

# David P. Brown

---

CONTACT INFORMATION	University of Alberta 9-24 HM Tory Edmonton, AB, Canada T6G 2H4	<i>Phone:</i> (780)-492-2447 <i>E-mail:</i> dpbrown@ualberta.ca <i>URL:</i> apps.ualberta.ca/directory/person/dpbrown
EMPLOYMENT	Professor, Department of Economics, University of Alberta	2023 - Present
	Canada Research Chair, Energy Economics and Policy, University of Alberta	2020 - Present
	Associate Professor, Department of Economics, University of Alberta	2019 - 2023
	Assistant Professor, Department of Economics, University of Alberta	2014 - 2019
AFFILIATIONS & APPOINTMENTS	Faculty Affiliate, Program on Energy and Sustainable Development, Stanford University	2023 - Present
	President, Canadian Association for Energy Economics	2020 - Present
	Research Fellow, Institute for Public Economics, University of Alberta	2016 - Present
	Research Associate, Institute for Child Health Policy, University of Florida	2011 - 2014
EDUCATION	Ph.D., Economics, University of Florida, May 2014 Dissertation: Three Essays on Market Power in Restructured Electricity Markets	
	M.A., Economics, University of Florida, May 2011	
	B.S., Quantitative Economics and Mathematics, Miami University of Ohio, May 2009	
EDITORIAL SERVICES	Co-Editor, <i>Resource and Energy Economics</i>	2024 - Present
	Senior Associate Editor, <i>The Electricity Journal</i>	2023 - Present
	Editorial Board, <i>Utilities Policy</i>	2022 - Present
	Assistant Editor, <i>Competition and Regulation in Network Industries</i>	2018 - Present
PUBLICATIONS	1. "Incentive Regulation and the Electricity Sector," <i>Handbook on Electricity Regulation</i> , Forthcoming (with David Sappington)	
	2. "Electricity: Markets, Regulation, and Competition Policy," <i>Elgar Encyclopedia on the Economics of Competition and Regulation</i> , Forthcoming (with Andrew Eckert)	
	3. "The Impact of Wholesale Price Caps on Forward Contracting," <i>The Energy Journal</i> , Forthcoming (with David Sappington)	
	4. "Screening for Collusion in Wholesale Electricity Markets: A Literature Review," <i>Utilities Policy</i> , December 2023 (with Andrew Eckert and Douglas Silveira).	
	5. "Strategic Interactions Between Wholesale and Ancillary Service Electricity Markets," <i>Competition and Regulation in Network Industries</i> , November 2023 (with Andrew Eckert and Douglas Silveira)	
	6. "Information and Transparency: Using Machine Learning to Detect Communication" <i>Stanford Journal of Computational Antitrust</i> , October 2023 (with Daniel Cajueiro, Andrew Eckert, and Douglas Silveira)	

7. “Market Structure, Risk Preferences, and Forward Contracting Incentives,” *Journal of Industrial Economics*, October 2023 (with David Sappington)
8. “Evaluating the Impact of Divestitures on Competition: Evidence from Alberta’s Wholesale Electricity Market,” *International Journal of Industrial Organization*, July 2023 (with Andrew Eckert and Blake Shaffer)
9. “Employing Gain-Sharing Regulation to Promote Forward Contracting in the Electricity Sector,” *Journal of Regulatory Economics*, January 2023 (with David Sappington)
10. “Procurement Auctions for Regulated Retail Service Contracts in Restructured Electricity Markets,” *Energy Economics*, December 2022 (with Andrew Eckert and Derek Olmstead)
11. “Load-Following Forward Contracts,” *The Energy Journal*, Summer 2022 (with David Sappington).
12. “Pricing Patterns in Wholesale Electricity Markets: Unilateral Market Power or Coordinated Behavior?” *Journal of Industrial Economics*, March 2022 (with Andrew Eckert).
13. “Socioeconomic and Demographic Disparities in Residential Battery Storage Adoption: Evidence from California,” *Energy Policy*, May 2022.
14. “Vertical Integration and Capacity Investment in the Electricity Sector,” *Journal of Economics and Management Strategy*, August 2021 (with David Sappington).
15. “On the Profitability of Self-Sabotage,” *Canadian Journal of Economics*, March 2021 (with David Sappington).
16. “Measuring Market Power in Electricity Markets: Empirical Challenges with a Residual Demand Analysis,” *International Journal of Industrial Organization*, January 2021 (with Andrew Eckert).
17. “Residential Electricity Pricing in Texas’s Competitive Retail Market,” *Energy Economics*, October 2020 (with CK Woo, Jay Zarnikau, Lucy Zhu, and Chen-Hao Tsai).
18. “Does Locational Marginal Pricing Impact Generation Investment Location Decisions? An Analysis of Texas’s Electricity Market” *Journal of Regulatory Economics*, August 2020 (with Jay Zarnikau and Chi-Keung Woo).
19. “Imperfect Competition in Electricity Markets with Renewable Generation: The Role of Renewable Compensation Policies,” *The Energy Journal*, Spring 2020 (with Andrew Eckert).
20. “On the Benefits of Behind-the-Meter Rooftop Solar and Energy Storage: The Importance of Retail Rate Design,” *Energy Economics*, February 2020 (with Richard Boampong).
21. “Motivating Efficient Market Participation of Energy Storage Assets,” *Energy Policy*, January 2020 (with David Sappington).
22. “Employing Simple Cost-Sharing Policies to Motivate the Efficient Implementation of Distributed Energy Resources,” *Energy Economics*, June 2019 (with David Sappington).
23. “Information and Transparency in Wholesale Electricity Markets: Evidence from Alberta,” *Journal of Regulatory Economics*, December 2018 (with Andrew Eckert and James Lin).
24. “Optimal Procurement of Distributed Energy Resources” *The Energy Journal*, Summer 2018 (with David Sappington).
25. “Capacity Payment Mechanisms and Investment Incentives in Restructured Electricity Markets,” *Energy Economics*, August 2018.

26. “The Effect of Default Rates on Retail Competition and Pricing Decisions of Competitive Retailers: The Case of Alberta” *Energy Policy*, July 2018 (with Andrew Eckert).
27. “Carbon Pricing with an Output Subsidy under Imperfect Competition: The Case of Alberta’s Restructured Electricity Market,” *Resource and Energy Economics*, May 2018 (with Andrew Eckert and Heather Eckert).
28. “Analyzing Electricity Market Structure Changes and Mergers: The Importance of Forward Commitments,” *Review of Industrial Organization*, February 2018 (with Andrew Eckert).
29. “The Effect of Subsidized Entry on Capacity Auctions and the Long-Run Resource Adequacy of Electricity Markets,” *Energy Economics*, January 2018.
30. “On the Role of Maximum Demand Charges in the Presence of Distributed Generation Resources,” *Energy Economics*, January 2018 (with David Sappington).
31. “Optimal Policies to Promote Efficient Distributed Generation of Electricity,” *Journal of Regulatory Economics*, October 2017 (with David Sappington).
32. “Measuring Market Power and the Efficiency of Alberta’s Restructured Electricity Market: An Energy-Only Market Design,” *Canadian Journal of Economics*, August 2017 (with Derek Olmstead).
33. “Electricity Market Mergers with Endogenous Forward Contracting,” *Journal of Regulatory Economics*, June 2017 (with Andrew Eckert).
34. “Designing Compensation for Distributed Solar Generation: Are Common Net Metering Policies Optimal?” *The Energy Journal*, Spring 2017 (with David Sappington).
  - Awarded the Campbell Watkins Award for the Best Paper in The Energy Journal for 2017
35. “On the Optimal Design of Demand Response Policies” *Journal of Regulatory Economics*, June 2016 (with David Sappington).
36. “Effects of an Integrated Care System on Children with Special Healthcare Needs’ Medicaid Expenditures” *The American Journal of Managed Care*, April 2016 (with Marcu, M., Knapp, C., Madden, V., and H. Wang).
37. “Using Bayesian Imputation to Assess Racial and Ethnic Disparities in Pediatric Performance Measures” *Health Services Research*, October 2015 (with Knapp, C. and M. Kaufmann).
38. “The Value of Electricity Reliability: Evidence from Battery Adoption” (with Lucija Muehlenbachs) (*Revise and Resubmit Journal of Public Economics*)
39. “Show Me the Money! Incentives and Nudges to Shift Electric Vehicle Charge Timing” (with Blake Shaffer, Megan Bailey, Frank Wolak) (*Revise and Resubmit American Economic Journal: Economic Policy*)
40. “Centralized vs Decentralized Demand Response: Evidence from a Field Experiment” (with Blake Shaffer, Megan Bailey, Frank Wolak) (*Under Review*)

**WORKING  
PAPERS**

**WORK IN  
PROGRESS**

41. “Unintended Consequences of Time-of-Use Rates: EV Charging and Distribution Network Constraints” (with Blake Shaffer, Erica Myers, Megan Bailey, Frank Wolak)
42. “Physical Versus Economic Withholding: Evidence from Alberta’s Wholesale Electricity Market” (with Andrew Eckert)
43. “Wholesale Price Prediction: The Role of Information and Transparency” (with Daniel Cajueiro, Andrew Eckert, and Douglas Silveira)

**POLICY  
PAPERS &  
PROCEEDINGS**

44. “Why are Power Prices so Darn High?” *University of Calgary, School of Public Policy, Energy & Environmental Policy Trends*, April 2022 (with Blake Shaffer and Andrew Eckert)
45. “Do Gentailers Charge Higher Residential Electricity Prices in the Texas Retail Electricity Market?” *The Electricity Journal*, May 2022 (with Jay Zarnikau and Chen-Hao Tsai)
46. “Rising Market Concentration in Texas’s Retail Electricity Market” *The Electricity Journal*, October 2020 (with Jay Zarnikau, Parviz Adib, Chen-Hao Tsai, Chi-Keung Woo)
47. “Procuring Electric Storage as a Transmission Asset” *The Electricity Journal*, April 2020 (with David Sappington)
48. “Pricing Patterns in Wholesale Electricity Markets: Unilateral Market Power or Coordinated Behavior?” *IAEE Energy Forum*, Summer 2019 (with Andrew Eckert)
49. Evidence for the “Capacity Market Comprehensive Market Design Final Proposal - Rebuttal and Reply”. Alberta Utilities Commission Proceeding # 23757, April 4, 2019.
50. Evidence for the “Capacity Market Comprehensive Market Design Final Proposal”. Alberta Utilities Commission Proceeding # 23757, February 28, 2019.
51. “Capacity Market Design: Motivation and Challenges in Alberta’s Electricity Market,” University of Calgary School of Public Policy, Briefing Paper Series, March 2018.
52. “Electricity Markets in Transition: Market Distortions Associated with Retail Price Controls,” *The Electricity Journal*, June 2017 (with Andrew Eckert and Heather Eckert).
53. Comment on “Options for Enhancing the Design of the Regulated Rate Option (RRO)”. Comments Submitted to the Alberta Market Surveillance Administrator, May 19, 2017. (with Andrew Eckert)
54. “Infrastructure Investment in Healthcare Information Technology.” In Public Utility Research Center’s Report for Florida DMS, *Strategic Planning for Florida Governmental Broadband Capabilities*, 2011 (pg. 296-309).

**HONORS AND  
AWARDS**

Faculty of Arts Research Award, Assistant Professor, University of Alberta, 2019  
Best Paper of 2017, The Energy Journal’s Campbell Watkins Best Paper Award, 2017  
American Economic Assoc. Transportation and Public Utilities Group Dissertation Award, 2015  
Walter-Lanzillotti Dissertation Award, University of Florida, 2014  
Madelyn M. Lockhart Award, University of Florida, 2013  
Rafael Lutsky Award for Best First Year Ph.D. Student, University of Florida, 2010  
Grinter Fellowship, University of Florida, 2009

## GRANTS

2024 - 2026 - Co-Applicant, Concordia's Volt-Age, Canada First Research Excellence Fund, Government of Canada. Project: *Electrification for Resilient Decarbonized Communities* - \$125,000

2023 - 2026 - PI, Future Energy Systems and Global Research Initiative, Canada First Research Excellence Fund, Government of Canada. Project: *Evaluating Methods to Shift Electric Vehicle Charge Timing* - \$110,000

2023 - 2025 - Co-Applicant, SSHRC Insight Development Grant. Project: *Field Experiments to Facilitate the Electricity Energy Transition* - \$70,200

2023 - 2024 - Co-Applicant, SSHRC Connection Grant. Project: *Electricity Camp in the Rockies* - \$24,810

2022 - 2023 - Collaborator, SSHRC Connection Grant. Project: *Canadian Electricity Policy Forum* - \$24,454

2021 - 2023 - Co-PI - Future Energy Systems and Global Research Initiative, Canada First Research Excellence Fund, Government of Canada. Project: *Dynamic Load Control and EV Charging Field Experiment* - \$86,000

2021 - 2023 - Collaborator - UCalgary Haskayne 2021 Big Idea Seed Research Grant. Project: *Central control versus pricing: A demand response field experiment in residential electricity* - \$20,000

2020 - 2025 - PI - Canada Research Chair (Tier 2), Energy Economics and Policy - \$600,000

2017 - 2023 - Co-PI - Future Energy Systems, Canada First Research Excellence Fund, Government of Canada. Project: *"Regulation and Integration of Solar PV into Electricity Markets"* - \$769,500

2017 - 2023 - Co-PI - Future Energy Systems, Canada First Research Excellence Fund, Government of Canada. Project: *"Market Design for Increased Wind Generation"* - \$499,570

2019 - 2021 - Co-PI - Faculty Research Grant, China Institute, University of Alberta. Project: *"Capital v.s. Energy Subsidies: Survey Evidence from China"* - \$5,000

2018 - 2019 - PI -Research Development Fund, Worldwide Universities Network - \$32,065

2017 - 2018 - PI - SAS Conference Fund, University of Alberta - \$1,000

2017 - 2018 - PI - Faculty of Arts Conference Fund, University of Alberta - \$2,500

2017 - 2018 - PI - Kule Institute for Advanced Study, University of Alberta, Dialogue Grant - \$2,000

2016 - 2017 - PI - The Economics and Environmental Policy Research Network (EEPRN) Research Grant, University of Ottawa - Institute of the Environment. Project: *"Quantifying the Impacts of Carbon Pricing in Alberta's Restructured Electricity Market: The Role of Market Power and Emission Allowance Allocation Methods"* - \$16,723

## STUDENT SUPERVISION

Co-supervisor, Douglas Silveira (University of Alberta, Economics Post-Doc, In Progress)

- *"Machine Learning and Electricity Markets"*

Co-supervisor, Bonnie Luo (University of Alberta, Economics PhD, In Progress)

- *"Retail Competition in Restructured Electricity Markets"*

Committee Member, Tong Liu (University of Alberta, Economics PhD, In Progress)

- *"Three Essays on Auctions"*

Co-supervisor, Yiang Guo (University of Alberta, Economics PhD, In Progress)

- *"Regulation and Integration of Solar PV into Electricity Markets"*

Co-supervisor, Boris Moreno (University of Alberta, Economics PhD, July 2023)

- *"Market Design for Increased Wind Generation"*

External Examiner, Gabriel Royal (George Washington University, Public Policy PhD, March 2023)  
 – “*Three Essays on Bitcoin, Energy, and Digital Asset Public Policy*”  
 Examiner, Kwabena Bediako (University of Alberta, Economics PhD, December 2022)  
 – “*Essays on Risk and Renewable Resource Management*”  
 Committee Member, Samprita Chakraborty (University of Alberta, Economics PhD, May 2022)  
 – “*Three Essays in Health Economics*”  
 Co-supervisor, Jingchao Zhang (University of Alberta, Economics Post-Doc, August 2021)  
 – “*Impact of Subsidies on Emerging Technology Adoption in China*”  
 Co-supervisor, Ryan Walch (University of Alberta, Economics Post-Doc, December 2019)  
 – “*Retail Rate Design and Rooftop Solar Adoption: Evidence from Salt River Project*”  
 Co-supervisor, Richard Boampong (University of Alberta, Economics Post-Doc, April 2019)  
 – “*Retail Rate Design and the Integration of Distributed Energy Resources*”  
 External Examiner, Parisa Pourkarimi (Carleton University, Economics PhD, November 2018)  
 – “*R&D, Innovation, and Market Power*”  
 External Examiner, James Lin (University of Alberta, Economics PhD, September 2016)  
 – “*Essays on Market Power in Alberta’s Wholesale Electricity Market*”  
 External Examiner, Benjamin Bernard (University of Alberta, Mathematics PhD, March 2016)  
 – “*Continuous-Time Repeated Games With Imperfect Information*”  
 External Examiner, Hanxiao Li (University of Alberta, Economics PhD, April 2015)  
 – “*Three Essays in Environmental Economics*”

#### TEACHING EXPERIENCE

ECON 373 Industrial Organization (Alberta)  
 ECON 572 Economics of Regulation: Theory and Applications (Alberta)  
 ECON 672 Topics in Industrial Economics (Alberta)  
 ECON 471 Strategic Behavior of the Firm (Alberta)  
 ECON 384 Intermediate Microeconomic Theory II (Alberta)  
 ECON 484 Game Theory and Applications (Alberta)  
 ECON 4400 Game Theory and Applications (Florida)

#### CONFERENCE & INVITED PRESENTATIONS

2024 University of California at Berkeley, POWER Conference, Berkeley  
 University of Alberta, Future Energy Systems Workshop, Edmonton  
 National Academies, Electricity Regulation Workshop, Washington D.C.

2023 University of Alberta, Dept. of Resource Economics, Edmonton  
 Resources for the Future, Resources Radio, Podcast  
 Electricity Camp, University of Calgary, Banff Alberta  
 Western University, 7th Annual Electricity Policy Workshop, Toronto  
 Alberta Electric System Operator, 6th Annual Economics Excellence Conference, Calgary  
 Advances in Field Experiments, University of Chicago, Chicago Illinois

2022 ASSA Annual Meeting, Boston, Massachusetts  
 University of Florida, Gainesville, Florida  
 USAEE/IAEE North American Conference, Houston TX  
 Advanced Workshop in Regulation and Competition, 34th Western Conference, Monterey CA  
 IAEE Webinar Series (Virtual)

- Western University, Ivey Energy and Policy Management Center Podcast  
 Alberta Electric System Operator, 5th Annual Economics Excellence Conference, Calgary  
 Western University, 6th Annual Electricity Policy Workshop, Toronto (Keynote)  
 Energy Transitions Round Table, Future Energy Systems, University of Alberta, Edmonton  
 Sloan Foundation, DER Compensation Policies, Fireside Chat (Virtual)  
 Electricity Camp, University of Calgary, Kananaskis Alberta
- 2021 Economic Society of Northern Alberta (Webinar)  
 INFORMS Annual Meeting, Anaheim, California  
 Texas A&M International University, Annual Conference (Keynote)  
 Alberta Electric System Operator, 4th Annual Economics Excellence Conference, Calgary
- 2020 Southern Economic Association 90th Annual Meeting, New Orleans LA (Webinar)  
 Advanced Workshop in Regulation and Competition, Eastern, Shawnee PA  
 IAEE 43rd Annual International Conference, Paris France (Rescheduled)  
 IAEE Webinar Series  
 Ivey Energy Centre, 4th Annual Workshop on the Economics of Electricity Policy and Markets
- 2019 IAEE 42nd Annual International Conference, Montreal Quebec  
 University of Florida, Gainesville, FL  
 Energy Regulatory Forum, Calgary, Alberta
- 2018 16th Annual International Industrial Organization Conference, Indianapolis, IN  
 UA Renewable Energy and Electricity Markets Workshop, Edmonton, Alberta  
 Australian Competition & Consumer Commission, Melbourne, Australia  
 University of Alberta, The Future of Alberta's Electricity Market, Edmonton Alberta  
 University of Alberta REES, Edmonton, Alberta  
 University of Auckland, Auckland, New Zealand  
 ACCC/AER Regulatory Conference, Brisbane, Australia (Keynote Seminar)  
 3rd Annual Alberta Energy Summit, Edmonton, Alberta  
 Electrical Distribution Leadership Workshop, Calgary, Alberta  
 IAEE/USAEE North American Conference, Washington DC
- 2017 Waseda University, Workshop on Carbon Pricing, Tokyo, JPN  
 Paris Agreement and International Trends of Carbon Pricing:  
 Towards Japan's Long Term Goals of Emissions Reductions, Tokyo, JPN (Keynote Seminar)  
 Harvard Electricity Policy Group Conference, Calgary AB  
 University of Western Ontario, Workshop on Canadian Electricity Policy and Markets  
 University of Alberta, School of Business, The Evolution of Alberta's Energy Markets  
 Economics Society of Northern Alberta's Lunch Workshop, Edmonton AB  
 University of Hawaii, Workshop on Distributed Generation, Honolulu HI (Keynote Seminar)  
 University of Alberta's Institute for Public Economics, Workshop on the Economics  
 of Capacity Payment Mechanisms in Electricity Markets, Edmonton AB  
 Economics Society of Northern Alberta's Annual Outlook Conference, Edmonton AB  
 15th Annual International Industrial Organization Conference, Boston MA
- 2016 American Economic Association/TPUG Annual Conference, San Francisco CA  
 Canadian Resource and Environmental Economics, Banff AB CA

Workshop on the Economics of Renewable Energy: Residential Solar Power, University of Alberta's Institute for Public Economics, Edmonton AB  
 Advanced Workshop in Regulation and Competition, 35th Eastern Conference, Shawnee PA  
 Advanced Workshop in Regulation and Competition, 29th Western Conference, Monterey CA

2015 Advanced Workshop in Regulation and Competition, 28th Western Conference, Monterey CA  
 Advanced Workshop in Regulation and Competition, 34th Eastern Conference, Shawnee PA  
 Economics of Electricity Generation and the Environment, Van Horne Institute, Calgary AB  
 University of Calgary, Calgary AB  
 Miami University, Oxford OH

2014 University of Alberta, Edmonton AB  
 Villanova University, Philadelphia PA  
 University of Cincinnati, Cincinnati OH  
 Cornerstone Research, Washington D.C.  
 Charles River Associates, Washington D.C.  
 Christensen Associates, Madison WI  
 The Brattle Group, Boston MA  
 University of Florida - Health Policy, Gainesville FL

2013 Southern Economics Association Conference, Tampa FL  
 1st Workshop on Smart Grid Design & Implementation, University of Florida

2012 Pressing Issues in World Energy Policy Conference, University of Florida  
 Southern Economics Association Conference, New Orleans LA

#### CONFERENCE ORGANIZATION

Conference Program Committee, European IAEE Conference, 2026  
 Track Chair, Electric Power and Energy Conference, University of Alberta, November 2020  
 Co-Organizer, Renewable Energy and Electricity Markets, University of Alberta, May 2018  
 Conference Planning Committee, Van Horne Institute, Renewable Electricity Conference, 2015-2016  
 Cartels: A Conference in Honor of Robert Lanzillotti, University of Florida, March 2013

#### REFEREE

**Journals:** American Economic Journal: Economic Policy, American Journal of Managed Care, Canadian Journal of Economics, Competition and Regulation in Network Industries, Contemporary Economic Policy, Economics Bulletin, Energy Economics, Energy Policy, Energy, Energies, The Energy Journal, Empirical Economics, European Journal of Operations Research, Joule, Journal of the Association of Environmental and Resource Economists, Journal of Industrial Economics, Journal of Regulatory Economics, Journal of Economics and Management Strategy, Journal of Environmental Economics and Management, Journal of Unconventional Oil and Gas Resources, Health Services Research, International Economic Review, International Journal of Industrial Organization, International Journal of the Economics of Business, Management Science, Operations Research, Renewable Energy Focus, Resource and Energy Economics, Review of Industrial Organization, Review of Network Economics, Strategic Behavior and the Environment, Sustainability, Utilities Policy

**Conferences and Other:** University of Calgary School of Public Policy, Sloan Foundation Energy and Environment Program Grant, IAEE 2023 Chicago Conference Abstracts, IAEE 2023 International Conference Abstracts Riyadh Saudi Arabia, IAEE 2022 Tokyo Conference Abstracts, IAEE 2019 Montreal Conference Abstracts, IAEE 2019 Denver Conference Abstracts, USAEE 2018 Washington DC Conference Abstracts, University Tenure Reviews (x3)



**SERVICE**

Faculty and Graduate Student Seminar Series Organizer, Department of Economics, 2016 - Present  
President, Canadian Association for Energy Economics, 2020 - Present  
Advisory Board, Istanbul Center for Regulation, 2020 - Present  
Energy Bar Association, Canadian Chapter, 2022 - Present  
Future Energy Systems, University of Alberta, Energy Storage Mentor, 2022 - 2023  
Energy Signature Area, Curriculum Committee, 2021 - 2023  
Research Theme Advisory Council, Future Energy Systems, 2016 - 2023  
Master Energy Plan Advisory Committee, 2022 - 2023  
PhD Microeconomics Comprehensive Exams, 2019 - 2021