Left to Right: (1) Surfclams on the dock getting loaded onto the research vessel for deployment at the project site, (2) Surfclams on the dock getting loaded onto the research vessel for deployment at the project site, and (3) Scientific divers discuss project objectives and safety procedures as the prep for in-water deployment and observation of surfclam burial, a metric of healthy clams and successful deployment.



(Offshore Wind, continued...)

Map depicting the glider route offshore between Long Island and New Jersey with fin whale detection

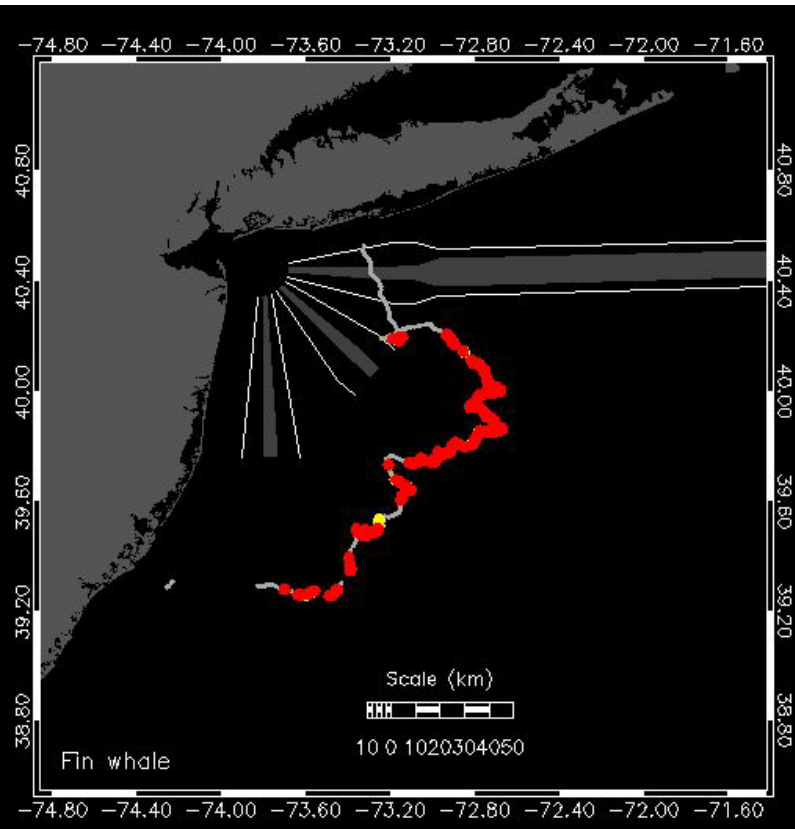


Photo Credits: Rutgers University, Stony Brook University and Woods Hole Oceanographic Institution

- Undersea Glider Deployment:** Stony Brook University, Rutgers University, and Woods Hole Oceanographic Institution completed their third deployment of a Slocum G3 glider (an autonomous underwater vehicle) off the coast of Long Island, New York to conduct surveys for baleen whales and collect oceanographic information. Whale data is being published in near-real time on [Robots4Whales](#) and oceanographic data can be found on the [SoMAS](#) Glider deployment site. The October deployment detected fin whales throughout the survey track and humpback whales were detected near the deepest portions of the track, possibly associated with colder temperatures (Image: Confirmed fin whale detections on 15 of 19 days between October 18 and November 6, 2023).
- NYSERDA continues to host a monthly offshore wind webinar series, [Learning from the Experts](#). Recent webinars have discussed how offshore wind developments are financed and how offshore wind is installed.

- Public Opportunity Notice (PON) 5226:** Three projects, funded under PON 5226, commenced in the fall to better understand potential impacts of offshore wind development on benthic habitats.
 - EONcrete, in partnership with Stony Brook University, will evaluate the performance and environmental impact of their [ecological Droplock units](#) compared to standard scour protection materials.
 - The Nature Conservancy (TNC), also in partnership with Stony Brook University, will evaluate field sampling techniques and analytical procedures to determine the most effective methods to test for the effects of scour protection on benthic habitats.
 - Lastly, the Biodiversity Research Institute, with Duke University, Rutgers University, University of St. Andrews, and Royal Belgian Institute of National Sciences, will develop models to project expected changes to benthic habitats from offshore wind development and propose research plans to answer questions about habitat and community change.

(Offshore Wind, continued...)

- **South Fork Wind Farm Tour:** On December 7th, Morgan Brunbauer, NYSERDA's Offshore Wind Marine Fisheries Manager, along with other colleagues from NYSERDA had the exciting opportunity to tour the construction occurring at the South Fork Wind Farm. This project is over 30 miles east of Montauk, New York and consists of twelve 11 MW wind turbines for a total project size of 132 MW. The offshore substation, wind installation vessel with turbine blades, and power generation were all observed during the trip. This project is the first offshore wind project in New York to send energy generated by offshore wind back to our power grid. More project details can be found here: <https://southforkwind.com/>

Left to Right: (1) NYSERDA Team, including NYSERDA President and CEO Doreen M. Harris, observe the construction happening at the South Fork Wind Farm and (2) View of the Offshore Substation and a cabling testing services vessel at South Fork Wind Farm.



Photo Credit: NYSERDA

- **State of the Science:** The 2024 [State of the Science Workshop](#) on Offshore Wind, Wildlife, and Fisheries, hosted by NYSERDA on behalf of the New York State Environmental Technical Working Group, will be held on Long Island, New York from July 16-19, 2024.
- On October 24, Governor Hochul announced the provisional awards [for three new offshore wind projects](#): Attentive Energy One (1,404 MW), Community Offshore Wind (1,314 MW) and Excelsior Wind (1,314 MW). Altogether, these project will bring more than \$85 million to support wildlife and fisheries research, mitigation, and ecosystem enhancement.
- On November 30, 2023, NYSERDA announced the launch of New York's [fourth competitive offshore wind solicitation](#) as part of New York's 10-Point Action Plan to bolster the State's large-scale renewable industry. This expedited solicitation supports progress toward achieving New York's Climate Act goals of sourcing 70% of the State's electricity from renewable sources by 2030 and developing 9,000 megawatts of offshore wind by 2035.

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NYSERDA Senior Project Manager Kate McClellan Press (second from right) participating in a panel at the American Clean Power Conference



Photo Credit: NYSERDA

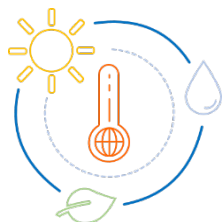
- **American Clean Power Conference:** NYSERDA has been active in discussions on reducing risk to marine species during offshore wind development through advancing monitoring technologies. NYSERDA participated on a panel at the American Clean Power Conference in October entitled "From the Drawing Board to the Permit: How Whale Monitoring Technology Can Save Offshore Wind Projects and Protect an Iconic Species". NYSERDA also moderated a panel at the National Offshore Wind Research and Development Consortium [Symposium](#) in December on "Applications of Autonomous Technology".
- **Cable Working Group:** NYSERDA continues to lead the State agency Cable Working Group (CWG), which is now focused on informing the

upcoming NYISO New York City Public Policy Transmission Need (PPTN) Solution Solicitation. The Public Service Commission [Order](#) included a requirement for proposers to address siting principles developed by the CWG to help the NYISO Board evaluate permitting risks. The Order also asks State, federal, and local authorities to assist proposers and the NYISO on questions related to permitting risk. To support that, the CWG hosted to Technical Conferences for proposers (See: [Public Policy Documents -> NYC Offshore Wind PPTN](#)).



Ecosystem Response

- **ALTM Science Advisory Committee:** Paul Smith’s Adirondack Watershed Institute (AWI) held their first Scientific Advisory Committee meetings for the Adirondack Long Term Monitoring lake sampling contract in Fall 2023. The Scientific Advisory Committee meetings are held annually to review the functionality of the program and guide decisions as the program faces changes due to funding and a reprioritization of its objectives. Members of the committee are expected to attend annual meetings as well as be available to provide guidance to AWI and NYSERDA throughout the year as needed. During the Fall 2023, committee members worked to provide input on aspects to strengthen the field standard operating procedure, understanding how to strengthen collaboration with other monitoring programs, and opportunities to overcome funding gaps due to recent federal budget cuts.



Climate Change

- **Climate Impacts Assessment:** Major components of the Climate Impacts Assessment (CIA) have been completed. A “quiet launch” of the climate projections happened in the fall to support utility climate change planning efforts. The full climate projection information and chapter were released in early January, as part of Governor Hochul’s State of the State agenda. Finally, the

(Climate Change, continued...)

technical sector chapters and accompanying summary information were released in early February. An economic impact analysis is still under development, to be released later in the year. Please [visit the assessment website](#) to access the chapters and summary products.

- **Extreme Heat Adaptation Plan:** NYSERDA staff have continued working with NYS Department of Environmental Conservation and other agencies on the Extreme Heat Adaptation Plan. The final plan will include specific actions the State will take to build resilience and adapt to extreme heat, build local capacities, and support local communities in taking action.



Air Quality and Public Health

- **US EPA International Emissions Inventory Conference:** In September, Ellen Burkhard and several NYSERDA-supported researchers attended this emission inventory conference in Seattle, WA. A session was dedicated to residential wood combustion and researchers from the Northeast States for Coordinated Air Use Management and Brookhaven National Laboratory (BNL) presented findings on laboratory measurements of particulate matter and co-pollutant gases. Additionally, BNL presented on its preliminary findings of emissions for oil- and gas- fired residential boilers tested under a realistic duty-cycle typical of upstate NY. The University of Rochester presented preliminary findings on a top-down methane emissions inventory. When final, this will be used to compare to the bottom-up NYS Greenhouse Gas Inventory. The University of Texas-Austin presented findings of methane emissions from mid-stream natural gas compressor stations in NYS which will be incorporated into the Rochester inventory as well. Cornell University presented results of innovative approaches to estimating heating and traffic sources using computer vision techniques.
- **U.S. Greenhouse Gas Center Stakeholder Meeting:** In November, Ellen Burkhard attended a stakeholder meeting and announcement of the U.S. GHG Center, a multi-agency collaboration between EPA, National Aeronautics and Space Administration, National Institute of Standards and Technology, and National Oceanic and Atmospheric Administration, that consolidates greenhouse gas information from observations and models. The goal of the U.S. GHG Center is to provide decision-makers, scientists, and the public with one stop for GHG data and analysis.
- **American Geophysical Union (AGU) Conference:** In December, Ellen Burkhard attended the AGU meeting along with NYSERDA-supported researchers. Researchers from the University of Rochester, Columbia University, and University of Texas Austin presented findings on methane emissions in NYS including compressor stations, landfills, wastewater treatment plants and buildings. Researchers from Yale University presented preliminary findings on speciated particulate matter and co-pollutants in the New York City region.

Program Reports and Papers

Program Reports & Papers posted recently include:

Air Quality and Related Health Research: Particulate Matter (PM), Ozone and Co-Pollutants

Cheng, B., K. Alapaty, S. Arunachalam (2023) Spatiotemporal trends in PM_{2.5} chemical composition in the conterminous U.S. during 2006–2020, *Atmos. Environ.*, 316, 120188, <https://doi.org/10.1016/j.atmosenv.2023.120188>

Commame, R., Hallward-Driemeier, A., and Murray, L. T.: Intercomparison of commercial analyzers for atmospheric ethane and methane observations, *Atmos. Meas. Tech.*, 16, 1431–1441, <https://doi.org/10.5194/amt-16-1431-2023>

Gu, J., Sward, J. A., and Zhang, K. M. (2023) Enhancing power plant emissions prediction using public datasets, *Environmental Science: Advances*, 2023, 2, 1696-1707, <https://doi.org/10.1039/D3VA00191A>

Yonghua Wu, Kaihui Zhao, Xinrong Ren, Russell R. Dickerson, Jianping Huang, Margaret J. Schwab, Phillip R. Stratton, Hannah Daley, Dingdong Li, Fred Moshary, Ozone pollution episodes and PBL height variation in the NYC urban and coastal areas during LISTOS 2019, Submitted to *Atmos. Environ.*, December 2023

Zhang, Jie, Junfeng Wang, Alexandra Catena, Margaret J. Schwab, Matthew Ninneman, Dirk Felton, and James Schwab. “[Enhanced summertime PM_{2.5}-suppression of O₃ formation over the Eastern US and implications for O₃-sensitivity](#)”, *Environ. Sci. Atmos.*, 2023, DOI: 10.1039/d3ea00040k