



**NREL Wind Energy Publications**  
*Fiscal Year 2022 through March 31, 2022*



## Journal Articles

- Abbas, Nikhar J.; Zalkind, Daniel S.; Pao, Lucy; Wright, Alan. 2022. "A Reference Open-Source Controller for Fixed and Floating Offshore Wind Turbines." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-7-53-2022>.
- Aird, Jeanie A.; Quon, Eliot W.; Barthelmie, Rebecca J.; Debnath, Mithu; Doubrawa, Paula; Pryor, Sara C. 2021. "Region-Based Convolutional Neural Network for Wind Turbine Wake Characterization in Complex Terrain." *Remote Sensing*. <https://dx.doi.org/10.3390/rs13214438>.
- Allen, Jeffery; Young, Ethan; Bortolotti, Pietro; King, Ryan; Barter, Garrett. 2022. "Blade Planform Design Optimization To Enhance Turbine Wake Control." *Wind Energy*. <https://dx.doi.org/10.1002/we.2699>.
- Bay, Christopher J.; Chintala, Rohit; Chinde, Venkatesh; King, Jennifer. 2022. "Distributed Model Predictive Control for Coordinated, Grid-Interactive Buildings." *Applied Energy*. <https://dx.doi.org/10.1016/j.apenergy.2022.118612>.
- Bay, Christopher J.; Fleming, Paul; Doekemeijer, Bart; King, Jennifer; Churchfield, Matt; Mudafort, Rafael. 2022. "Addressing Deep Array Effects and Impacts to Wake Steering With the Cumulative-Curl Wake Model." *Wind Energy Science Discussions* [preprint]. <https://doi.org/10.5194/wes-2022-17>.
- Ben-Naim, Micha; Aldridge, Chase W.; Steiner, Myles A.; Britto, Reuben J.; Nielander, Adam C.; King, Laurie A.; Deutsch, Todd G.; Young, James L.; Jaramillo, Thomas F. 2022. "Engineering Surface Architectures for Improved Durability in III-V Photocathodes." *ACS Applied Materials & Interfaces*. <https://dx.doi.org/10.1021/acsami.1c18938>.
- Thomsen, Jonas Bjerg; Bergua, Roger; Jonkman, Jason; Robertson, Amy; Mendoza, Nicole; Brown, Cameron; Galinos, Christos; Stiesdal, Henrik. 2021. "Modeling the TetraSpar Floating Offshore Wind Turbine Foundation as a Flexible Structure in OrcaFlex and OpenFAST." *Energies*. <https://dx.doi.org/10.3390/en14237866>.
- Bergua, Roger; Robertson, Amy; Jonkman, Jason; Platt, Andy; Page, Ana; Qvist, Jacob; Amet, Ervin; et al. 2021. "OC6 Phase II: Integration and Verification of a New Soil-Structure Interaction Model for Offshore Wind Design." *Wind Energy*. <https://dx.doi.org/10.1002/we.2698>.
- Bodini, Nicola; Hu, Weiming; Optis, Mike; Cervone, Guido; Alessandrini, Stefano. 2021. "Assessing Boundary Condition and Parametric Uncertainty in Numerical-Weather-Prediction-Modeled, Long-Term Offshore Wind Speed Through Machine Learning and Analog Ensemble." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-6-1363-2021>.
- Bodini, Nicola; Lundquist, Julie K.; Moriarty, Patrick. 2021. "Wind Plants Can Impact Long-Term Local Atmospheric Conditions." *Scientific Reports*. <https://dx.doi.org/10.1038/s41598-021-02089-2>.
- Camarena, Ernesto; Anderson, Evan; Paquette, Josh; Bortolotti, Pietro; Feil, Roland; Johnson, Nick. 2022. "Land-Based Wind Turbines With Flexible Rail-Transportable Blades - Part 2: 3D Finite Element Design Optimization of the Rotor Blades." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-7-19-2022>.
- Cryan, Paul M.; Gorresen, Paulo M.; Straw, Bethany R.; Thao, Syhoune (Simon); DeGeorge, Elise. 2021. "Influencing Activity of Bats by Dimly Lighting Wind Turbine Surfaces With Ultraviolet Light." *Animals*. <https://dx.doi.org/10.3390/ani12010009>.
- Doekemeijer, Bart Matthijs; Simley, Eric; Fleming, Paul. 2022. "Comparison of the Gaussian Wind Farm Model With Historical Data of Three Offshore Wind Farms." *Energies*. <https://dx.doi.org/10.3390/en15061964>.
- Dong, Liang; Lio, Wai Hou; Simley, Eric. 2021. "On Turbulence Models and Lidar Measurements for Wind Turbine Control." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-6-1491-2021>.

Fleming, Paul; Sinner, Michael; Young, Tom; Lannic, Marine; King, Jennifer; Simley, Eric; Doekemeijer, Bart. 2021. "Experimental Results of Wake Steering Using Fixed Angles." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-6-1521-2021>.

Guest, Emma E.; Stamps, Brittany F.; Durish, Nevin D.; Hale, Amanda M.; Hein, Cris D.; Morton, Brogan P.; Weaver, Sara P.; Fritts, Sarah R. 2022. "An Updated Review of Hypotheses Regarding Bat Attraction to Wind Turbines." *Animals*. <https://dx.doi.org/10.3390/ani12030343>.

Hale, Amanda M.; Hein, Cris D.; Straw, Bethany R. 2022. "Acoustic and Genetic Data Can Reduce Uncertainty Regarding Populations of Migratory Tree-Roosting Bats Impacted by Wind Energy." *Animals*. <https://dx.doi.org/10.3390/ani12010081>.

Harrison-Atlas, Dylan; King, Ryan N.; Glaws, Andrew. 2021. "Machine Learning Enables National Assessment of Wind Plant Controls With Implications for Land Use." *Wind Energy*. <https://dx.doi.org/10.1002/we.2689>.

Hawbecker, Patrick; Churchfield, Matthew. 2021. "Evaluating Terrain as a Turbulence Generation Method." *Energies*. <https://www.nrel.gov/docs/fy22osti/81049.pdf>.

Jimenez, Antonio; Summerville, Brent. 2022. "Design Innovations for Deployable Wind Turbines." *Military Engineer*. <https://sameneews.org/tme-march-april-2022/>.

Key, Alicia; Roberts, Owen; Eberle, Annika. 2021. "Scaling Trends for Balance-of-System Costs at Land-Based Wind Power Plants: Opportunities for Innovations in Foundation and Erection." *Wind Engineering*. <https://dx.doi.org/10.1177%2F0309524X211060234>.

Latiffianti, Effi; Ding, Yu; Sheng, Shawn; Williams, Lindy; Morshedizadeh, Majid; Rodgers, Marianne. 2022. "Analysis of Leading Edge Protection Application on Wind Turbine Performance Through Energy and Power Decomposition Approaches." *Wind Energy*. <https://dx.doi.org/10.1002/we.2722>.

Lu, Bing; Li, Shuhui; Das, Himadry Shekhar; Gao, Yixiang; Wang, Jing; Baggu, Murali. 2021. "Dynamic P-Q Capability and Abnormal Operation Analysis of a Wind Turbine With Doubly-Fed Induction Generator." *IEEE Journal of Emerging and Selected Topics in Power Electronics*. <https://dx.doi.org/10.1109/JESTPE.2021.3133527>.

Martínez-Tossas, Luis A.; Branlard, Emmanuel; Shaler, Kelsey; Vijayakumar, Ganesh; Ananthan, Shreyas; Sakievich, Philip; Jonkman, Jason. 2021. "Numerical Investigation of Wind Turbine Wakes Under High Thrust Coefficient." *Wind Energy*. <https://dx.doi.org/10.1002/we.2688>.

Millican, Samantha L.; Clary, Jacob M.; Musgrave, Charles B.; Lany, Stephan. 2022. "Redox Defect Thermochemistry of FeAl<sub>2</sub>O<sub>4</sub> Hercynite in Water Splitting From First-Principles Methods." *Chemistry of Materials*. <https://dx.doi.org/10.1021/acs.chemmater.1c01049>.

Nejad, Amir R.; Keller, Jonathan; Guo, Yi; Sheng, Shawn; Polinder, Henk; Watson, Simon; Dong, Jianning; et al. 2022. "Wind Turbine Drivetrains: State-of-the-Art Technologies and Future Development Trends." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-7-387-2022>.

Otter, Aldert; Murphy, Jimmy; Pakrashi, Vikram; Robertson, Amy; Desmond, Cian. 2021. "A Review of Modelling Techniques for Floating Offshore Wind Turbines." *Wind Energy*. <https://dx.doi.org/10.1002/we.2701>.

Peterson, Trevor S.; McGill, Brian; Hein, Cris D.; Rusk, Adam. 2021. "Acoustic Exposure to Turbine Operation Quantifies Risk to Bats at Commercial Wind Energy Facilities." *Wildlife Society Bulletin*. <https://dx.doi.org/10.1002/wsb.1236>.

Redfern, Stephanie; Lundquist, Julie K.; Toon, Owen B.; Muñoz-Esparza, Domingo; Bardeen, Charles G.; Kosović, Branko. 2021. "Upper Troposphere Smoke Injection From Large Areal Fires." *Journal of Geophysical Research: Atmospheres*. <https://dx.doi.org/10.1029/2020JD034332>.

- Redfern, Stephanie; Optis, Mike; Xia, Geng; Draxl, Caroline. 2021. "Offshore Wind Energy Forecasting Sensitivity to Sea Surface Temperature Input in the Mid-Atlantic." *Wind Energy Science Discussions* [preprint]. <https://doi.org/10.5194/wes-2021-150>.
- Robertson, Amy; Wang, Lu. 2021. "OC6 Phase Ib: Floating Wind Component Experiment for Difference-Frequency Hydrodynamic Load Validation." *Energies*. <https://dx.doi.org/10.3390/en14196417>.
- Rybczuk, Alex; Juliano, Timothy W.; Lundquist, Julie K.; Rosencrans, David; Bodini, Nicola; Optis, Mike. 2021. "The Sensitivity of the Fitch Wind Farm Parameterization to a Three-Dimensional Planetary Boundary Layer Scheme." *Wind Energy Science Discussions* [preprint]. <https://doi.org/10.5194/wes-2021-127>.
- Sandhu, Rimple; Tripp, Charles; Quon, Eliot; Thedin, Regis; Lawson, Michael; Brandes, David; Farmer, Christopher J.; et al. 2022. "Stochastic Agent-Based Model for Predicting Turbine-Scale Raptor Movements During Updraft-Subsidized Directional Flights." *Ecological Modelling*. <https://dx.doi.org/10.1016/j.ecolmodel.2022.109876>.
- Shaw, William; Berg, Larry; Debnath, Mithu; Deskos, Georgios; Draxl, Caroline; Ghate, Virendra; Hasager, Charlotte; et al. 2022. "Scientific Challenges to Characterizing the Wind Resource in the Marine Atmospheric Boundary Layer." *Wind Energy Science Discussions* [preprint]. <https://doi.org/10.5194/wes-2021-156>.
- Simley, Eric; Fleming, Paul; Girard, Nicolas; Alloin, Lucas; Godefroy, Emma; Duc, Thomas. 2021. "Results From a Wake-Steering Experiment at a Commercial Wind Plant: Investigating the Wind Speed Dependence of Wake-Steering Performance." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-6-1427-2021>.
- Stanley, Andrew P. J.; Roberts, Owen; Lopez, Anthony; Williams, Travis; Barker, Aaron. 2022. "Turbine Scale and Siting Considerations in Wind Plant Layout Optimization and Implications for Capacity Density." *Energy Reports*. <https://dx.doi.org/10.1016/j.egy.2022.02.226>.
- Stanly, Ronith; Martínez-Tossas, Luis A.; Frankel, Steven H.; Delorme, Yann. 2022. "Large-Eddy Simulation of a Wind Turbine Using a Filtered Actuator Line Model." *Journal of Wind Engineering and Industrial Aerodynamics*. <https://dx.doi.org/10.1016/j.jweia.2021.104868>.
- Tan, Bendong; Zhao, Junbo; Duan, Nan; Maldonado, Daniel Adrian; Zhang, Yingchen; Zhang, Hongming; Anitescu, Mihai. 2022. "Distributed Frequency Divider for Power System Bus Frequency Online Estimation Considering Virtual Inertia From DFIGs." *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*. <https://dx.doi.org/10.1109/JETCAS.2022.3141975>.
- Tan, Bendong; Zhao, Junbo; Terzija, Vladimir; Zhang, Yingchen. 2022. "Decentralized Data-Driven Estimation of Generator Rotor Speed and Inertia Constant Based on Adaptive Unscented Kalman Filter." *International Journal of Electrical Power & Energy Systems*. <https://dx.doi.org/10.1016/j.ijepes.2021.107853>.
- Wald, Dylan; King, Jennifer; Bay, Christopher J.; Chintala, Rohit; Johnson, Kathryn. 2022. "Integration of Distributed Controllers: Power Reference Tracking Through Charging Station and Building Coordination." *Applied Energy*. <https://dx.doi.org/10.1016/j.apenergy.2022.118753>.
- Wang, Lu; Robertson, Amy; Jonkman, Jason; Kim, Jang; Shen, Zhi-Rong; Koop, Arjen; Borràs Nadal, Adrià; et al. 2022. "OC6 Phase Ia: CFD Simulations of the Free-Decay Motion of the DeepCwind Semisubmersible." *Energies*. <https://dx.doi.org/10.3390/en15010389>.
- Wang, Lu; Robertson, Amy; Jonkman, Jason; Yu, Yi-Hsiang. 2022. "OC6 Phase I: Improvements to the OpenFAST Predictions of Nonlinear, Low-Frequency Responses of a Floating Offshore Wind Turbine Platform." *Renewable Energy*. <https://dx.doi.org/10.1016/j.renene.2022.01.053>.
- Wilson, Samuel; Hall, Matthew; Housner, Stein; Srinivas, Senu. 2021. "Linearized Modeling and Optimization of Shared Mooring Systems." *Ocean Engineering*. <https://dx.doi.org/10.1016/j.oceaneng.2021.110009>.

Wise, Adam S.; Neher, James M. T.; Arthur, Robert S.; Mirocha, Jeffrey D.; Lundquist, Julie K.; Chow, Fotini K. 2022. "Meso- to Microscale Modeling of Atmospheric Stability Effects on Wind Turbine Wake Behavior in Complex Terrain." *Wind Energy Science*. <https://dx.doi.org/10.5194/wes-7-367-2022>.

Ye, Ketian; Zhao, Junbo; Zhang, Yingchen; Liu, Xiaodong; Zhang, Hongming. 2022. "A Generalized Computationally Efficient Copula-Polynomial Chaos Framework for Probabilistic Power Flow Considering Nonlinear Correlations of PV Injections." *International Journal of Electrical Power & Energy Systems*. <https://dx.doi.org/10.1016/j.ijepes.2021.107727>.

## Technical Reports

Anderson, Benjamin; Reilly, Jim; Krishnan, Venkat. 2022. *Load Control for Frequency Response – A Literature Review*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77780. <https://www.nrel.gov/docs/fy22osti/77780.pdf>.

Barker, Aaron; Bhaskar, Parangat; Anderson, Benjamin; Eberle, Annika. 2021. *Potential Infrastructure Cost Savings at Hybrid Wind Plus Solar PV Plants*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-78912. <https://www.nrel.gov/docs/fy22osti/78912.pdf>.

Bergua Archeli, Roger; Keller, Jon; Bankestrom, Olle; Dunn, Mark; Guo, Yi; Key, Alicia; Young, Emma. 2021. *Up-Tower Investigation of Main Bearing Cage Slip and Loads*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81240. <https://www.nrel.gov/docs/fy22osti/81240.pdf>.

Bothwell, Cynthia; Marquis, Melinda; Lau, Jessica; Fu, Jian; Hartman, Liz. 2021. *Atlantic Offshore Wind Transmission Literature Review and Gaps Analysis*. Washington, D.C.: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. DOE/EE-2503. <https://www.energy.gov/sites/default/files/2021-10/atlantic-offshore-wind-transmission-literature-review-gaps-analysis.pdf>.

Clark, Caitlyn E.; Barker, Aaron; King, Jennifer; Reilly, James. 2022. *Wind and Solar Hybrid Power Plants for Energy Resilience*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-80415. <https://www.nrel.gov/docs/fy22osti/80415.pdf>.

Cole, Wesley; Carag, J. Vincent; Brown, Maxwell; Brown, Patrick; Cohen, Stuart; Eurek, Kelly; Frazier, Will; et al. 2021. *2021 Standard Scenarios Report: A U.S. Electricity Sector Outlook*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-80641. <https://www.nrel.gov/docs/fy22osti/80641.pdf>.

Denholm, Paul; Cole, Wesley; Frazier, A. Will; Podkaminer, Kara; Blair, Nate. 2021. *Storage Futures Study: The Challenge of Defining Long-Duration Energy Storage*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-80583. <https://www.nrel.gov/docs/fy22osti/80583.pdf>.

Fields, M. Jason; Optis, Mike; Perr-Sauer, Jordan; Todd, Austin; Lee, Joseph C. Y.; Meissner, John; Simley, Eric; et al. 2021. *Wind Plant Performance Prediction Benchmark Phase 1 Technical Report*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-78715. <https://www.nrel.gov/docs/fy22osti/78715.pdf>.

Gates, Nathaniel; Cole, Wesley; Frazier, A. Will; Gagnon, Pieter. 2021. *Evaluating the Interactions Between Variable Renewable Energy and Diurnal Storage*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-78042. <https://www.nrel.gov/docs/fy22osti/78042.pdf>.

Gevorgian, Vahan; Koralewicz, Przemyslaw; Shah, Shahil; Mendiola, Emanuel; Wallen, Robb; Villegas Pico, Hugo. 2022. *Photovoltaic Plant and Battery Energy Storage System Integration at NREL's Flatirons Campus*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-81104. <https://www.nrel.gov/docs/fy22osti/81104.pdf>.

Gill, Elizabeth; Hein, Cris. 2022. *IEA Wind White Paper: Cumulative Effects Analysis for Wind Energy Development: Current Practices, Challenges, and Opportunities*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-80553. <https://www.nrel.gov/docs/fy22osti/80553.pdf>.

Gill, Liz; Savage, Evan; Stout, Sherry. 2022. *Strategies for Optimizing WIP Investment in State Energy Offices*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81275. <https://www.nrel.gov/docs/fy22osti/81275.pdf>.

Holttinen, Hannele; Kiviluoma, Juha; Heliöstö, Niina; Levy, Thomas; Menemenlis, Nickie; Jun, Liu; Cutululis, Nicolaos; et al. *Design and Operation of Energy Systems With Large Amounts of Variable Generation: Final Summary Report, IEA Wind TCP Task 25*. Otaniemi, Finland: VTT Technical Research Centre of Finland Ltd. <https://publications.vtt.fi/pdf/technology/2021/T396.pdf>.

Johnson, Nick; Paquette, Josh; Bortolotti, Pietro; Mendoza, Nicole; Bolinger, Mark; Camarena, Ernesto; Anderson, Evan; Ennis, Brandon. 2021. *Big Adaptive Rotor Phase I Final Report*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-79855. <https://www.nrel.gov/docs/fy22osti/79855.pdf>.

Jonkman, Jason. 2022. *Demonstration of NREL Modeling Capability To Design the Next Generation of Floating Offshore Wind Turbines with Stiesdal and Magellan Wind: Cooperative Research and Development Final Report, CRADA Number CRD-19-00787*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-82246. <https://www.nrel.gov/docs/fy22osti/82246.pdf>.

Jorgenson, Jennie; Frazier, A. Will; Denholm, Paul; Blair, Nate. 2022. *Storage Futures Study: Grid Operational Impacts of Widespread Storage Deployment*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-80688. <https://www.nrel.gov/docs/fy22osti/80688.pdf>.

Keller, Jonathan. 2021. *WhiteWind: White Etching Crack (WEC) Bearing Failures in Wind Turbines: Cooperative Research and Development Final Report, CRADA Number CRD-18-00758*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81232. <https://www.nrel.gov/docs/fy22osti/81232.pdf>.

Kilcher, Levi; Green, Rebecca; Hotchkiss, Eliza; Stark, Greg; Salmon, AlexAnna; Hill, Karl. 2021. *Igiugig Site Visit Report*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-79607. <https://www.nrel.gov/docs/fy22osti/79607.pdf>.

Novacheck, Josh; Schwarz, Marty. 2021. *Evaluating the Grid Impact of Oregon Offshore Wind*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-81244. <https://www.nrel.gov/docs/fy22osti/81244.pdf>.

Pulikollu, Raja V.; Sheng, Shawn; McLaughlin, Jeff; Fitchett, Brandon; Han, Andrew. 2021. *Wind Turbine Gearbox Reliability Assessment: Value of Increased Reliability and Reduced Operations and Maintenance Costs*. Palo Alto, CA: EPRI. 3002021422. <https://www.epri.com/research/programs/113055/results/3002021422>.

Robertson, Amy; Mucha, Philipp; Wendt, Fabian; Jonkman, Jason. 2022. *OC6 Phase Ia Definition Document: Validation of Nonlinear Hydrodynamic Loading on the DeepCwind Semisubmersible*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-80803. <https://www.nrel.gov/docs/fy22osti/80803.pdf>.

Shields, Matt; Duffy, Patrick; Musial, Walt; Laurienti, Michael; Heimiller, Donna; Spencer, Rob; Optis, Mike. 2021. *The Cost and Feasibility of Floating Offshore Wind Energy in the O'ahu Region*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-80808. <https://www.nrel.gov/docs/fy22osti/80808.pdf>.

Stehly, Tyler; Duffy, Patrick. 2022. *2020 Cost of Wind Energy Review*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81209. <https://www.nrel.gov/docs/fy22osti/81209.pdf>.