EPRI ENERGY SYSTEMS AND CLIMATE ANALYSIS GROUP RESEARCH ON THE VALUE, COSTS, AND IMPACTS OF RENEWABLE GENERATION

LAST UPDATED: APRIL 2023

This is a summary of all of EPRI's Energy Systems and Climate Analysis (ESCA) Group's research in the renewable generation space, including work in progress. Web links are included where available. Publications marked with an * are available to the public free of charge or are published in academic journals. Other publications are available to EPRI member companies that fund certain program(s), and can be purchased by members of the public who may be interested in doing so, subject to EPRI's product distribution requirements. For a full listing of ESCA research that is free to the public, please visit the ESCA public website at http://esca.epri.com/research.html. To receive the ESCA group's quarterly newsletter with research updates, please email your request to eea@epri.com.

ECONOMICS OF HIGH RENEWABLE GENERATION PENETRATION

* ***Impacts of Wind and Solar Costs on Electric Sector Decarbonization.*** EPRI Insight, May 2022, https://esca.epri.com/pdf/Back-Pocket-Insights/Renewables_Cost_TwoPager_FINAL.pdf.

* Young, D; Bistline, JET; Cole, W; Mai, T. 2021. T***he Outlook for Wind and Solar Deployment: Drivers and Constraints.*** Published in EM Magazine, a copyrighted publication of the Air & Waste Management Association, May 2021, https://www.awma.org/content.asp?admin=Y&contentid=707.

* Cole, W; Mai, T; Bistline, JET; Young, D. 2021. ***The Current State of Renewable Energy for Electricity.*** Published in EM Magazine, a copyrighted publication of the Air & Waste Management Association, May 2021, https://www.awma.org/content.asp?admin=Y&contentid=707.

  Program 201-C Webcast on Technological Options and Uncertainties for Very High CO_2 Reductions, March 2020, https://www.epri.com/events/D8E91360-8B97-4314-82CC-171C1F2CACE4 (webcast recording also available via this link).

* Bistline, J. and Blanford, G. ***Value of Technology in the U.S. Electric Power Sector: Impacts of Full Portfolios and Technological Change on the Costs of Meeting Decarbonization Goals.*** Energy Economics 84:104694, February 2020. https://doi.org/10.1016/j.eneco.2020.104694.

* Bistline, J.E. T. and Young, D. T. ***Drivers of Economic Wind and Solar Penetration in the United States.*** Environmental Research Letters, 14, 124001, 2019. https://doi.org/10.1088/1748-9326/ab4e2d.

* ***A Primer on Wind and Solar Value Deflation, EPRI Program 201 Back Pocket Insight,*** August 2019, https://eea.epri.com/pdf/Back-Pocket-Insights/EPRI-P201-Decreasing-Returns.pdf.

Program 201-C Webcast on the Use of LCOE Metrics for Renewable Energy, July 2019, https://www.epri.com/events/41493DA7-98AD-4F90-AF9F-09D38D19ADB8 (webcast recording also available via this link).

Program 201-C Webcast on the Economics of Storage under Very High Renewable Penetration, May 2019, https://www.epri.com/events/010ED223-F0BA-4260-9708-5590E23FDDF3 (webcast recording also available via this link).

Program 201-C Webcast on Regional Renewable Penetration, September 2018, https://www.epri.com/events/6C586B9D-12E2-474B-8C04-B86F121F4F38 (webcast recording also available via this link).

Program 201-C Webcast on Economic Drivers of Wind and Solar, January 2018, https://www.epri.com/events/3EF76A32-FA8A-4664-8553-05C08A602DD2 (webcast recording also available via this link).

Webcast on the Economics of Storage and Renewable Generation, May 2017, https://www.epri.com/events/933B40CA-3F6E-4ECB-9C75-B1C7AAEC9E8E.

* ***Decreasing Returns to Renewable Energy.*** EPRI Report 3002003946, January 2015, http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002003946.

VALUE OF FLEXIBLE OPERATIONS AND ANCILLARY SERVICES UNDER HIGH RENEWABLE DEPLOYMENT

Power System Reliability under Deep Decarbonization: Insights from the New US-REGEN Reliability Post-Processing Tool. EPRI Report 3002025593, January 2023, https://www.epri.com/research/programs/109396/results/3002025593.

Power System Reliability Under Deep Decarbonization. Webcast, November 2022, https://www.epri.com/research/programs/109396/events/508A54C5-7A2E-4353-80B6-F081FF455198.

Program on Technology Innovation: Modeling Flexible Demand Resources in a Capacity Expansion Model. EPRI Report 3002024261, December 2022, https://www.epri.com/research/programs/109396/results/3002024261.

Exploring Power System Reliability under Zero-CO2 Policy: A US-REGEN and PLEXOS Modeling Case Study. August 2022, https://www.epri.com/research/programs/109396/results/3002025269.

Webcast: "Enabling Load Flexibility for a High Renewable Future," February 2022, https://www.epri.com/research/programs/069228/events/5C89014F-20F5-4A63-99EC-135EF164EB6A (webcast recording also available via the link).

Enabling Load Flexibility for a High Renewable Future: Considerations for Resource Planning. EPRI Report 3002021219, December 2021, https://www.epri.com/research/programs/069228/results/3002021219.

Synchronous Condenser Impact on Stability and Inertial Support on KEPCO's Jeju Island. EPRI Report 3002025111, June 2022, https://www.epri.com/research/programs/069228/results/3002025111.

Program 178-B Webcast on Enabling Load Flexibility for a High Renewable Future. June 2021, https://www.epri.com/events/49C71292-573F-4669-9397-986E6E47A1DD (webcast slides also available via the link).

System Flexibility Investments and Energy Prices in Regional High Renewable Grids: Preliminary Results. EPRI Report 3002016633, December 2019, https://www.epri.com/research/products/000000003002018501.

* Bistline, J. E., ***Turn Down for What? The Economic Value of Operational Flexibility in Electricity Markets.*** IEEE Transactions on Power Systems, 34(1):527–534, January 2019, https://ieeexplore.ieee.org/abstract/document/8412506.

  Economic Value of Increased Operational Flexibility for Fossil-Fired Generation Assets. EPRI Report 3002013735, April 2018, https://www.epri.com/research/products/000000003002013735.

* Bistline, J. E., ***Economic and technical challenges of flexible operations under large-scale variable renewable deployment.*** Energy Economics, 64:363-372, May 2017, http://www.sciencedirect.com/science/article/pii/S0140988317301196.

  Impact of Variable Renewable Energy on Fossil Fleet Utilization: Insights for the High Plains. EPRI Report 3002008450, December 2016, https://www.epri.com/research/products/000000003002008450.

* ***The Evolution of Ancillary Services to Facilitate Integration of Variable Renewable and Distributed Energy Resources: A Survey of Some Changes to the Ancillary Services and Ancillary Service Markets.*** EPRI Report 3002008987, December 2016, https://www.epri.com/#/pages/product/000000003002008987/?lang=en.

* ***Technical and Economic Challenges of Flexible Operations: Case Studies of California and Texas.*** EPRI Report 3002008242, March 2016, http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002008242.

* ***Program on Technology Innovation: Fossil Fleet Transition with Fuel Changes and Large Scale Variable Renewable Integration.*** EPRI Report 3002006517, October 2015, http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002006517.

RENEWABLE MANDATE POLICY ANALYSIS

* ***Economic, System, and Environmental Implications of High Renewables in the Western U.S.*** EPRI Report 3002019986, January 2021, https://www.epri.com/research/programs/109396/results/3002019986.

* ***Impacts of Recent State Renewable Policies in the U.S.*** EPRI Program 201 Back Pocket Insight, December 2019, https://eea.epri.com/pdf/Back-Pocket-Insights/P201-Back-Pocket-Insight-Recent-State-Policies.pdf.

  Program 201-B Webcast on Impacts of Recent and Proposed Renewable Policies. October 2019, https://www.epri.com/events/B1ECDAFF-BEE8-4204-A07F-46ED0AE087C7 (webcast recording also available via this link).

  Program 201-B Webcast on Analysis of the Smith-Luján Proposed Clean Energy Standard. June 2019, https://www.epri.com/events/49F082DC-F775-4908-BFFA-00C8DAAD089D (webcast recording also available via this link).

* Bistline, J., Santen, N., and D. Young. T***he Economic Geography of Variable Renewable Energy and Impacts of Trade Formulations for Renewable Mandates,*** Renewable and Sustainable Energy Reviews 106:79-96, May 2019, https://www.sciencedirect.com/science/article/pii/S1364032119301194.

* ***Minnesota High Renewable Standards Insights.*** EPRI Program 201 Back Pocket Insight, March 2019, https://eea.epri.com/pdf/Back-Pocket-Insights/MN_HRS_Back_Pocket_Insight_20190305_FINAL.pdf.

* ***Cost-Effectively Achieving Carbon Goals in Minnesota: Renewable Standards vs. Technology-Neutral Policies — A scenario-based analysis of electric-sector impacts through 2050.*** EPRI Report 3002015420, March 2019, https://www.epri.com/#/pages/product/3002015420/.

  Program 201-B Webcast on the Economic Geography of Variable Renewable Energy and Impacts of Trade Formulations for Renewable Mandates. January 2019, https://www.epri.com/events/4C3CEB49-F3F1-444C-B85B-2D67A57D77D9 (webcast recording also available via this link).

Program 201-C Webcast on California's Rooftop PV Mandate, November 2018, https://www.epri.com/events/D52C707B-CDEE-4664-B2E8-815D5D24DA1D (webcast recording also available via this link).

Program 201-B Webcast on Insights into Clean Energy Standards with Restrictions on Eligible Technologies, October 2018, https://www.epri.com/events/577B426F-4774-417D-908E-9495B2339660.

* ***The Costs and Value of Renewable Portfolio Standards***. EPRI Program 201 Back Pocket Insight, July 2018, http://eea.epri.com/pdf/EPRI-P201-Value-and-Costs-of-State-RPS.pdf.

* Young, D. T. and J. E. Bistline, ***The Costs and Value of Renewable Portfolio Standards in Meeting Decarbonization Goals,*** Energy Economics 73:337-351, June 2018, https://www.sciencedirect.com/science/article/pii/S0140988318301427.

Webcasts on True Costs of Renewable Portfolio Standards, June 2017 (preliminary) https://www.epri.com/events/01785E0F-1DA1-49C2-941D-7E78592B9CE6 and November 2017 (final) https://www.epri.com/events/C2B6173D-2C33-4574-9EC9-F522A48E27BF.

* ***Systems Analysis in Electric Power Sector Modeling: Evaluating Model Complexity for Long-Range Planning.*** EPRI Report 3002011365, October 2017, https://www.epri.com/#/pages/product/3002011365/.

REPRESENTING HIGH RENEWABLE PENETRATION IN CAPACITY PLANNING MODELS

* ***Analysis of Foresight in Long-Term Energy System Models.*** EPRI Report 3002021161, December 2021, https://www.epri.com/research/programs/109396/results/3002021161.

* Bistline, J.E., G. J. Blanford, T Mai, J Merrick. ***Modeling Variable Renewable Energy and Storage in the Power Sector.*** Energy Policy. 156:112424, September 2021, https://doi.org/10.1016/j.enpol.2021.112424.

* Bistline, J.E. ***The Importance of Temporal Resolution in Modeling Deep Decarbonization of the Electric Power Sector.*** Environmental Research Letters, 16:084005, July 2021, https://iopscience.iop.org/article/10.1088/1748-9326/ac10df#erlac10dff1.

* ***Importance of Temporal Resolution in Modeling Deep Decarbonization.*** EPRI Program 201 Back Pocket Insights, July 2021, https://publicdownload.epri.com/PublicAttachmentDownload.svc/AttachmentId=74654.

* Bistline, J.E. V***ariability in Deeply Decarbonized Electricity Systems.*** Environmental Science & Technology. 55:9:5629-5635. April 2021. https://doi.org/10.1021/acs.est.0c06708.

ESCA Perspective on Berkeley Report "2035: Plummeting Solar, Wind, and Battery Costs Can Accelerate Our Clean Electricity Future," Program 201 Perspective, June 2020, https://membercenter.epri.com/Programs/109396/Documents/EPRI%20ESCA%20Perspective%20-%202035%20Report.pdf.

Program 201-C Webcast on 2020 Research Summary of Beyond 80% (Temporal Resolution explanation) and 2021 Research Prioritization. March 2021, https://www.epri.com/events/535AE4B4-7F9D-46F0-8B4C-57F76C683573 (webcast recording also available via this link).

* ***Temperature Impacts on Electricity Demand: US-REGEN Load Projections for Climate Resilience.*** EPRI Report 3002020013, February 2021, https://www.epri.com/research/products/000000003002020013.

The Role of Input Assumptions and Model Structures in Projections of Variable Renewable Energy: A Multi-Model Perspective of the U.S. Electricity System, Energy Economics 76:313-324, October 2018, https://www.sciencedirect.com/science/article/pii/S0140988318304213 Part of the DOE Inter-model Comparison Study on the Representation of Renewables, co-authored by EIA, EPRI, and NREL.

* Blanford, G. J., J. H. Merrick, J. E. Bistline, and D. T. Young, ***Simulating Annual Variation in Load, Wind, and Solar by Representative Hour Selection,*** The Energy Journal 39(3):189-212, June 2018, http://www.iaee.org/energyjournal/article/3083.

* ***Variable Renewable Energy in Long-Term Planning Models: A Multi-Model Perspective,*** NREL Report NREL/TP-6A20-70528, November 2017, https://www.nrel.gov/docs/fy18osti/70528.pdf Part of the DOE Inter-model Comparison Study on the Representation of Renewables, co-authored by EIA, EPA, EPRI, and NREL.

* ***Simulating Annual Variation in Load, Wind, and Solar by Representative Hour Selection.*** EPRI Report 3002008653, June 2016, http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002008653.

EVALUATING THE POTENTIAL IMPACT OF CHANGES IN RENEWABLE POLICIES, TECHNOLOGY COST AND PERFORMANCE ON FUTURE ENERGY GENERATION AND CAPACITY

* Browning, M, et al. (2023). ***Net-zero CO_2 by 2050 scenarios for the United States in the Energy Modeling Forum 37 study.*** Energy and Climate Change, 4(2666–2787). https://doi.org/w10.1016/j.egycc.2023.100104.

* I***mpacts of Inflationary Drivers and Updated Policies on U.S. Decarbonization and Technology Transitions.*** EPRI Report 3002026229, March 2023, https://www.epri.com/research/products/000000003002026229.

  Webcast: 24/7 Carbon-free Energy: Matching Carbon-free Energy Procurement to Hourly Electric Load. Webcast, February 2023, https://www.epri.com/research/programs/109396/events/17D84983-4B4F-4C86-B8F6-3037582EF608.

* ***EPRI's Response to the U.S. Department of the Treasury's Request for Comment on Implementing the Inflation Reduction Act's Clean Energy Incentives.*** EPRI Report 3002025923, January 2023, https://www.epri.com/research/programs/109396/results/3002025923.

* ***LCRI Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis.*** EPRI, Palo Alto, CA: 2022. 3002024882. https://lcri-netzero.epri.com/. https://www.epri.com/research/products/000000003002024993.

* ***24/7 Carbon-free Energy: Matching Carbon-free Energy Procurement to Hourly Electric Load.*** EPRI Report 3002025290, December 2022, https://www.epri.com/research/products/000000003002025290.

  2022 REGEN Scenarios Analysis. EPRI Report 3002024235, December 2022, https://www.epri.com/research/programs/069228/results/3002024235.

  Webcast: 2022 REGEN Scenarios Analysis Project. Webcast, November 2022, https://www.epri.com/research/programs/069228/events/08A3490E-ED8D-4A5C-8AFE-01DE5A850711 (webcast recording also available via the link).

* Bistline, J.E.T., Blanford, G., Grant, J. et al. ***Economy-wide evaluation of CO_2 and air quality impacts of electrification in the United States.*** Nat Commun 13, 6693 (2022). https://www.nature.com/articles/s41467-022-33902-9.

* ***Ohio Efficient Electrification Study: Task 1, Energy System Assessment—Executive Summary.*** EPRI Report 3002023157, September 2022, https://www.epri.com/research/programs/109396/results/3002023157.

* ***Ohio Efficient Electrification Study: Task 4, Utility-Level Assessment, and Implementation Plan--Executive Summary.*** EPRI Report 3002023159, September 2022, https://www.epri.com/research/programs/109396/results/3002023159.

* ***Opportunities for Decarbonizing Minnesota's Economy: Energy System Supply and Demand Assessment.*** EPRI Report 3002019333, September 2022, https://www.epri.com/research/programs/109396/results/3002019333.

  Impacts of 111(d) Design Decisions and Tax Credit Interactions: Near-Term Electric Sector Decarbonization Policy Sensitivities. EPRI Report 3002025234, August 2022, https://www.epri.com/research/programs/109396/results/3002025234.

* Bistline, J., N. Abhyankar, G. Blanford, L. Clarke, R. Fakhry, H. McJeon, J. Reilly, C. Roney, T. Wilson, M. Yuan, and A. Zhao (2022): ***"Actions for Reducing U.S. Emissions at Least 50% by 2030"*** (Science), May 2022, https://www.science.org/doi/pdf/10.1126/science.abn0661.

* ***Actions for Reducing U.S. Emissions at Least 50% by 2030.*** EPRI Insight, May 2022, https://publicdownload.epri.com/PublicAttachmentDownload.svc/AttachmentId=78689.

* ***Understanding Generation and Storage Technology Supply Chain Risks and Needs to Support Electric Utility Sector Decarbonization.*** EPRI Report 3002023228, May 2022 https://www.epri.com/research/products/000000003002023228.

* ***Electric Utility Workforce Development and Decarbonization.*** EPRI Report 3002023229, March 2022, https://www.epri.com/research/products/000000003002023229.

  Webcast: 2022 REGEN Scenarios Analysis–Project Kickoff, March 2022, https://www.epri.com/research/programs/069228/events/C9611155-92A8-47AB-A9AD-3FCF526C2F11 (webcast recording also available via the link).

* ***Strategies and Actions for Achieving a 50% Reduction in U.S. Greenhouse Gas Emissions by 2030.*** EPRI Report 3002023165, November 2021, https://www.epri.com/research/products/3002023165.

  2021 REGEN Scenarios Analysis Project: Final Results. EPRI Report 3002022003, December 2021, https://www.epri.com/research/programs/069228/results/3002022003.

  Understanding Interactions Between Electric-sector and Economy-wide CO_2 Policies. EPRI Report 3002021397, December 2021, https://www.epri.com/research/programs/109396/results/3002021397.

  Understanding Renewable Cost Projections and Planning Impacts: How Future Assumptions Shape U.S. Electric Sector Decarbonization Strategies. EPRI Report 3002021223, October 2021, https://www.epri.com/research/programs/109396/results/3002021223.

* ***Canadian National Electrification Assessment: Electrification Opportunities for Canada's Energy Future.*** EPRI Report 3002021160, September 2021, https://www.epri.com/research/programs/109396/results/3002021160.

  Program 201-C and 178-A Webcast on Renewable Costs and Planning Impacts. August 2021, https://www.epri.com/research/programs/109396/events/E53E23B2-C0A4-4D88-84D3-F617F9BB026F (webcast recording also available via this link).

  2021 Beyond 80% Analysis: Technological Options and Uncertainties for Net-Zero Electric Sector CO_2 Emissions. EPRI Report 3002021159, July 2021, https://www.epri.com/research/programs/109396/results/3002021159

* Bistline, J.E.T., Blanford, G.J. ***Impact of carbon dioxide removal technologies on deep decarbonization of the electric power sector.*** Natural Communication 12:3732. June 2021, https://doi.org/10.1038/s41467-021-23554-6

* ***Impacts of Carbon Removal on Power Sector Decarbonization.*** EPRI Program 201 Back Pocket Insights, June 2021, https://esca.epri.com/pdf/Back-Pocket-Insights/EPRI-CDR-Impacts.pdf.

(201-D) Program 201-D Webcast on Strategies for Achieving 50% Emissions Reductions in the U.S. by 2030. May 2021, https://www.epri.com/events/CEA141BB-8A62-48D2-AE64-7EEC7A78E15B (webcast recording also available via this link.)

Long Term Planning Considerations for Hybrid Renewable- Plus- Storage Resources. EPRI Report 3002019611, April 2021, https://www.epri.com/research/programs/109396/results/3002019611.

* ***Powering Decarbonization: Strategies for Net-Zero CO2 Emissions.*** EPRI Report 3002020700, February 2021, https://www.epri.com/research/programs/109396/results/3002020700.

Cost-Effective Strategies for Net-Zero Electric Sector Decarbonization Targets: Project Set 201-D: Economy-wide Analysis and Electrification. EPRI Report 3002020254, February 2021, https://www.epri.com/research/programs/109396/results/3002020254.

ESCA Perspective on Princeton "Net-Zero America: Potential Pathways, Infrastructure, and Impacts." Program 201 Perspective, January 2021, https://membercenter.epri.com/Programs/109396/Documents/EPRI%20ESCA%20Perspective%20-%20Princeton%20Net-Zero%20Report.pdf.

2020 REGEN Scenarios Analysis: Understanding Key Factors that May Impact Future Electricity Generation. EPRI Report 3002018503, December 2020, https://www.epri.com/research/programs/069228/results/3002018503.

Program 201-C Webcast on Technology Investment and Cost Impacts of 90% Clean Electricity by 2035. December 2020, https://www.epri.com/events/66DCFB3E-24D2-4068-84F6-D0178A4EF77C (webcast recording also available via the link).

* Bistline, J; Brown, M.; Siddiqui, S.; Vaillancourt, K. ***Electric Sector Impacts of Renewable Policy Coordination: A Multi-Model Study of the North American Energy System.*** Energy Policy, 145: 111707, October 2020. https://doi.org/10.1016/j.enpol.2020.111707.

* ***Georgia-Alabama Efficient Electrification Energy System Assessment: Executive Summary.*** EPRI Report 3002019860, September 2020, https://www.epri.com/research/products/000000003002019860.

* ***Efficient Electrification in California: Assessment of Energy System and Air Quality Impacts.*** EPRI Report 3002019494, May 2020, https://www.epri.com/research/products/000000003002019494.

* ***Electrification Scenarios for North Carolina's Energy Future: Executive Summary.*** EPRI Report 300201932, April 2020, https://www.epri.com/research/products/3002019327.

* ***Electrification Scenarios for New York's Energy Future.*** EPRI Report 3002017940, February 2020, https://www.epri.com/research/products/3002017940.

Beyond 80%: Technological Options and Uncertainties for Very High Electric Sector CO_2 Reductions. EPRI Report 3002019612, July 2020, https://www.epri.com/research/programs/109396/results/3002019612.

2019 REGEN Scenarios Analysis: Understanding Key Factors That May Impact the Evolution of Electricity Generation in the United States 2015–2050. EPRI Report 3002016570, December 2019, https://www.epri.com/research/products/000000003002016570.

2018 REGEN Scenarios Analysis: Understanding Key Factors That May Impact Future Electricity Generation. EPRI Report 3002013733, December 2018, https://www.epri.com/#/pages/product/000000003002013733/?lang=en.

2017 REGEN Scenarios Analysis: Understanding Key Factors That May Impact Future Electricity Generation. EPRI Report 3002011044, December 2017, https://www.epri.com/#/pages/product/000000003002011044/?lang=en.

2016 REGEN Scenarios Analysis: Understanding Key Factors That May Impact Future Electricity Generation. EPRI Report 3002008451, December 2016, https://www.epri.com/#/pages/product/000000003002004851/?lang=en.

2015 REGEN Scenarios Analysis: Understanding Key Factors That May Impact Future Electricity Generation. EPRI Report 3002005839, December 2015, https://www.epri.com/#/pages/product/000000003002005839/?lang=en.

2014 REGEN Scenarios Analysis: Understanding Key Factors That May Impact Future Electricity Generation. EPRI Report 3002004880, December 2014, https://www.epri.com/#/pages/product/000000003002004880/?lang=en.

RENEWABLE TECHNOLOGY COST AND PERFORMANCE

2022 TAGWeb Updates. Software 3002024336, December 2022, https://www.epri.com/research/programs/069228/results/3002024336.

Technology Assessment Guide: 2022 Technology Cost and Performance Basis Update. EPRI Report 3002024239, December 2022, https://www.epri.com/research/programs/069228/results/3002024239.

Exploring the Trade-Offs between Solar + Storage Hybrid Plants and Standalone Configurations. Webcast, November 2022, https://www.epri.com/research/programs/109396/events/BEEDFA90-A05F-4614-BFFE-A963DEEC1AD9.

* Bistline, J., R. Bedilion, N. S. Goteti, and N. Kern (2022). ***"Implications of Variations in Renewable Cost Projections for Electric Sector Decarbonization in the United States"*** (iScience) https://www.sciencedirect.com/science/article/pii/S2589004222006630.

2022 Energy System Technology Cost and Performance Summary: Market Trends & Technology Insights. EPRI Report 3002024231, May 2022, https://www.epri.com/research/programs/069228/results/3002024231.

TAGWeb v3.51 (2021 Database Update Only). EPRI Software 3002021575, November 2021, https://www.epri.com/research/programs/069228/results/3002021575.

* ***Historical Trends and Projected Changes in U.S. Wind and Solar Resources.*** EPRI Report 3002020619, November 2021, https://www.epri.com/research/products/3002020619.

Technology Assessment Guide: Engineering Economics—Fundamentals and Methods of Electricity Supply Economic Calculations. EPRI Report 3002021216, October 2021, https://www.epri.com/research/programs/069228/results/3002021216.

Assessment of Supply-Side Capital Costs as a Function of Future Capacity Scenarios: Endogenous Learning for Renewable and Gas Technologies. EPRI Report 3002021213, May 2021, https://www.epri.com/research/programs/109396/results/3002021213.

* ***Endogenous Learning for Projecting Future Capital Costs – Evaluation and Implications for Electric Power Generation Technologies.*** EPRI Report 3002019786, November 2020, https://www.epri.com/research/products/000000003002019786.

Program 178-A Webcast on Technology Series Webcast #3: Advanced Renewable Technologies, October 2020, https://www.epri.com/events/14A91AE9-2642-4ABB-A2AC-4C5C588F6094 (webcast recording also available via the link).

Understanding Firm Hybrid Resources: Creating Firm Electric Power from Wind and Solar with Storage. EPRI Report 3002018415, October 2020, https://www.epri.com/research/programs/109396/results/3002018415.

Webcast on Understanding Virtual Generation: Creating Firm Energy from Wind and Solar with Storage, July 2020, https://www.epri.com/events/DA7F71F4-B1B5-4842-BF6B-AE98B1899100 (webcast recording also available via the link).

Assessing the Capacity Contribution of Renewables + Storage Resources. EPRI Report 3002016264, July 2020, https://www.epri.com/research/programs/109396/results/3002016264.

* ***An Insider's Guide to the Calculation and Use of LCOEs, EPRI Program 201 Back Pocket Insights.*** January 2020, https://esca.epri.com/pdf/Back-Pocket-Insights/EPRI-P201-LCOE-Brief.pdf.

Cost of Cycling Phase II: A Technology Assessment Guide Associated Program Study. EPRI Report 3002016563, August 2019, https://www.epri.com/research/products/000000003002016563.

Forecasting Photovoltaics Market Potential: Methods and Approaches. EPRI Report 3002005775, 2015, https://www.epri.com/#/pages/product/000000003002015775/?lang=en.

RESPONSES TO THE ACADEMIC LITERATURE ON '100% RENEWABLES'

* Bistline, J. E. and Blanford, G. J. ***More than One Arrow in the Quiver: Why "100% Renewables" Misses the Mark.*** Proceedings of the National Academy of Sciences, 113(28): E3988, June 2016, http://www.pnas.org/content/113/28/E3988.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

CONTACT INFORMATION

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

EPRI RESOURCES

EPRI members interested in engaging in and supporting this effort should contact EPRI for further discussion.

David Young, *Senior Program Manager*
650.855.8927, dyoung@epri.com

Silas Swanson, *Engineer/Scientist I*
415.238.3941, sswanson@epri.com

Energy Systems and Climate Analysis

3002027576 May 2023

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com