**The Impact of Retail Electricity Price Rises and Inflation on Energy Poverty in NSW.**

**Paul Ward**

paul.ward@tueor.net

+61 484 762 875

# Table of Contents

[Table of Contents 0](#_Toc148132144)

[Abbreviations, Acronyms, Initialisms, or Terms 1](#_Toc148132145)

[Introduction 2](#_Toc148132146)

[1.0 Background 3](#_Toc148132147)

[2.0 Literature Review 5](#_Toc148132148)

[2.1 Energy Poverty 5](#_Toc148132149)

[2.2 Price Elasticity and Demand 5](#_Toc148132150)

[2.3 Hardship Programs and Government Assistance 6](#_Toc148132151)

[3.0 The Research Problem 8](#_Toc148132152)

[4.0 The Research Question 10](#_Toc148132153)

[5.0 Theoretical Framework 11](#_Toc148132154)

[6.0 Method 12](#_Toc148132155)

[6.1 Data 12](#_Toc148132156)

[6.2 Model 13](#_Toc148132157)

[7.0 Envisaged Contribution 14](#_Toc148132158)

[8.0 Anticipated Issues 15](#_Toc148132159)

[9.0 Timelines 16](#_Toc148132160)

[10.0 References 17](#_Toc148132161)

# Abbreviations, Acronyms, Initialisms, or Terms

|  |  |
| --- | --- |
| **Term** | **Definition** |
| #/100k | number per 100,000 |
| ABS | Australian Bureau of Statistics |
| AC | Autocorrelation |
| ACF | AutoRegressive Function |
| AER | Australian Energy Regulator |
| CPI | Consumer Price Index |
| CPI | Consumer Price Index |
| EP | Energy Poverty |
| EPI | Electrical Price Index |
| HIH | High-income households |
| LIH | low-income households |
| NEM | National Energy Market |
| NSW | New South Wales |
| RBA | Reserve Bank of Australia |

# Introduction

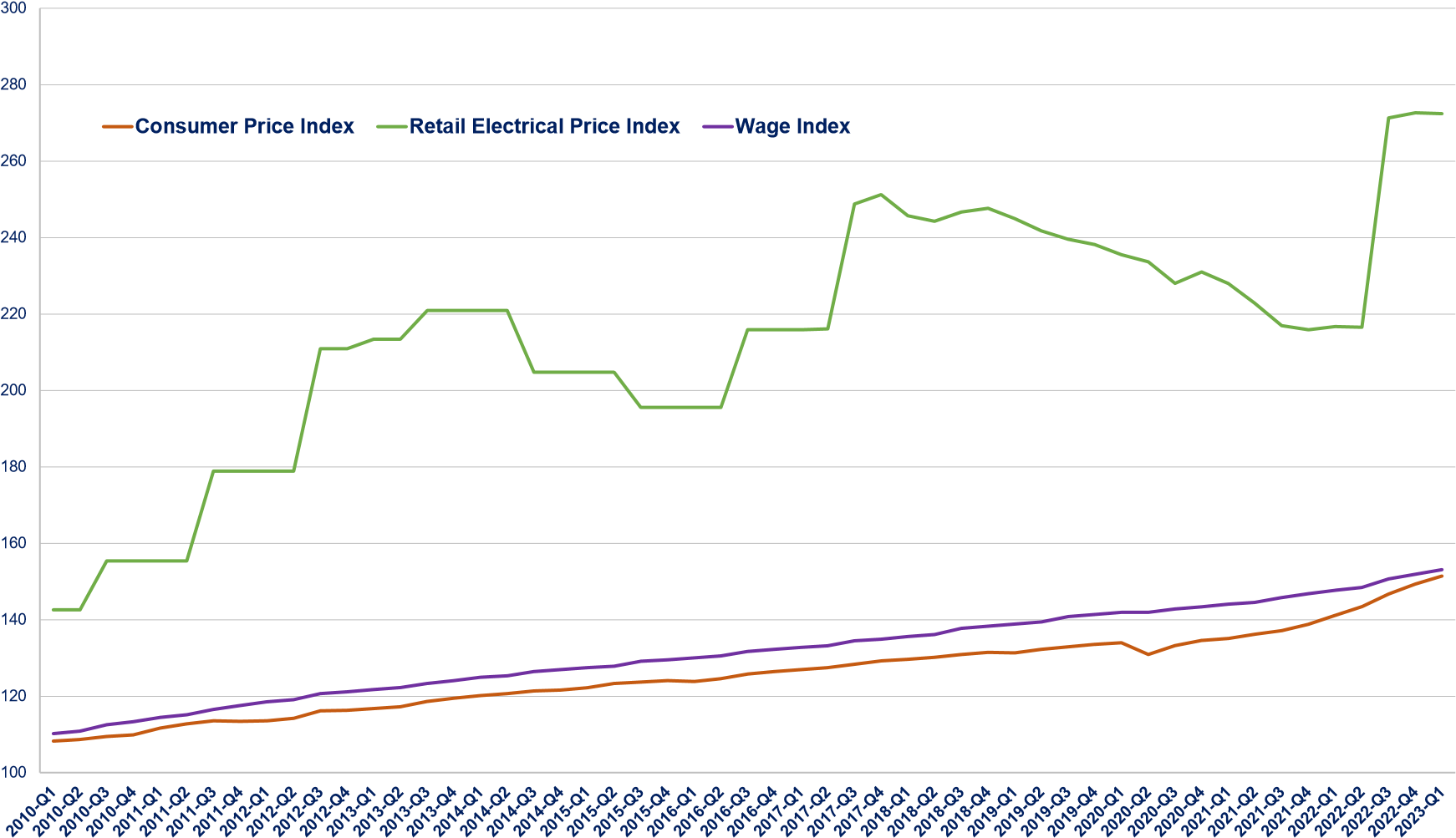
This paper proposes a study involving rising electricity prices and their impact on New South Wales (NSW) energy poverty (EP). The study will use open-source data from the Australian Energy Regulator (AER) and the Australian Bureau of Statistics (ABS) to model the effects of consumer goods inflation and electrical price inflation on NSW households experiencing energy-related financial stress.

It is anticipated that the article will be between 5000 and 8000 words. The submitted article will be written in R Markdown. All R code[[1]](#footnote-1) will be submitted for review and replication.

The study will first assess the current state of knowledge regarding energy poverty in Australia and its impacts by reviewing the current literature. This is followed by a discussion of the data acquisition strategy and the model(s) used. Then, an analysis of the results and their broader policy implications.

# 1.0 Background

In 2017, the Australian Financial Review reported that Australian households pay the highest electricity prices in the world. NSW retail electricity prices were also reported as the fourth highest globally (Potter and Tillett 2017). As Figure 1 illustrates, in the decade leading up to this article, retail electricity prices increased at a faster rate than the Consumer Price Index (CPI) or wages growth: approximately 8% per annum, compared to CPI at 2.4% and wages growth at 3.1% (ABS 2023a; 2023b).



*Figure 1: Retail Electrical Price Index versus Consumer Price Index and Wage Index: NSW 2010 – 2023*

*Data source: (ABS 2023a; 2023b)*

Since July 2022, Australian retail electricity prices have increased by 14.8% (ABS 2023b). Furthermore, in May 2023, the AER determined that NSW electricity prices would rise by 19.6 to 24.9% for the 2023-24 financial year (AER 2023b, 5). This was followed by AGL and Origin Energy announcing price increases for NSW of 21.1% and 29.7%, respectively, starting in July 2023 (ABC News 2023).

Against this background of rising electricity prices, households experiencing energy-related financial stress have also been increasing. In 2022, the number of households on energy retailer hardship programs increased by 21.5% (AER 2023a).

The research would quantify the relationship between electricity prices, inflation, and EP for NSW households. Furthermore, it is anticipated that it could gauge the effectiveness of new alleviation programs by comparing actual rates of EP against the model-estimated rates that do not account for the new policy interventions.

# 2.0 Literature Review

### 2.1 Energy Poverty

Energy poverty differs from normalised definitions of poverty. Structural differences ensure that low-income households (LIH) pay more for the same energy outcomes as higher-income households (HIH). Boardman (1991) discussed how low-income housing stock was less energy efficient, which meant LIH had to buy more energy for heating. Nelson et al. (2019) noted that LIH in NSW consumes 58% more energy on average than the rest of the population (Nelson et al. 2019, 267), which confirms Boardman's original thesis regarding the structural differences between EP and normalised definitions of poverty. Additionally, because LIH were considered a greater credit risk, they were more likely to be forced to use higher-cost plans (Nelson et al. 2019, 268) or pre-paid electricity plans, which preclude cost smoothing between high and lower expenditure periods (Boardman 2015, 274).

### 2.2 Price Elasticity and Demand

The problem with electricity is that it is not an easily substitutable good. For this reason, price elasticity, or a consumer's ability to reduce demand when prices increase, is very low. Chai, Ratnasiri, and Wagner (2021, 64–68) noted that the price elasticity for LIH was approximately 0.647[[2]](#footnote-2). They also noted that HIH had a greater ability to reduce demand through more energy-efficient appliances and housing, and the purchase of solar photovoltaic panels.

Chester (2013) noted that LIH had already reduced demand as much as possible and responded to price increases through other means. This included not using appliances like water heaters, refrigerators, or space heating, or forgoing other purchases like food and medication. Chester also noted that these decisions often lead to further costs, especially regarding health and mental well-being (Chester 2013, 67–101).

As electricity is an essential service, and the inability of LIH to reduce demand further, increasing prices have a deleterious impact on household budgets and financial stress.

### 2.3 Hardship Programs and Government Assistance

Electricity is an essential service, and all Australian energy retailers are mandated to maintain customer hardship policies and programs. They aim to prevent disconnection by providing flexible payment options for households experiencing financial stress (AER 2014).

A study of households on hardship programs in 2019 found that 14% of hardship program consumers are on plans that pay for both ongoing energy use and accrued debt, whereas 20% are on plans that only cover the cost of ongoing consumption, but do not pay off any debt. Further, over 60% of hardship program consumers are on plans that account for neither consumption nor accrued debt, meaning these households continue to increase energy-related debt (Nelson et al. 2019, 266–67).

Direct government support through rebates and transfer payments is another way to assist LIH experiencing EP. As inclusion in these programs is usually income-based, inclusion and exclusion error is a problem. Nelson (2019) noted that only ~25% of hardship program customers were eligible for government assistance. They concluded that income might not be the only factor determining EP (Nelson et al. 2019, 266). Other studies supported this, concluding a range of determinants for EP, such as ethnicity, household size and type, residential mode[[3]](#footnote-3), and climate (Churchill and Smyth 2020; Chester

2013; Chester and Elliot 2019; Best and Burke 2019; Best et al. 2021; Nance 2017). Another study by Simshauser (2023) found that the government assistance exclusion error for households experiencing EP was ~5.4% of all Queensland households (Simshauser 2023, 10).

Hardship programs and government assistance alleviate the impacts of EP. However, rapidly rising electricity prices result in a larger cohort of households experiencing EP, especially in households excluded from current policy settings.

# 3.0 The Research Problem

In most Australian EP research, four data sources are predominately utilised.

They are: the 2012 Household Energy Consumption Survey (ABS 2012), the

2016 Household Expenditure Survey (ABS 2016), the Household, Income and Labour Dynamics in Australia (HILDA) Survey (The Melbourne Institute 2022), and ABS microdata (ABS 2021).

The 2012 Household Energy Consumption Survey and the 2016 Household Expenditure Survey are both point-in-time surveys. In contrast, HILDA is an annual longitudinal survey. While they have been used extensively to map the determinant of energy poverty, they are insensitive to smaller time increments of price data (Azpitarte, Johnson, and Sullivan 2015; Best and Burke 2019; Churchill and Smyth 2020; 2021a; 2021b; 2022; Vera‐Toscano and Brown 2022).

ABS microdata has been used to map EP, usually by combining household income and expenditure data with assumptions of the level of expenditure that constitutes EP (Simshauser 2023; Chai, Ratnasiri, and Wagner 2021).

While some studies, such as Chester (2013; 2014) and Chester and Elliot

(2019), have conducted qualitative surveys to understand EP in Australia.

They have mostly worked to understand the human impacts of EP rather than the sensitivity of EP to other stimuli, like prices or inflation.

Studies that have sought to measure the incidence or rates of EP have resorted to using energy expenditure as a percentage of income, a fixed income threshold, to measure EP (Boardman 1991b; 1991a; 2015; Chai, Ratnasiri, and Wagner 2021; Simshauser 2023). However, as noted in Section

2.0, other determinants of EP need to be accounted for when measuring EP. This view concurs with the Hill's Report findings, Fuel Poverty Review, where they noted that a fixed income threshold is problematic as it fails to account for other EP determinants, such as those discussed in Section 2.0 (Hills 2012, 50–68).

This study seeks to use quarterly panel data, avoiding a fixed income threshold, for measuring the impact of fluctuations in electricity prices and inflation on the incidence of EP in Australia.

# 4.0 The Research Question

To what extent can the relationship between electricity prices and inflation to energy poverty be measured, such that changes to the rates of energy poverty can be confidently estimated and used to inform appropriate policy responses?

# 5.0 Theoretical Framework

Poverty is not having the resources to access the necessities to sustain life. So, it seems somewhat axiomatic to say that in an environment where costs increase more than household income, the number of households experiencing poverty will also increase.

Energy poverty is a phenomenon that describes not just the relationship between income and the cost of an essential good, but also that poorer households need to spend more to achieve the same energy outcomes as households on higher incomes. Section 2.0 discussed some of the reasons behind this phenomenon.

This study theorises that an expected behaviour of households experiencing energy-related financial stress is measurable and, further, that this behaviour is sensitive to price fluctuations. The AER reports energy retailer Hardship Program data quarterly. Entry into a Hardship Program reduces household energy-related financial stress and can be expected of most households experiencing EP. As such, this is a valuable measure of EP, which is both longitudinal and not subject to fixed income thresholds or not measuring other determinants of EP. Additionally, because the behaviour happens in an environment of current government EP alleviation policies, the data automatically considers these settings[[4]](#footnote-4).

# 6.0 Method

This study will use AER and ABS data to measure the impact of electricity price rises on NSW households experiencing energy-related financial stress. It is envisaged that two models will be employed and tested to understand and predict the impact of inflation and electricity price rises on EP.

### 6.1 Data

The AER releases a quarterly market performance report, which includes Hardship Program metrics. While the ABS releases quarterly price data, including an electrical price index (EPI) and a consumer price index (CPI) (ABS 2023b; AER 2023a).

The AER started reporting Hardship Program metrics in the second quarter of 2015. The data covers all states[[5]](#footnote-5) in the National Energy Market (NEM) and reports numerically and as a percentage of total households. The study will generate a number per 100,000 (#/100k) NSW households in Hardship Programs from NSW percentage data. Using #/100K instead of absolute reported numbers automatically corrects for population growth over the sample period.

The ABS reports price index data quarterly. The study will utilise the ABS CPI and EPI as explanatory variables for the NSW EP data.

The model will also include a COVID-19 binary explanatory variable to account for the Federal Government's special financial measures during the COVID-19 pandemic.

### 6.2 Model

It is envisaged that the study will generate and test two models. A log-log regression will determine the relationship between EP and price data in percentage terms. In contrast, a linear regression will return a numeric relationship from the same data.

The dependent variable[[6]](#footnote-6) will be lagged by one quarter to account for a delay between using the electricity, receiving the bill, and requesting assistance through retailer Hardship Programs. Additionally, the model will use a NeweyWest estimator to account for autocorrelation within the data.

𝑙n(ℎ)𝑡−1 = 𝛽0 + 𝛽1𝑙n(𝑛)𝑡 + 𝛽2𝑙n(𝑒)𝑡 + 𝛽3𝑐𝑡 + μ𝑡

*Equation 1: Log-Log Regression Model*

ℎ(𝑡−1) = 𝛽0 + 𝛽1𝑛𝑡 + 𝛽2𝑒𝑡 + 𝛽3𝑐𝑡 + μ𝑡

*Equation 2: Linear Regression Model*

Where:

h is the #/100k NSW households in Hardship Programs

n is the NSW consumer price index

e is the NSW electrical price index

c is the COVID-19 binary variable

# 7.0 Envisaged Contribution

In May 2023, the AER determined that electricity prices would rise by 19.6 to 24.9% for the 2023-24 financial year (AER 2023b, 5). AGL and Origin Energy also announced price increases for NSW of 21.1% and 29.7%, respectively, starting in July 2023 (ABC News 2023).

Also, the Federal Budget predicted inflation for 2023-24 in May at 3.24% (The Treasury of Australia 2023, 66). Compared to a Reserve Bank of Australia (RBA) forecast between 3 to 4.75% (RBA 2023).

It is envisaged that this study will provide two contributions to the current understanding of EP: a measurable understanding of the ratio between price rises and EP, and a predictive model to measure the impact of price rises on EP.

The log-log regression model returns coefficients that are interpretable as for every 1% change in an explanatory variable, such as CPI or electricity prices, equals a 𝛽 coefficient rise in EP. This helps understand the scope of EP changes in response to price fluctuations.

The predictive model uses known price rises or forecasts to predict future movements in EP. As mentioned in Section 5.0, the data already considers current policy settings. This means the efficacy of current policy settings or the efficiency of policy changes can be evaluated against the model.

# 8.0 Anticipated Issues

Two anticipated issues are known at this stage: correlation errors in the model and interim period predictions.

Given the nature of the data, as is a common issue in economic panel data, autocorrelation (AC) could be an issue with the model. The data frame can be tested in R using the Bruesch-Pagan Test or an AutoRegressive Function (ACF). If AC will impact the model's accuracy, using a NeweyWest estimator to account for autocorrelation and/or a lagged dependent variable will overcome this.

Another issue is that the AER reporting period is three months after the quarter finishes. If a next-quarter prediction is required, an interim current-quarter estimate will be required to transition the data to be ready for a next-quarter prediction.

# 9.0 Timelines

This journal article is anticipated to be ready for submission four to eight weeks postapproval. The work with the data frame is complete. Most of the remaining work is writing the study and compiling the R Markdown. The author will also engage external professional editors[[7]](#footnote-7) to review the text before submission.

# 10.0 References

ABC News. 2023. 'Energy Bills to Rise as Major Retailers Announce Price Hike'. *ABC News*, 10 June 2023.

https://www.abc.net.au/news/2023-06-11/agl-originannounce-energy-price-rise/102465710.

ABS. 2012. 'Australian Bureau of Statistics: Household Energy Consumption Survey, Australia'. Commonwealth of Australia. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Su bject/4671.0~2012~Main%20Features~Contents~1.

———. 2016. 'Australian Bureau of Statistics: Household

Expenditure Survey, Australia'. Commonwealth of Australia. https://www.abs.gov.au/statistics/economy/finance/househ old-expenditure-survey-australia-summary-results/latestrelease.

———. 2021. 'Australian Bureau of Statistics: Microdata and Table Builder'. 8 November 2021.

https://www.abs.gov.au/statistics/microdata-tablebuilder.

———. 2023a. 'Australian Bureau of Statistics: Average Weekly Earnings, Australia',. Australian Bureau of Statistics. 2023. https://www.abs.gov.au/statistics/labour/earnings-andworking-conditions/average-weekly-earnings-australia/may2022#data-download.

———. 2023b. 'Australian Bureau of Statistics: Consumer Price Index, Australia'. Australian Bureau of Statistics - Consumer Price Index, Australia. 26 July 2023.

https://www.abs.gov.au/statistics/economy/price-indexesand-inflation/consumer-price-index-australia.

AER. 2014. 'Australian Energy Regulator: Customer Hardship Policies'. Australian Energy Regulator. 4 September 2014. https://www.aer.gov.au/retail-markets/customer-hardshippolicies.

———. 2023a. 'Australian Energy Regulator - Performance Reporting'. Australian Energy Regulator. 2023.

https://www.aer.gov.au/retail-markets/performancereporting.

———. 2023b. 'Default Market Offer Prices 2023–24: Final Determination'. 64687. Canberra, Australia: Australian Energy Regulator.

https://www.aer.gov.au/system/files/Default%20market%20 offer%20prices%202023-24%20final%20determination.pdf.

Azpitarte, Francisco, Victoria Johnson, and Damian Sullivan. 2015. 'Fuel Poverty, Household Income and Energy Spending: An Empirical Analysis for Australia Using HILDA Data'. Fitzroy, Vic: Brotherhood of St Laurence. https://library.bsl.org.au/jspui/bitstream/1/7906/1/Azpitar teJohnsonSullivan\_Fuel\_poverty\_household\_income\_energy\_s pending\_2015.pdf.

Best, Rohan, and Paul J. Burke. 2019. 'Factors Contributing to Energy-Related Financial Stress in Australia'. *Economic Record* 95 (311): 426–79.

Best, Rohan, Mara Hammerle, Pundarik Mukhopadhaya, and Jacques Silber. 2021. 'Targeting Household Energy Assistance'. *Energy Economics* 99 (July): 105311.

https://doi.org/10.1016/j.eneco.2021.105311.

Boardman, Brenda. 1991a. *Fuel Poverty: From Cold Homes to Affordable Warmth.* London: Belhaven Press.

———. 1991b. 'Fuel Poverty Is Different'. *Policy Studies* 12 (4): 30– 41. https://doi.org/10.1080/01442879108423600.

———. 2015. 'Housing, Energy Efficiency and Fuel Poverty.' In *The Routledge Handbook of Planning for Health and Well-Being.*, 305–16. Routledge. https://doi.org/10.4324/978131572826131.

Chai, Andreas, Shyama Ratnasiri, and Liam Wagner. 2021. 'The Impact of Rising Energy Prices on Energy Poverty in Queensland: A Microsimulation Exercise'. *Economic Analysis and Policy* 71: Pages 57-72.

https://doi.org/10.1016/j.eap.2021.03.014.

Chester, Lynne. 2013. 'The Impacts and Consequences for LowIncome Australian Households of Rising Energy Prices'. University of Sydney.

———. 2014. 'The Growing Un-Affordability of Energy for

Households and the Consequences'. *International Association for Energy Economics*, 23–27.

Chester, Lynne, and Amanda Elliot. 2019. 'Energy Problem Representation: The Historical and Contemporary Framing of Australian Electricity Policy'. *Energy Policy* 128 (May): 102– 13. https://doi.org/10.1016/J.ENPOL.2018.12.052.

Churchill, Sefa Awaworyi, and Russell Smyth. 2020. 'Ethnic Diversity, Energy Poverty and the Mediating Role of Trust:

Evidence from Household Panel Data for Australia'. *Energy Economics* 86: 104663-.

https://doi.org/10.1016/j.eneco.2020.104663.

———. 2021a. 'Energy Poverty and Health: Panel Data Evidence from Australia'. *Energy Economics* 97: 105219-.

https://doi.org/10.1016/j.eneco.2021.105219.

———. 2021b. 'Locus of Control and Energy Poverty'. *Energy Economics* 104: 105648-.

https://doi.org/10.1016/j.eneco.2021.105648.

———. 2022. 'Local Area Crime and Energy Poverty'. *Energy Economics* 114: 106274-.

https://doi.org/10.1016/j.eneco.2022.106274.

Hills, John. 2012. 'Getting the Measure of Fuel Poverty: Final Report of the Fuel Poverty Review'. Monograph. London, UK: Centre for Analysis of Social Exclusion, London School of Economics and Political Science. 2012.

http://sticerd.lse.ac.uk/case/.

Nance, Andrew. 2017. 'Energy Access and Affordability Policy Research'. Energy Consumers Australia Limited.

http://aemc.gov.au/News-Center/What-s-

New/Announcements/AEMC-submission-to-the-.

Nelson, Tim, Eleanor McCracken-Hewson, Gabby Sundstrom, and Marianne Hawthorne. 2019. 'The Drivers of Energy-Related

Financial Hardship in Australia-Understanding the Role of

Income, Consumption and Housing.' *Energy Policy* 124: Pages 262-271. https://doi.org/10.1016/j.enpol.2018.10.003.

Potter, Ben, and Andrew Tillett. 2017. 'Australians Pay Highest Power Prices in World'. *Australian Financial Review*, 5 August 2017.

RBA. 2023. 'Economic Outlook | Statement on Monetary Policy – February 2023'. Reserve Bank of Australia. Australia. 10 February 2023.

http://www.rba.gov.au/publications/smp/2023/feb/econom ic-outlook.html.

Simshauser, Paul. 2023. 'The 2022 Energy Crisis: Fuel Poverty and the Impact of Policy Interventions in Australia's National Electricity Market'. *Energy Economics* 121 (May): 106660.

https://doi.org/10.1016/j.eneco.2023.106660.

The Melbourne Institute. 2022. 'HILDA Survey'. Melbourne Institute: Applied Economic & Social Research. 19 October 2022. https://melbourneinstitute.unimelb.edu.au/hilda.

The Treasury of Australia. 2023. 'Budget Paper No. 1, Budget Strategy and Outlook (May 2023)'. Canberra, Australia:

Commonwealth of Australia.

https://budget.gov.au/content/bp1/download/bp1\_202324.pdf.

Vera‐Toscano, Esperanza, and Heather Brown. 2022. 'Empirical Evidence on the Incidence and Persistence of Energy Poverty in Australia'. *Australian Economic Review* 55 (4): 515–29.

https://doi.org/10.1111/1467-8462.12493.

1. 1 R is a statistical computing language. [↑](#footnote-ref-1)
2. This translates to a 0.647% fall in demand for every 1% increase in price. [↑](#footnote-ref-2)
3. Home-owner, private renter, or government housing [↑](#footnote-ref-3)
4. This point is important in Section 8.0 Anticipated Contributions. [↑](#footnote-ref-4)
5. Australian Capital Territory, New South Wales, Queensland, Sourth Australia, and Tasmania [↑](#footnote-ref-5)
6. #/100k NSW households in Hardship Programs [↑](#footnote-ref-6)
7. At this stage, it is anticipated to utilise the services of Standard Error Research Editors. <https://stderr-editors.com/> [↑](#footnote-ref-7)