

## Dr Richard Bean

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### Summary

I am a data scientist with a research focus on Energy, which extends into Transport, Health and Cyber Security (all National Science and Research Priorities). I worked in the energy sector for 10 years before joining the UQ's Centre for Energy Data Innovation with positions at ROAM Consulting, AEMO (Australian Energy Market Operator) and Redback Technologies.

### Education

Ph.D. Mathematics, 1998 - 2001. The University of Queensland, Department of Mathematics.

B.Sc. (First Class Honours and [University Medal](#)) Computer Science and Mathematics, 1994 - 1997. The University of Queensland.

### Employment

#### Research Fellow, University of Queensland, July 2019 – current.

- The [Centre for Energy Data Innovation](#) is a research enterprise created in partnership between Redback Technologies, Energy Queensland, and The University of Queensland. The research centre is focused on data aggregation and analytics in the field of power and energy systems. The integrating of meters, digital controls and cloud computing will enable new data products for direct use by multiple disparate industries.

#### Data Scientist, [Redback Technologies](#), July 2016 – June 2019.

- Prediction of solar and load data on a large network of inverters. Development of algorithms in R for battery scheduling and optimization, embedded network operation and virtual power plants. Data cleaning, outlier detection and statistical analysis.

#### Senior Epidemiologist, Preventive Health Branch, [Queensland Health](#), July 2015 – June 2016.

- Analysis of survey data and burden of disease data for the biennial Chief Health Officer's Report and other reports. STATA programming.

#### Senior Research Officer, Health Protection Branch and Communicable Diseases Branch, Queensland Health, December 2015 – June 2016.

- Epidemiology of food-borne illness outbreaks involving salmonella and campylobacter

#### Advanced Research Officer, Health Protection Unit/Branch, Queensland Health, February 2014 – December 2015.

- Analysis of public health data and report preparation; finding public health datasets to perform preventative health programs rather than reactive health programs; administration of Department of Health's ArcGIS Online system; developing and analysing public health targets and key performance indicators. Health areas included asbestos, lead, Aboriginal and Torres Strait Islander health, food-borne illnesses, medicines and poisons, and water programs. Analysing epidemiology of food-borne illness outbreaks and statistical analysis of areas including asbestos and food.

**Research Assistant, School of Geography, Planning and Environmental Management, University of Queensland, November 2013 – June 2019 (various times)**

- Analysing data from Brisbane's CityCycle scheme from 2010 to date and co-authoring papers analysing journeys by land use, topography, cycleway density, and weather. Co-authored an article in The Conversation.

**Senior Analyst, [Australian Energy Market Operator](#), February 2013 – June 2013.**

- Reviewing AEMO's National Electricity Forecasting Report data and models
- Assessing the impact of mandatory electricity restrictions and analysing weather correction models

**Senior Analyst, [ROAM Consulting](#), April 2007 – December 2012.**

- Mathematical modelling of the Australian NEM (National Electricity Market) and New Zealand Electricity Market (NZEM).
- Writing reports on market forecasting and analysis for a wide range of commercial and government clients
- Development of statistical methodologies for assessing reliability in interconnected power systems; detailed analysis of outages of power stations and their effect on reliability in the 2010 Minimum Reserve Levels project
- Programming in Microsoft VBA, C++, writing spreadsheets in Excel and maintaining databases in Access, including SQL work.

**Research Officer, [Institute for Molecular Bioscience](#), University of Queensland, December 2003 - March 2007.**

**Postdoctoral Associate, [Institute for Studies in Theoretical Physics and Mathematics](#), Tehran, Iran, April 2002 - October 2003.**

**Lecturer, [Sharif University of Technology](#), Tehran, Department of Mathematics, Second Semester 2002.**

**Research Assistant and Officer (Statistics), [Department of Mathematics](#), University of Queensland April 2001 - March 2002.**

- Developing and optimizing algorithms related to graph theory, combinatorics, operations research, and statistics; analysing microarray data.
- Programming in C, Fortran, Matlab, R, and Python

## **Publications**

Despite spending significant time in industry (2007-2019) my total career publication count is **47** – 4 book chapters, 28 journal articles, 9 peer-reviewed conference articles, and 6 articles in The Conversation. **8% of my journal publications fall in the Top 1% citation percentile and 31% fall in Top 5% citation percentile. 21.7% of my publications were published in the Top 1% Journal Percentiles by CiteScore (SciVal, April 2021).**

My publications have attracted 2,487 citations with h-index=15 (source Google Scholar, November 2021). My Weighted Citation Impact for my publications during 2017-2021 is 6.89, indicating that my publications have been cited 689% more than the expected citation rates in the field (Source: SciVal, April 2021)

### Book Chapter

1. D. Pojani, J. Chen, I. Mateo-Babiano, **R. Bean**, and J. Corcoran (2020). Docked and dockless public bike-sharing schemes: research, practice and discourse. Handbook of Sustainable Transport, Edward Elgar Publishing.
2. G. J. McLachlan, **R. W. Bean**, S-K. Ng (2017) "Clustering" in "Bioinformatics", Humana Press, pp 345—362.
3. G. J. McLachlan, **R. W. Bean**, S-K. Ng (2008) "Clustering" in "Bioinformatics", Humana Press, pp 423—439.
4. G. J. McLachlan, **R. Bean**, and S. Ng (2008) "Clustering of microarray data via mixture models," Statistical Advances in Biomedical Sciences: Clinical Trials, Epidemiology, Survival Analysis, and Bioinformatics, pp. 365—384.

### Journal Papers

5. **R. Bean**, D. Pojani and J. Corcoran (2021). "How does weather affect bikeshare use? A comparative analysis of forty cities across climate zones". Journal of Transport Geography 95:103155.
6. S. Snow, **R. Bean**, M. Glencross, and N. Horrocks. (2020) Drivers behind residential electricity demand fluctuations due to COVID-19 restrictions. Energies 13:21, 5738.
7. **R. Bean**, G. Lasry and F. Weierud. (2020) "Eavesdropping on the Biafra-Lisbon link – breaking historical ciphers from the Biafran war". Cryptologia, 1-66.
8. **R. Bean** (2020) "Letter from Richard Bean". Journal of the Society for Psychical Research 84 (1), 56-57.
9. W. Tushar, T. K. Saha, C. Yuen, M. I. Azim, T. Morstyn, H. V. Poor, D. Niyato, **R. Bean**. (2020) "A coalition formation game framework for peer-to-peer energy trading", Applied Energy 261, 114436. **Top 1% Journal Percentiles & Top 1% most cited.**
10. **R. Bean**, S. Snow, M. Glencross, S. Viller, and N. Horrocks. (2020) "Keeping the Power on to home medical devices", PloS ONE 15 (7), e0235068, 2020. **Top 1% Journal Percentiles & Top 1% most cited.**
11. W. Tushar, T. K. Saha, C. Yuen, T. Morstyn, H. V. Poor, and **R. Bean**. (2019) "Grid Influenced Peer-to-Peer Energy Trading", IEEE Transactions on Smart Grid.
12. W. Tushar, T. K. Saha, C. Yuen, P. Liddell, **R. Bean**, and H. V. Poor. (2018) "Peer-to-peer energy trading with sustainable user participation: A game theoretic approach", IEEE Access 6, 62932-62943, 2018.
13. Mateo-Babiano, **R. Bean**, J. Corcoran, and D. Pojani. (2016) "How does our natural and built environment affect the use of bicycle sharing?" Transportation Research Part A: Policy and Practice, vol. 94, pp. 295--307, 2016.
14. C. E. McLaren, V. R. Gordeuk, ..., **R. Bean** (2008) "Bivariate mixture modeling of transferrin saturation and serum ferritin concentration in Asians, African Americans, Hispanics, and whites in the Hemochromatosis and Iron Overload Screening (HEIRS) study," Translational Research, vol. 151, no. 2, pp. 97--109, 2008.

15. G. J. McLachlan, **R. Bean**, and L. B.-T. Jones (2007). "Extension of the mixture of factor analyzers model to incorporate the multivariate t-distribution," *Computational Statistics & Data Analysis*, vol. 51, no. 11, pp. 5327—5338. **Top 1% Journal Percentiles & Top 5% most cited.**
16. K. Do, G. McLachlan, **R. Bean**, and S. Wen (2007) "Application of gene shaving and mixture models to cluster microarray gene expression data," *Cancer Informatics*, vol. 5, pp. 25—43.
17. G. J. McLachlan, S.-K. Ng, and **R. Bean** (2006) "Robust cluster analysis via mixture models," *Austrian Journal of Statistics*, vol. 35, no. 2&3, pp. 157—174.
18. L. B.-T. Jones, **R. Bean**, G. J. McLachlan, and J. X. Zhu (2006) "Mixture models for detecting differentially expressed genes in microarrays," *International Journal of Neural Systems*, vol. 16, no. 5, pp. 353--362, 2006.
19. **R. Bean** (2006) "Latin trades on three or four rows," *Discrete Mathematics*, vol. 306, no. 23, pp. 3028—3041.
20. G. J. McLachlan, **R. Bean**, and L. B.-T. Jones (2006) "A simple implementation of a normal mixture approach to differential gene expression in multiclass microarrays," *Bioinformatics*, vol. 22, no. 13, pp. 1608—1615. **Top 1% Journal Percentiles & Top 5% most cited.**
21. G. McLachlan, **R. Bean**, L. B.-T. Jones, and J. Zhu (2005) "Using mixture models to detect differentially expressed genes," *Australian Journal of Experimental Agriculture*, vol. 45, no. 8, pp. 859—866.
22. **R. Bean**, H. Bidkhor, M. Khosravi, and E. Mahmoodian (2005) "k-homogeneous Latin trades," *Bayreuther Mathematische Schriften*, vol. 74, p. 7.
23. **R. Bean** (2004) "Critical sets in the elementary abelian 2- and 3-groups," *Utilitas Mathematica*, vol. 68, pp. 53—61.
24. **R. Bean** (2004) "The size of the smallest uniquely completable set in order 8 Latin squares," *Journal of Combinatorial Mathematics and Combinatorial Computing*, vol. 52, pp. 159—168.
25. J. H. Friedman and J. J. Meulman (2004) "Clustering objects on subsets of attributes (with discussion)," *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, vol. 66, no. 4, pp. 815—849 (note by G. J. McLachlan and **R. Bean**)
26. G. J. McLachlan, D. Peel, and **R. Bean** (2003) "Modelling high-dimensional data by mixtures of factor analyzers," *Computational Statistics & Data Analysis*, vol. 41, no. 3-4, pp. 379—388.
27. P. Adams, **R. Bean**, and A. Khodkar (2003) "A census of critical sets in the Latin squares of order at most six," *Ars Combinatoria*, vol. 68, pp. 203—224.
28. **R. Bean** and E. S. Mahmoodian (2003) "A new bound on the size of the largest critical set in a Latin square," *Discrete Mathematics*, vol. 267, no. 1-3, pp. 13—21.
29. G. J. McLachlan, **R. Bean**, and D. Peel (2002) "A mixture model-based approach to the clustering of microarray expression data," *Bioinformatics*, vol. 18, no. 3, pp. 413—422. **Top 1% Journal Percentiles & Top 1% most cited.**
30. **R. Bean**, D. Donovan, A. Khodkar, and A. P. Street (2002) "Steiner trades that give rise to completely decomposable Latin interchanges," *International Journal of Computer Mathematics*, vol. 79, no. 12, pp. 1273—1284.
31. P. Adams, **R. Bean**, and A. Khodkar (2001) "Disjoint critical sets in Latin squares," *Congressus Numerantium*, vol. 153, pp. 33—48.
32. **R. Bean** and D. Donovan (2000) "Closing a gap in the spectrum of critical sets," *Australasian Journal of Combinatorics*, vol. 22, pp. 191—200.

### Conference Papers

33. **R. Bean** (2021) "Cryptodiagnosis of Kryptos K4". In *Proceedings of Histocrypt 2021, Proceedings of the 4<sup>th</sup> International Conference on Historical Cryptology*.

34. **R. Bean** (2020) "The Use of Project Gutenberg and Hexagram Statistics to Help Solve Famous Unsolved Ciphers". In Proceedings of Histocrypt 2020, Proceedings of the 3<sup>rd</sup> International Conference on Historical Cryptology.
35. **R. Bean** and H. Khan (2018). "Using solar and load predictions in battery scheduling at the residential level," Proceedings of the 8th Solar Integration Workshop, 2018.
36. **R. Bean** and B. Vanderwaal (2011) "Calculation of minimum reserve levels for the Australian National Electricity Market," in 17th Power Systems Computation Conference Stockholm Sweden - August 22-26, 2011, pp. 364--371, 2011.
37. C. E. McLaren, V. R. Gordeuk, ..., **R. Bean** et al., (2007) "Subpopulations with Iron Deficiency, Liver Disease, or HFE Mutations Revealed by Statistical Mixture Modeling of Transferrin Saturation and Serum Ferritin Concentration in Asians, African Americans, Hispanics, and Whites," Blood, vol. 110, no. 11, p. 2672.
38. S. Ng, G. McLachlan, **R. Bean**, and S.-W. Ng (2006). "Clustering replicated microarray data via mixtures of random effects models for various covariance structures," in Proceedings of the 2006 workshop on Intelligent systems for Bioinformatics-Volume 73, pp. 29--33, Australian Computer Society, Inc.
39. K. Basford, G. McLachlan, and **R. Bean** (2006) "Issues of robustness and high dimensionality in cluster analysis," in Compstat 2006-Proceedings in Computational Statistics, pp. 3--15, Physica-Verlag HD.
40. **R. Bean** and G. McLachlan (2005) "Cluster analysis of high-dimensional data: A case study," in International Conference on Intelligent Data Engineering and Automated Learning, pp. 302--310, Springer, Berlin, Heidelberg.
41. L. B.-T. Jones, **R. Bean**, G. McLachlan, and J. Zhu (2005) "Application of mixture models to detect differentially expressed genes," in International Conference on Intelligent Data Engineering and Automated Learning, pp. 422--431, Springer, Berlin, Heidelberg.

### The Conversation

42. R. Bean, D. Pojani and J. Corcoran, "[We analysed 100 million bike trips to reveal where in the world cyclists are most likely to brave rain and cold](#)", The Conversation, 2021.
43. R. Bean, M. Piorko and S. Lang, "[Deciphering the Philosophers Stone: how we cracked a 400-year-old alchemical cipher](#)", The Conversation, 2021.
44. **R. Bean**, "[Declassified Cold War code-breaking manual has lessons for solving 'impossible' puzzles](#)", The Conversation, 2021.
45. **R. Bean**, G. Lasry and F. Weierud, "[We decrypted messages from the Biafran war that have remained secret for 50 years](#)", The Conversation, 2020.
46. **R. Bean**, "[Cryptology from the crypt: how I cracked a 70-year-old coded message from beyond the grave](#)," The Conversation, 2019.
47. Mateo-Babiano, D. Pojani, J. Corcoran, and **R. Bean**, "[Here's what bike-sharing programs need to succeed](#)," The Conversation, 2017.

### Industry Reports and Presentations

1. **R. Bean** "Phase identification and load forecasting with home energy data", Energy Queensland EDS Series, 19 March 2020.
2. **R. Bean** "Data for Networks: New Insights for Network Operations Using Big Data", Australian Power Institute Summer School 26 February 2020.
3. **R. Bean**, "[Aspects of Data Science at Redback Technologies](#)", IEEE Queensland PES Chapter, Brisbane, Australia, 2 April 2019.

4. **R. Bean**, "[Using solar and load prediction in battery scheduling at the residential level](#)", IEEE Queensland PES Chapter, Brisbane, Australia, 27 June 2017.
5. **R. Bean**, "The effect of climate on Salmonella notifications in Queensland HHSs from 2001 to 2015", Queensland Health, January 2016.
6. **R. Bean** and N. Cutler, "[Queensland Shrugs off a clean energy future](#)", Business Spectator, 2012,
7. **R. Bean** (presenter) and J. Gilmore, "[The Merit Order Effect](#)", Presentation at Clean Energy Week, Sydney, July 2012.
8. I. Rose, B. Vanderwaal, **R. Bean**, A. Turley, N. Culpitt, "[Modelling Transmission Frameworks Review](#)", Report for Australian Energy Market Commission by ROAM Consulting, 2012,
9. N. Cutler, C. Giacomantonio, J. Gilmore, **R. Bean**, I. Rose, "[Wind and Solar Modelling for AEMO 100% Renewables Project](#)", Report for Australian Energy Market Operator by ROAM Consulting, 2012, [4](#)
10. D. Winch, I. Rose, **R. Bean**, T. Riesz, C. Giacomantonio, "[Pumped Storage Modelling for AEMO 100% Renewables Project](#)", Report for Australian Energy Market Operator by ROAM Consulting, 2012,
11. J. Riesz, J. Gilmore, S. Shiao, D. Yeowart, **R. Bean**, M. Holmes, "[Impact of the LRET on the costs of FCAS, NCAS and Transmission Augmentation](#)", Report for Australian Energy Market Commission by ROAM Consulting, 2011.
12. J. Riesz and **R. Bean**, "[Impact of renewable energy and carbon pricing policies on retail electricity prices](#)", Report for Clean Energy Council by ROAM Consulting, 2011,
13. **R. Bean** and B. Vanderwaal, "[Final Report for Operational URLs – 2010 MRL Recalculation](#)", Report for Australian Energy Market Operator by ROAM Consulting, 2010.
14. B. Vanderwaal, D. Yeowart, **R. Bean**, J. Riesz, J. Gilmore, M. Buchanan, J. Merefield, "[Network Augmentation and Congestion Modelling](#)", Report for Australian Energy Market Commission by ROAM Consulting, 2009.
15. **R. Bean**, J. Gilmore, J. Riesz, A. Turley, B. Vanderwaal, "[Market Impacts of CPRS and RET](#)", Report for Australian Energy Market Commission for ROAM Consulting, 2008.
16. **R. Bean**, "[Transpower Transmission to Enable Renewables Evaluation](#)", Report for Transpower by ROAM Consulting, 2008.

## Academic conference presentations

1. **R. Bean** (presenter) and H. Khan, "Using solar and load predictions in battery scheduling at the residential level," 8th Solar Integration Workshop, Stockholm, Sweden, 16-17 October 2018.
2. Mateo-Babiano (presenter), J. Corcoran and **R. Bean**. "Is bicycle sharing for her? Unpacking the gender dimensions of Brisbane's CityCycle Scheme", Australian Transport Research Forum, Melbourne, 16 November 2016.
3. **R. Bean** (presenter) and B. Vanderwaal. "Calculation of minimum reserve levels for the Australian National Electricity Market", Power Systems Computation Conference 2011, Stockholm, Sweden, 22-26 August 2011.
4. **R. Bean** (presenter) and G. J. McLachlan. "Cluster analysis of high-dimensional data: a case study". Sixth International Conference on Intelligent Data Engineering and Automated Learning (IDEAL '05), 6-8 July 2005, The University of Queensland, Brisbane, Australia.
5. **R. Bean**. "Latin trades". International Workshop on Combinatorics, Linear Algebra and Graph Coloring, Institute for Studies in Theoretical Physics and Mathematics, Tehran, Iran, 9-14 August 2003.
6. **R. Bean**. "Integer programming and critical sets". 19<sup>th</sup> British Combinatorial Conference, University of Wales, Bangor, 30 June – 4 July 2003.

7. **R. Bean** (presenter) and I. Wanless. "Subsquare-rich Latin squares and their critical sets". 34<sup>th</sup> Southeastern International Conference on Combinatorics, Graph Theory and Computing, Florida Atlantic University, Boca Raton, 3-7 March 2003.
8. **R. Bean** (presenter), P. Adams and A. Khodkar. "A census of critical sets in the latin squares of order at most six". 25<sup>th</sup> Australasian Conference on Combinatorial Mathematics and Combinatorial Computing, Christchurch, New Zealand, 4-8 December 2000.
9. **R. Bean** (presenter) and E. S. Mahmoodian. "On the size of the largest critical set in a Latin square". Combinatorics 2000, Gaeta, Italy, 28 May-3 June 2000.
10. **R. Bean** (presenter) and D. M. Donovan. "Closing a gap in the spectrum of critical sets". 24<sup>th</sup> Australasian Conference on Combinatorial Mathematics and Combinatorial Computing (24ACCMCC), Northern Territory University, Darwin, 5-9 July 1999.

## Teaching activities

- COSC2500 "Numerical Methods in Computational Science" – taught C and C++ programming part. **50% of the course**. The University of Queensland's School of Information Technology and Electrical Engineering, Semester 2 2020 and Semester 2 2021.
- "The Biafran Ciphers". MATH3302 lecture, "Coding and Cryptography", The University of Queensland's School of Mathematics and Physics, 5 May 2021.
- "Phase identification and load forecasting with home energy data", UQ ITEE Research Seminar, 30 October 2019.
- "Kryptos". MATH3302 lecture, "Coding and Cryptography", The University of Queensland's School of Mathematics and Physics, 2 April 2019.
- "Data Science at Redback", DATA7001 lecture, "Introduction to Data Science", The University of Queensland's School of Information Technology and Electrical Engineering, 10 October 2018.

## Media appearances

[4BC IRA interview](#) (23 August 2019 - 7:24) "Cracking the IRA Code"

[3AW IRA interview](#) (27 August 2019 – 8:00) "Cracking the IRA Code"

[Adelaide Drive interview](#) (27 August 2019 - 9:11) "Cracking the IRA Code"

[6PR Thouless interview](#) (30 August 2019 - 8:32) "Cryptology from the Crypt"

[ASIO Coin Brisbane ABC interview](#) with Steve Austin (13 September 2019 - 7:49)

[Midnight in the Desert interview](#) (14 September 2019 - 50:56)

[ABC Sydney interview](#) (31 May 2021 - 7:44)

[ABC Perth interview](#) (31 May 2021 - 9:34)

[ABC Nightlife Interview](#) (5 August 2021 - 50:08)

ABC Regional Riffs across six regional Victorian stations (12 October 2021)

[ABC Patricia Karvelas Interview](#) (13 October 2021 - 8:16)

[ABC North Queensland Henry Bretz Interview](#) (14 October 2021 - 9:02)

[ABC Shaun Bindley Interview](#) (16 October 2021 - 15:40)

[ABC Kelly Higgins-Devine Interview](#) (21 October 2021 - 11:28)

[2NUR Interview](#) (12 November 2021)

### **Achievements, awards and memberships**

- Associate Fellow of the [Institute of Combinatorics and Its Applications](#)
- Life Member of the [Combinatorial Mathematical Society of Australasia](#)
- Co-convenor of Brisbane CBD Bicycle Users Group (2013-2021)

### **Other interests**

Chess, cycling, travel