PRINCIPAL ECONOMICS

Sector-specific input price escalation forecasts

for Electricity Distribution Businesses (EDBs)

REPORT TO

The Commerce Commission

www.principaleconomics.com

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Executive summary

The Commerce Commission (the Commission) approached Principal Economics Limited (PEL) to develop sector-specific forecasts for the escalation of input prices pertinent to electricity distribution businesses (EDBs). These forecasts will be used to inform the reset of the forthcoming default price-quality path (DPP) for EDBs and encompass the following key components:

- An evaluation of the adequacy of the Commission's approach in the previous DPP, considering the prevailing inflationary environment.
- Identification of cost categories and relevant indices essential for analysing price inflators.
- Collaboration with stakeholders to devise a methodology for predicting EDBs' cost escalation factors.
- Development of sector-specific input price escalation forecasts for EDBs.

The resulting report is designed to meet the specifications of DPP4 (2025-2030), tackle various risk and uncertainty factors, and benefit from close cooperation with the Commission and input garnered from submissions.

We used the inputs from the Commission teams and the findings from the literature and submissions to identify the cost areas and the relevant indices

Our report begins with a thorough examination of the costs incurred by EDBs, incorporating an extensive review of documents supplied by the Commission pertaining to DPP paths for EDBs. This includes a critical assessment of the Commission's methodology in the previous DPP cycle, taking into consideration the prevailing inflationary environment. Additionally, The Commerce Commission has received 33 individual submissions and 11 cross-submissions from stakeholders in the distribution sector in response to the Commission's Default Price-Quality Path Issues Paper. We draw on the information provided in the submissions and utilise the findings from our literature review, stakeholder inputs, and contributions from various teams within the Commission to identify cost categories earmarked for escalation and assess available indices for benchmarking costs. This comprehensive approach ensures accuracy in capturing price effects, relevance to market conditions, and practicality in forecasting.

In our forecasts of cost escalation, we allow for uncertainty driven by inflation and climate policy

Given the high-level of uncertainty with inflation, after considering best practice from other countries, we adopted upper- and lower-bounds for inflation in our calculation of real price effects. Also, given the significant impact of the climate policy, particularly the second emission reduction plan (ERP2), during the DPP4 period, we incorporated the latest available information on the economic impact of the climate policy into our forecasts. PEL is currently working on refining the modelling of ERP2 for the Government, and a few changes are expected until the release of the ERP2 policy documents by November 2024.

We considered various aspects for identifying the relevant indices for different cost areas

We considered the size, similarity to other costs, and the volatility of cost areas for categorising EDB costs. Then we selected indices to benchmark costs based on:

- Ability to capture price effects and not quality changes,
- Ability to reflect general market conditions,
- Relevance to firm’s business and costs,
- Are practical to produce and forecast.

Labour costs will continue to escalate at slightly lower rate than the last decade

Our econometric models are rigorously tested across each sector-specific forecast to ascertain their validity. Four categories of labour costs were identified for cost escalation based on the size of expenditure and similarity of cost drivers in each cost category.

These costs are indexed by Statistics New Zealand labour cost indices (LCIs). LCIs are chosen because they are adjusted for the composition of labour and therefore capture price effects and not quality changes. The LCIs chosen are industry level indices. Industry level indices were chosen because they reflect costs faced by EDBs while being sufficiently high-level to capture market conditions.

The LCIs are forecasted using econometric models which capture two effects:

- the extent to which trend labour costs tend to rise more quickly in some industries than in the economy as a whole,
- cyclical cost pressures.

The real series will incorporate the uncertainties led by inflation. As discussed, we will consider an upper and lower forecast for CPI to deal with uncertainty. There are various sources of uncertainty, and our approach accounts for uncertainty driven by supply chain issues, which is predicted based on fluctuations in oil price.

Table E.1 shows the labour cost escalation factors, and the historic and forecasted growth. Table E.2 illustrates the identified opex cost areas and the historic and forecasted growth for their relevant indices.[1]

Table E.1 Labour cost escalation factors

Cost item	Applied to	Index measure	Growth		
			Last 15 years	Last 10 years	2023-2030
Network opex labour	Labour for Preventive Predictive, Corrective, and Proactive maintenance-	LCI for Electricity, Gas and Water industry (LCI EGW)	0.6%	2.7%	2.0%
Network capex labour	Labour for Network Capex portfolios	LCI Construction	0.7%	2.5%	2.2%
Network Capex labour - design consultants	Labour for Network capex portfolios design consultants	LCI Professional and Technical Services industry	0.7%	2.0%	1.8%
ICT labour	Labour for ICT capex and ICT opex portfolios	LCI Professional and Technical Services industry	0.7%	2.0%	1.8%
Internal labour	Asset Management & Operations; Business Support	LCI for Electricity, Gas and Water industry (LCI EGW)	0.6%	2.7%	2.0%

Source: Principal Economics

1 For brevity of the summary, we provide further details about capex cost areas and indices in the report.

Table E.2 Opex cost categories and relevant indices

Cost item	Applied to	Narrow index	Growth		
			Last 15 years	Last 10 years	2023-2030
Network	Rent	PPI - Published output commodities 'Rent of commercial land and buildings'	0.60%	1.40%	2.10%
	Electricity	PPI - Published output commodities 'Electricity: commercial consumers'	-0.40%	1.90%	-0.60%
	Field technicians and project management	LCI 'Professional and Technical Services'	0.70%	2.50%	2.20%
Technology	Network electronics service agreements	PPI Outputs 'Electronic and Electrical Equipment Manufacturing'	-0.40%	1.90%	-0.60%
	IT technical and management staff (internal)	LCI 'Professional and Technical Services'	0.70%	2.00%	1.80%
Business Support	All aspects	LCI 'Professional and Technical Services'	0.70%	2.00%	1.80%

Source: Principal Economics

Metal prices and insurance cost will likely escalate at slightly lower rate than the last decade

Four metals have been chosen for escalation, each treated as separate cost items due to their significant size and fluctuating nature. International prices are adopted as the indexing mechanism for these metals, as they offer a reflection of general market conditions. The forecasts for metal prices rely on a combination of futures market prices, mid-points (and upper and lower ranges) from international consensus forecasts, and projections from the World Bank regarding metals and minerals. For insurance cost, we constructed an index based on EDB's information disclosures and informed our forecasts by the various sources of local and global risk assessments for insurance and building, the global market and cybercrime.

Table E.3 Metals, Insurance and other cost areas

Cost area	Applied to	Narrow index	Growth (NZD)		
			Last 15 years	Last 10 years	2023-2030
Copper	Network capex	LME copper price (US$/mt)	5.10%	5.20%	0.80%
Aluminium	Network capex	LME aluminium price (US$/mt)	2.90%	1.60%	2.10%
Steel	Network capex	Hybrid of World Bank steel price index and Asia Hot-Rolled Coil (HRC) US$/t	15.40%	8.90%	1.10%
Other metals	Network capex	World Bank Metals & Mineral Price Index	5.10%	4.70%	2.90%
Construction	Network capex	Producers Price Index – Outputs, for Heavy and Civil Engineering Industry	1.00%	3.70%	2.00%
IST hardware and software	ICT capex and opex	All groups CPI	-4.90%	11.40%	-14.50%
Maintenance related material and plant	Maintenance opex	PPI - O All groups	0.50%	2.80%	1.30%
Cost area	**Applied to**	**Narrow index**	**Last 10 years**	**Last 5 years**	**2023-2030**
Insurance	Insurance cost	EDB Average insurance Index	6.30%	12.50%	5.20%

Source: Principal Economics

The high level of uncertainty requires close monitoring of the costs over the DPP period

In using the outputs of this report, we suggest that the Commission should consider the following:

- With the high level of uncertainty with inflation, climate and other risk factors that we have been experiencing over the last , a useful approach for addressing uncertainty is to adopt an adaptive approach, with defining various thresholds, pathways and actions – see Principal Economics (2023, p. 28). We suggest adopting a similar approach for DPP4 will be useful for avoiding issues raised in the submissions about the increased gap over the previous regulatory periods, particularly DPP3. Currently, the Commission mainly monitors inflation, and that does not address various cost pressures applied to the EDBs and, technically, the deterministic RPE series[2]. We suggest that this topic needs to be investigated further for DPP4.
- While we have considered a wide range of indices in this report, it is possible to expand this list to cover the cost areas in more details – as we observed in our review of recent report from other countries. The advantage of this approach is to provide detailed and frequent information about cost escalation factors. We suggest that a future report should further consider the advantages of a more granular approach in New Zealand.
- It is difficult to judge the efficiency of investments of the regulated monopolies, that often come at a cost to consumers – which is more prominent in short- and medium-terms. This increases the risk that the cost efficiencies will be prioritised to long-term social gains. We suggest that the Commission provides further

2 Our report addressed this by providing forecast ranges for variation in CPI.

technical and strategic guidance for the regulated monopolies. This should build based on the current Building Block Model.

- The submissions highlighted the need for considering local features, which vary across EDBs. This is an important and technically challenging task that is beyond the scope of our report. Given the consumer welfare focus of the Commission, we suggest that further exploration of affordability/price sensitivity at a local level will be useful for understanding the balance between cost of improved resilience and the affordability pressure to local communities.
- While we used the most likely climate policy package, as of 7th February 2024, to inform the DPP4 forecasts, these policy packages are still being refined and are not final. Given the significant impact of climate policy as identified in our report, we suggest an update of this report once the economic impact of ERP2 report will be released by the Government in November 2024.

Abbreviations and acronyms

Abbreviation	Description
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMP	Asset Management Plans
ARIMA	Autoregressive integrated moving average
CAGR	Compound annual growth rate
CGE	Computable general equilibrium
CON	Construction
CPI	Consumer price index
DPP	Default Price-quality Path
EA	Electricity Authority
ECC	Electricity: commercial consumers
EDB	electricity distribution businesses
EGW	Electricity, Gas and Water industry
ENA	Electricity Networks Aotearoa
ERP	Emissions Reduction Plan
FMOLS	Fully Modified Ordinary Least Squares
GDP	Gross domestic product
HEAVY/HEV	PPI-outputs index for heavy and civil engineering
HVDC	high-voltage direct current
HYEFU	Half Year Economic and Fiscal Update
ICT	Information and Communications Technology
IFRS15	International Financial Reporting Standard 15
INTSA	Innovation and Non-Traditional Solutions Allowance
IRIS	Incremental Rolling Incentive Scheme
IST	Information Services and Technology
IT	Information Technology
LCI	Labour cost index
LME	London Metal Exchange
LV	Low Voltage
NZ	New Zealand
NZD	New Zealand Dollar
NZTA	New Zealand Transport Authority
OECD	Organisation for Economic Co-operation and Development
PCFM	Price Control Financial Model
POA	Price on Application

PPI	producer's price index
PRO	Professional
RBNZ	Reserve Bank of New Zealand
RCP	Regulatory Control Period
RENT	Rent of commercial land and buildings'
RPE	Real Price Effects
RSE	Reliability, Safety & Environment
SCADA	Supervisory Control and Data Acquisition
SG	Steering Group
STPIS	Service Target Performance Incentive Scheme
TWI	Trade Weighted Index
UK	United Kingdom
USA	United States of America
USD	United States Dollar
WTI	West Texas Intermediate

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1 Introduction

The Commerce Commission (the Commission) approached Principal Economics Limited (PEL) to produce sector-specific input price escalation forecasts for electricity distribution businesses (EDBs). The outputs of this work will support the reset of the next default price-quality path (DPP) for EDBs and include:

- A review of the suitability of the Commission's approach from the last DPP considering the current inflation environment.
- A list of cost areas and available indices useful for the analysis of price inflators.
- A methodology, developed in collaboration with the stakeholders, for forecasting EDB's cost escalation factors.
- Sector-specific input price escalation forecasts for EDBs.

The outputs of this report:

- align with the requirements of the DPP4,
- address a range of factors of risk and uncertainty,
- build on close collaboration with the Commission and inputs received from submissions.

In this report we undertake a literature review of the costs incurred by EDBs including a comprehensive review of documents provided by the Commission regarding DPP paths for EDBs. This includes a critical review of the Commission's approach in the previous DPP cycle, considering the prevailing inflationary environment. We also use the submissions received on EDBs Issues Paper (Commerce Commission, 2023). We use the findings from our literature review, the inputs received from stakeholders through the submissions, and inputs from various teams across the Commission to identify categories of costs to be escalated and indices available for benchmarking costs based on whether that accuracy capture price effects, reflect general market conditions, relevant to general market conditions and are practical to produce and forecast. We test the validity of econometric models across each sector-specific forecast.

In this chapter, we first provide a brief description of the background of the project. Then we describe the current DPP system and provide an overview of this report's approach. In the end, we provide details on the report content.

1.1 Background

The Commerce Commission plays a crucial role in regulating the electricity distribution businesses in New Zealand through the implementation of default price-quality paths (DPPs). These DPPs are designed to influence the behaviour of the businesses by setting the maximum average price or total allowable revenue that they can charge, as well as by establishing standards for the quality of services they must provide. This ensures that businesses do not compromise on service quality to maximise profits under their price-quality path. The 2020-2025 electricity default price-quality path applies to 16 electricity distributors in New Zealand and will be in effect until 31 March 2025.

As the current DPP (DPP3) approaches its expiration on 31 March 2025, the Commission faces the task of formulating DPP4 in a dynamic energy environment characterised by increased electrification, climate change impacts, and significant economic pressures, including high inflation. In this context this proposal outlines our approach to developing sector-specific input price escalation forecasts for EDBs to support the reset of the next DPP.

As part of the issues identified from the DPP3 the Commerce Commission are revisiting the assumption that 'all industries series' is a suitable proxy for EDB input costs. As such there is interest in considering whether Real Price Effects (RPE) forecast accuracy could be improved by a sector-specific forecast series based on a basket of input commodities and services that better reflects the composition of EDBs' input costs (Commerce Commission, 2023).

It is identified in the issues paper published by Commerce Commission (2023) that over the medium and long-term different industries have shown sustained differences in the level of real input price changes. Should this trend continue, it may warrant the implementation of an escalator tailored specifically for EDBs. Such an index will exclude inappropriate inputs including energy or distribution services themselves that create a circularity problem (Commerce Commission, 2019).

1.2 The approach used in the current DPP (DDP3)

Building blocks are the methods for determining the revenue allowance for a supplier from the sum of their forecast (or actual) costs over a given period. The inputs defined by DPP resets are Capex, opex and Disposals, which all need to be considered in calculation of building blocks allowable revenue. Then CPI is added to the calculation of Maximum Allowable Revenue (MAR). Expenditure forecasts are critical to the building formula calculations. The methodology for opex and capex forecasts are not specified by Input Methodologies and are subject to consultation during the DPP reset process. Currently, the opex allowance considers base year opex, One-off steps and change from trends (such as input price inflation). Capex is less predictable (compared to opex) and consists of renewal, growth, non-network RSE and aggregate caps. For quality, network reliability has been used on a no material deterioration principle developed based on historical performance over 10 years and normalised to limit the impact of major events. There is a quality (revenue-linked) incentive scheme developed to encourage EDBs to perform better than their quality target.

The more prevalent major trends affect the accuracy and usefulness of the current DPP approach. This includes a range of regulatory (decarbonisation), economic (inflation) and network factors (resilience). The electrification (required for decarbonisation and network resilience) will require extra capacity on electricity network. We will further investigate these topics based on the inputs from the stakeholders and our findings from the literature review.

1.3 The strategic context

Commerce Commission is an independent Crown entity accountable for the performance to the Minister of Commerce and Consumer Affairs and, in relation to telecommunications services, the Minister for the Digital Economy and Communications. The vision of the Commission is to 'Making New Zealanders better off because markets work well and consumers and businesses are confident market participants.' (Commerce Commission, 2023b, p. 3)

To achieve this vision and according to Part 4 of the Commerce Act 1986, the Commission is responsible for the regulation of price and quality of goods and services in markets where there is little or no competition and little or no likelihood of a substantial increase in competition. This includes electricity distribution and transmission. To achieve this, the Commission determines the maximum revenues and the required quality standards for EDBs over the next four to five years from 1 April 2025 (known as DPP4). Table 1.1 provides a list of EDBs that are subject to price-quality regulation over the DPP4 period.

Table 1.1 List of EDBs

EDBs subject to price-quality regulation			
Alpine Energy	Firstlight Network	Orion	Top Energy
Aurora Energy*	Horizon Energy	OtagoNet Joint Venture	Unison Networks
EA Networks	Nelson Electricity	Powerco	Vector
Electricity Invercargill	Network Tasman	The Lines Company	Wellington Electric

Source: Commerce Commission (2023a)

* Aurora Energy is currently on a customised price-quality path which expires 31 March 2026, when it will be transitioned onto DPP4.

1.4 Overview of our approach

This section describes our high-level approach to the identification of data and methods required for a credible solution. The detail of our methodology is provided in Chapter 3. Most relevant reports in New Zealand are the two studies by Torshizian (2018, 2020) investigating cost escalation factors for Transpower's and Chorus' base capital and operating expenditure proposal for the Commerce Commission. These reports provide a comprehensive range of local and international indices for various cost categories. We follow the same methodology to those studies and use the guidelines available from the Commission and inputs from stakeholders to identify the cost categories and reach consensus on the most appropriate indices. This approach is tested in the previous reports and has led to useful outputs with complete agreement across the multi-disciplinary teams involved in those projects. Hence, for this work, we build on the inputs from the Steering Group (SG) of the project and the available literature, complemented with the views of stakeholders and, where required, our expert judgement.

We will choose data, methodology and overall approach based on various criteria as will be discussed. As will be outlined in Chapter 3, our approach is unique because:

- It closely aligns with the requirements of the DPP3,
- It provides a solution to address factors of risk and uncertainty,
- It builds on close collaboration with the Commission and stakeholders,
- It provides a clear list of criteria for data and methodology.

The combination of these features leads to a robust and practical output for this project.

1.5 Report contents

This report is structured as below:

- Chapter 2 provides a brief review of the available literature.
- Chapter 3 summarises the stakeholder engagements and submissions, identifies the cost areas, and describes our technical methodology.
- Chapter 4 describes the real price indices.
- Chapter 5 provides a conclusion and suggestions for the next step.

2 Literature review

This chapter provides a review of the most relevant reports. The findings from the literature review will serve as a starting point which we will build our comprehensive approach to forecasting sector-specific input price escalation factors for EDBs.

Our review investigated approaches used for considering the changing costs and composition of sector-specific inputs facing EDBs in response to an evolving market. The review aims to identify existing indices, and methodologies used and proposed for forecasting indices. Our objective is to build upon the existing knowledge base and gather insights to inform our forecasting methodology in the next chapter. By thoroughly examining the strengths and weaknesses of these indices, we aim to contribute to a robust and effective approach to forecasting sector-specific input price escalation factors for EDBs, aligning with the best practices observed both nationally and abroad.

As we will describe in this chapter, the regulation of EDB price escalation varies across different countries reflecting their market conditions and regulatory goals. Table 2.1 provides a summary of the features of the regulation regime for New Zealand, Australia and the UK. As will be explained in the next chapter, we use the findings from the comparisons between the current approaches to inform our approach to price escalation forecasting. For example, we adopt a robust approach to incorporate the impact of climate change commitments, which is currently considered in the UK.

Table 2.1 Regulation of EDB price escalation across different countries - Summary

Criteria	New Zealand (The Commission -DPP Regime)	Australia (AER -Building Block & AEMO)	UK (Ofgem – RIIO ED2)
Historical Context	Transition from government-controlled to market-oriented. Small, isolated market.	Integration of state-based systems into a national framework. Diverse and complex market.	Transition to market liberalisation. Mature market with a focus on sustainability and innovation.
Regulatory Focus	Balancing investment with consumer price pressures. Emphasis on reliability and efficiency.	Setting the maximum revenue that a network service provider can earn from its customers for delivering electricity.	Long-term investment, sustainability, and innovation. Emphasis on consumer value.
Regulatory Model	Building block model[3]: focusing on allowable returns, Opex, and Capex.	Building block model: similar to New Zealand's.	RIIO model, a variant of the building block approach: RIIO stands for Revenue = Incentives + Innovation + Outputs. Complex, incorporating various incentives and output regulations.
Policy and Economic Priorities	Efficient and reliable energy distribution.	Balancing diverse state interests, managing vast geography.	Climate change commitments, transition to a low-carbon economy.

3 For definition refer to Section 1.2.

Consumer and Industry Dynamics	Smaller market with an emphasis on maintaining reliability and efficiency.	Large, varied market with state-based differences. Focus on national framework consistency.	Highly competitive market. Focus on long-term value and consumer engagement.
Adaptability to Future Challenges	Managing demand changes, efficiency improvements.	Integrating renewable energy, adapting to changing demand patterns.	Embracing technological disruption, renewable energy integration, and changing consumer behaviour.

Sources: Principal Economics based on information collected from AER (2023); Commerce Commission (2023a); Mott MacDonald (2023, p. 19); Ofgem (2023)

2.1 New Zealand's approach to forecasting EDB price escalation

In New Zealand, the approach to forecasting Electricity Distribution Business (EDB) price escalation is primarily governed through price-quality regulation, as defined by Commerce Commission (2023a). This regulation is designed to influence business behaviour by imposing limits on the total revenue recoverable from consumers through established price-quality paths, such as the Default Price-Quality Path (DPP) and the Customised Price-Quality Path (CPP). These paths are essential in setting both revenue constraints and service quality standards for EDBs, ensuring a balanced approach to pricing that does not compromise service quality. Central to determining the DPP is the requirement to apply Input Methodologies (IMs), which provide the upfront rules, processes, and requirements of regulation, including considerations of cost allocations, capital expenditure, and operating expenditure forecasts. These methodologies play a crucial role in forecasting price escalations by establishing a systematic approach to calculating allowable revenues and incentivizing efficient investment.

In setting the revenue path under the DPP regime, the New Zealand approach involves a detailed consideration of various components, including forecast net allowable revenue and pass-through and recoverable costs. The revenue path determines the annual revenues EDBs are allowed to earn over the regulatory period, influencing the price escalation over time. To ensure accuracy and promote efficiency, the Commerce Commission uses an Incremental Rolling Incentive Scheme (IRIS) alongside these components. IRIS refines the incentive mechanism for EDBs to encourage ongoing cost-effectiveness and prudent investment, directly impacting the forecasted price escalations. The scheme modifies the incentives for EDBs to maintain efficient operations and capital expenditure, thus influencing the overall price escalation projections. This comprehensive approach ensures that the forecast of EDB price escalation is reflective of both current market conditions and the regulatory objectives to provide quality service at reasonable prices to consumers (Commerce Commission, 2023a).

Beyond the DPP, the New Zealand regulatory framework incorporates Customised Price-Quality Paths (CPPs) and DPP reopeners as additional tools to accommodate specific needs of EDBs that the standard DPP cannot meet. CPPs allow individual EDBs to propose alternative paths that align more closely with their unique circumstances and requirements, offering a tailored approach to price-quality regulation and, consequently, a more precise method for forecasting price escalations. This method is particularly beneficial for EDBs undergoing substantial changes in their operational environment or those requiring significant investments that are not adequately covered by the DPP. Similarly, DPP reopeners provide an opportunity for EDBs to adjust their price-quality paths mid-period in response to significant changes or unexpected shocks. This flexibility in the regulatory framework ensures that price escalations are not only based on generalized forecasts but can be adapted to reflect real-time changes and demands, thereby enhancing the accuracy and relevance of price escalation projections for each EDB (Commerce Commission, 2023a).

The New Zealand electricity sector is navigating through an era of transformative challenges and adaptations, influencing the forecasting of EDB price escalation, especially as it transitions from DPP3 to DPP4. Challenges such as increased emphasis on decarbonisation, emerging technologies, and climate change-induced extreme weather events

are driving significant shifts in investment focus and timing for EDBs – these factors are acknowledged in the Commission's issue paper. The dynamic of increased electrification, coupled with the need for resilient and sustainable infrastructure, is shaping a more complex investment landscape, requiring larger-scale investments and innovative solutions. Moreover, the unpredictability of high inflation rates and fluctuating interest rates adds financial complexity to forecasting and planning. In response, the DPP4 aims to provide a more flexible and adaptive regulatory framework. It is expected to accommodate necessary investments in resilience and innovation, allow for adjustments in investment timing and nature, and minimise price shocks to consumers. As the sector moves forward, EDBs are likely to emphasise agility in adapting to technological advances and consumer preferences, ensuring investments align with the evolving energy landscape and regulatory environment while maintaining consumer affordability and network reliability. We will describe our approach for addressing these issues in the next chapter.

2.2 Australia

In the context of forecasting Electricity Distribution Business (EDB) price escalation in Australia, the Australian Energy Regulator (AER)[4] utilises a structured Building Block Model as a fundamental tool for determining network pricing (Australian Energy Regulator, 2023). Their Building Block Model calculates the total revenue requirement by adding several components: a return on capital to reflect the cost of investment in the network, operating and maintenance costs, asset depreciation, and taxation costs. Additionally, adjustments are made for any over- or under-recovery of revenue from past periods and for rewards or penalties earned through incentive schemes.[5] This comprehensive framework allows for a systematic and transparent assessment of a network service provider's revenue needs, aligning the EDB's revenue with its efficient costs and ensuring that consumers are not overcharged, thereby facilitating accurate forecasts for sector-specific input price escalation (AER, 2023).

Other tools like Revenue Cap Regulation, Service Target Performance Incentive Scheme (STPIS), and Regulatory Investment Test for Distribution (RIT-D) indirectly influence EDB price escalation forecasts. For the Revenue Cap Regulation, the AER sets a maximum revenue that EDBs can earn over a regulatory period. By capping the total allowed revenue, this form of control indirectly influences the prices that EDBs will set for their services. Similar to New Zealand's approach, the revenue cap is adjusted annually to account for inflation, changes in allowed returns on debt, and other cost pass-throughs. It ensures that while EDBs can cover their costs and earn a reasonable return, they are also incentivised to control costs and operate efficiently, thereby affecting the long-term forecast of prices (AER, 2023). Additionally, STPIS provides a balanced approach by offering incentives for network service providers to improve service performance, ensuring that efforts to reduce costs do not compromise service quality. It applies financial penalties or bonuses based on performance relative to set targets, influencing operational decisions and investment strategies that ultimately affect cost structure and pricing. On the other hand, RIT-D serves as a cost-benefit analysis tool for assessing network investments. It requires providers to choose investment options that offer the highest net economic benefits, considering alternatives like demand-side responses. By encouraging efficient and prudent investments, RIT-D indirectly shapes the capital expenditure component of the building block model, affecting the forecasted prices of electricity distribution over time (AER, 2023). These tools collectively ensure that EDBs not only provide reliable and efficient services but also do so at a cost that reflects prudent and efficient business practices, thereby influencing the overall trajectory of price escalation in the sector.

[4] AER enforces the national electricity market rules and makes judgements on the regulatory proposals of monopoly network operators.

[5] The key difference in the wash-up approach between Australia and New Zealand is that New Zealand uses a more direct "wash-up" method for immediate past revenue adjustments, whereas Australia integrates past revenue performance into its multi-year revenue reset process and complements this with performance-based incentive schemes.

2.2.1 Introduction

The Australian Energy Market Operator's (AEMO) Transmission Cost Database[6] provides cost areas and selected indices for EDB cost forecasting. This encompasses the incorporation of building block costs, adjustment factors, indirect costs, and risk costs. Using this database, Mott MacDonald (2023) developed nine parametric formulas to show how each index affects the pricing of various equipment types, materials, and services in transmission projects, including overhead lines, substations, and underground cables. The Mott MacDonald report suggested adding 280 new building blocks to the existing database, along with the recalibration of ratings for overhead lines under different ambient temperatures and the updated appraisal of transmission lines' ratings from the original building blocks. This update was used for AEMO's development of cost estimates for transmission expansion options in its 2024 Integrated System Plan (ISP).

One of the key strengths of AEMO's granular approach is its dynamic nature such that costs can be updated continuously, allowing for real-time estimations of market prices. This real-time update capability is pivotal in an ever-changing economic landscape, providing a reliable and current estimate of costs at any given point. Additionally, the approach balances the weight of different indices within each basket, ensuring a nuanced representation of cost factors. The use of publicly available economic data further enhances transparency in the cost-forecasting process. These attributes collectively enhance the accuracy and reliability of forecasting future building block costs, setting a new standard in the methodology for producing sector-specific input price escalation forecasts for EDBs.

2.2.2 Methodology

In the Australian context, as exemplified in the AEMO Transmission Cost Database update, a comprehensive methodology has been developed for forecasting cost factors relevant to electricity transmission facilities. This approach involves identifying and utilising a set of twelve key economic indices that significantly impact the costs of equipment, materials, and services in transmission systems. These indices, sourced from reliable entities like the Australian Bureau of Statistics, the Reserve Bank of Australia, and the Rural Bank, have been applied to update the costs in the 2020 Transmission Cost Database to reflect values on 30 June 2022 Australian dollars.

The methodology extends to assigning appropriate weights to each economic index within the escalation baskets, based on Australian economic trends, international benchmarking methods, consultant experience in transmission projects, and anonymized project data from AEMO and Mott MacDonald (2023). Their data-driven approach attempts to balance local economic factors with broader global benchmarks to provide a reliable framework for forecasting EDB's cost escalation factors, supporting the creation of sector-specific input price escalation forecasts. This aligns with the requirements of the Commerce Commission, including reviewing the suitability of the Commission's previous approach, identifying relevant cost areas and indices, and developing a collaborative methodology for future EDB cost projections.

2.2.3 Workshop and stakeholder engagement

Similar to the approach that we have adopted in the current report (and our earlier reports (Torshizian, 2018, 2020)), AEMO and Mott MacDonald adopted a comprehensive stakeholder engagement framework. Their process and necessity of stakeholder engagement is follows:

- Engagement Framework:, holding webinars and workshops to gather diverse perspectives. This approach is essential for capturing real-world insights and practical challenges in cost forecasting.
- Diverse Participation: Engagements included TNSPs, consumer advocates, and AEMO staff, ensuring a wide range of viewpoints from various sectors of the electricity distribution network.

6 It reflects the most recent cost estimation processes and data for transmission network assets.

- Feedback Mechanism: Feedback from these sessions is crucial in refining the cost forecasting methodology, particularly in areas like community engagement, commodity pricing, labour costs, and state government initiatives.

The feedback influenced the tailoring of cost factors to regional differences, addressing specific challenges like underground cable benchmarking and the suitability of CPI for updating easement and property costs. Stakeholder insights also highlighted external factors impacting cost forecasting, such as state incentives for local manufacturing and supply-demand balance for infrastructure projects.

This participatory approach not only aligns with the focus of our report on developing a robust methodology for sector-specific input price escalation forecasts but also offers valuable insights for similar strategies in the New Zealand context. The lessons learned from such stakeholder engagements, especially in addressing regional variances and external economic factors, can significantly enhance the reliability and applicability of our forecasting methodology.

2.2.4 United Kingdom -Office of Gas and Electricity Markets (Ofgem)

The Office of Gas and Electricity Markets (Ofgem) regulates the companies that manage the gas and electricity networks. It is responsible for making decisions on price controls and enforcement. Ofgem uses what is called a key building blocks approach in the current RIIO-2 framework across all sectors. This approach is used for running price control where it makes sense and does not put too much risk on energy consumers. RIIO-ED2[7] is the specific price control for the electricity distribution network. The ED2 Price Control Financial Model (ED2 PCFM) is a price control financial instrument within this framework, which is used for figuring out the Allowed Revenue. The inputs to the ED2 PCFM, called the PCFM Variable values, get updated from time to time. These updates then lead to changes in the Allowed Revenue during the Price Control Period (Ofgem, 2023).

The ED2 Price Control Financial Model (PCFM) calculates Allowed Revenue for each Regulatory Year within the Price Control Period using these values, along with embedded formulae and functions (Ofgem, 2023). This model employs a hybrid inflation indexing approach, transitioning from the Retail Prices Index (RPI) to the Consumer Prices Index Including Housing Costs (CPIH). This approach aligns with the latest economic policies and offers a more comprehensive reflection of inflation, incorporating significant household expenditures like housing costs. This transition not only ensures consistency with national economic indicators but also facilitates balanced financial planning and risk mitigation for utility companies (Office for National Statistics, 2023). For each Regulatory Year, the ED2 PCFM adjusts Allowed Revenue based on several parameters including expenditure forecasts, time value of money, and tax considerations. The model also allows for adjustments to reflect changes in previous years' revenues or to correct charging errors, emphasising the importance of accuracy and timeliness in updates.

Within the ED2 PCFM's finance inputs are the real price effects. The indices and forecasting methodologies are similar to other reports identified across New Zealand and Australia. The range of indices is not wider than what we already identified as is available through Ofgem (2020, p. 19).

7 RIIO stands for Revenue = Incentives + Innovation + Outputs.

3 Data and methodology

Torshizian (2018, 2020) provided a methodology for forecasting the cost factors. The methods used were chosen carefully based on the best available information from the literature, the Commission's guidelines, the available data, and technical merits. Building on this, we further consider the appropriateness of the identified methodology based on a range of criteria including simplicity (ie transferability and clarity), the inputs from stakeholders, the feedback of the SG and the availability of data. The outcome provides a robust and established methodology for this work.

Our methodology considers EDBs' aggregate recent and forecast operating and base capital expenditure, and the costs commonly escalated in comparable Australian EDBs. For this methodology, we identify the most relevant indices for different EDB cost areas. Then we further revise our available econometric forecasting models (for the identified indices) for the identified factors from the literature and stakeholder inputs.

In the forecasting phase, we use econometric techniques to generate forecasts for cost escalation in EDBs. These forecasts will be based on the validated indices and the data we agreed and collected. In addition to producing the forecasts, we also rigorously check for robustness throughout the analysis. This means subjecting our models to sensitivity tests and stress-testing various assumptions to ensure that our forecasts remain reliable even under different scenarios. This will ensure that our forecasts that are not only accurate under normal conditions but also resilient in the face of potential variations or uncertainties in the future.

3.1 Stakeholder engagement/submissions

The Commerce Commission has received 33 individual submissions and 11 cross-submissions from stakeholders in the distribution sector in response to the Commission's Default Price-Quality Path Issues Paper (Commerce Commission, 2023a).[8] In preparing our report, we have closely reviewed and considered these stakeholder responses to refine our approach based on their feedback. While not all the raised issues in the submissions are directly related to the technical scope of our report, we still include the most important aspects in our review. This is to consider potential implications of the raised issues for using the outputs of our report. **It is important to note that we only summarise the most relevant points made in submissions, and consider them in our analysis, but do not necessarily endorse any of those points.**

The stakeholders are on the brink of their most significant transformation in over a century due to a mix of factors, such as inflationary pressure, transformation in demand due to the Government's Climate Response policy and the supply chain disruptions experienced frequently over the last few years. Our report acknowledges the challenges they are confronting, including price shocks and affordability issues, the impact of prices in a high inflation environment, and the need for increased investment to address these challenges. The submissions are useful for improving the accuracy of cost forecasts. We provide a confidentialised summary of the submissions in Appendix A:.[9]

There are common aspects across submissions as well as specific requirements depending on the features of the distribution network. An important finding from the submissions is the need for considering further details. Technically, this implies the need for specific (as opposed to general) measures. Table 3.1 describes the benefits and risks of general and specific measures.

8 Available here.

9 Most submissions are not confidential, and are available on the Commission's website – see here.

Table 3.1 Trade-off between generality and relevance

Measure types	Benefits	Risks
General measures	Reflects 'unavoidable' generalised cost inflation. Smooth out volatility of individual cost components.	May not adequately reflect a producer's input cost profile and may therefore systematically over- or under-compensate by including or putting too much weight on extraneous sources of cost inflation.
Specific measures	Ability to target/escalate very specific costs of particular or peculiar importance to the firm which are otherwise not accounted for by a general index.	May not adequately consider cost mitigation options so it does not necessarily reflect 'unavoidable' cost inflation.[10]

Source: Torshizian (2018)

DPP4 requires higher allowances to compensate for the under-investment during DPP3: An important issue raised by various submissions is the need for increased opex during the DPP4 period because of the low allowances during the DPP3 period constraining the investment required for maintaining the network and for infrastructure investment. Also, the submissions raised the importance of investment to invest in non-network solutions that are more efficient than capex alternatives.

The decrease in household affordability will be compensated by their lower spending on fossil fuel: All submissions acknowledged that the need for increased investments will decrease household affordability. However, they suggested that this will be compensated for by a) households' lower spending on fossil fuel[11], and b) improved resilience of the network, which will lead to economic gains to households in long-term.

The capital goods price index is a useful index to forecast capex.

The current (DPP3) approach to forecasting opex has failed to capture inflation over the last few years. This is driven by not accounting for the factors of inflation, uncertainty and resilience as listed above.

The submissions highlighted the need for scaling growth factors to reflect EDB's increased focus on investment to meet growth and renewal needs.

Other costs need to be further considered including LV monitoring, cyber-security threats[12], technology 'as a service' solutions.

While the submissions expressed similar challenges with the price-quality path topic, there were differences amongst the submissions depending on the features of the EDB's operating area – as mentioned, these need to be dealt with using CPPs. For example Alpine Energy Limited (2023) suggested the following features as the most challenging:

10 We further describe our approach to address inflation and uncertainty in Section 3.4.3. The shortcomings of our approach will be suggested in Chapter 5 for further consideration in the next steps.

11 Consumer Advocacy Centre's survey shows that: (Consumer Advocacy Council, n.d., p. 2)

- almost one in two (48%) consumers think their home will have switched to mostly electric power tools and equipment, such as electric lawnmowers ¬
- four in 10 (42%) think their household will have an electric car and
- a similar number (40%) think they will have an electric bike, scooter or motorbike ¬ about one in three (32%) of those with mains gas expect to swap gas appliances for electric ones.

12 This fits within insurance cost, which is beyond the scope of our report.

1. Diverse land use and economic activities: Dairy, sheep and beef, and crop farming, significant food processing and other industrial operations, and high tourism activity in the Mackenzie District
2. Diverse energy demand: Significant industrial process heat requirements combined with seasonal demand driven by irrigation.
3. Diverse geography and climate: Stretching from the Alpine village of Aoraki/Mt Cook to the temperate coast at the Waitaki River.
4. Diverse population spread: One significant urban centre (Timaru) and many smaller towns and rural settlements throughout the region.
5. Seven Grid Exit Points.

We will propose a solution for further consideration of local factors in our suggestions for the next steps in Chapter 5. The focus of our report is on the technical task of the sector-specific forecast series. While this is closely tied to the policy/strategic framework, addressing the required regulatory requirements is beyond the scope of our report.

3.2 Forecasting approach

As described in Figure 3.1, our forecasting approach consists of three steps:

1. **Identifying categories of costs** to be subject to cost escalation analysis,
2. **Identifying indices of cost inflation** that can reasonably be used to understand historical and future inflationary pressure,
3. **Constructing forecasts** of the indices identified in step 2.

Figure 3.1 Forecasting framework

Source: Principal Economics adapted from Torshizian (2018)

3.2.1 Categories of cost

Based on the earlier work, the literature review and the information provided by the submissions, we consider the following features of a cost for the identification of categories of costs to be escalated:

- Size,
- Similarity to other costs,
- Volatility.

Our earlier work selected indices used to benchmark costs based on: (Torshizian, 2018, 2020)

- Ability to capture price effects and not quality changes,
- Ability to reflect general market conditions,
- Relevance to firm's business and costs,
- Are practical to produce and forecast.

Accordingly, we categorise cost into the categories illustrated in Table 3.2. We will further discuss these in Section 3.2.2.

Table 3.2 Identified cost categories

Opex			Capex	
Area	**Activities**	**Labour cost**	**Area**	**Activities**
Network	Rent	Network capex Labour	**IT Capex**	IT technical staff (internal)
	Electricity	Network capex Labour - design consultants		IT project management (internal)
	Field technicians (standard, external)	ICT labour	**POA connections**	In-property hardware (e.g. ONTs)
	Project management (internal)	Internal Labour		Field technicians (standard, external)
Technology	Network electronics service agreements			Metals (Aluminium, and other metals)
	IT technical staff (internal)		**Network electronics**	IT technical staff (internal)
	IT project management (internal)			Network electronics hardware
Business Support	Legal			Network electronics service agreements
	Accounting			Poles Capex
	Communications		**Greenfield expansion**	Ducts
	Product design			Field technicians (standard, external)

	Marketing			Construction
	Strategy			Civil labour (digging)
	Customer experience			Poles Capex
	Human resources			

Source: Principal Economics

3.2.2 Indices identified for each cost category

3.2.2.1 Our criteria for identifying the indices

We identify benchmarks or reference prices that can be used to understand how cost inflation has occurred in the past and how it may evolve in the future. Four attributes for any such indices or reference prices are that they:

- capture price effects and not quality changes,
- reflect general market conditions,
- are relevant to the firm's business and costs,
- are practical to produce and forecast.

These attributes are not always correlated, ie indices do not always display all of the desired features, and hence some trade-offs are required.

The most important element is that **price and not quality effects** are captured. For example, if a product of inferior quality comes to dominate the market then observed (unadjusted) market prices may fall and yet expenditure may need to increase if producers have to buy more of the product to offset declining quality. The reverse may also be true when quality improves.[13]

Indices should ideally **reflect general market conditions** and unavoidable price inflation rather than specific price changes which can be avoided by substituting away from particular products. For example, if desktop phones are becoming more expensive a mobile phone might do the job for a lower price, in which case there is little value in adjusting for the rising cost of desktop phones.

The need for **relevance** may, however, commend specificity over generality. This will be the case where a company has a need for a particular product for which there is no technical alternative. These are rare but a commodity like aluminium provides one such example.

The need for **practicality** reflects the ultimate objective of producing workable estimates of cost escalation. In some cases a cost may be observable and measurable but does not have a readily usable statistical history or widely used benchmark upon which to gauge cost trends and forecasts.

13 This is a complex topic that requires more granular analysis of demand, which is beyond the scope of this report. To minimise the risk of including quality effects, we use specific and detailed price indices and forecast them based on the best available predictors. We will highlight the need for further work on demand analysis and the choice of detailed indices in Chapter 5.

3.2.2.2 Identified indices

We have identified nine narrowly defined price indices for most of the operational and capital expenditure categories provided by EDBs. The indices are:

- Operating expenditure:

  Labour Cost Index (LCI) for the 'Professional and Technical Services', 'Information Media and Telecommunifcations' and 'Administrative and Support Services' sub-groups.

  'LCI for Electricity, Gas and Water industry (LCI EGW)' for Labour for Preventive Predictive, Corrective, and Proactive maintenance.

  Producers Price index (PPI) Published output commodities 'Electricity: commercial consumers' and 'Rent of commercial land and buildings'.

- Capital expenditure:

  LCI 'Professional and Technical Services', 'Construction' and 'Administrative and Support Services'.

  PPI Outputs 'Heavy and Civil Engineering Construction', 'Non-Residential Property Operation' and 'Electronic and Electrical Equipment Manufacturing'.

- Hybrid expenditure:

  PPI Published output commodities 'Rent of commercial land and buildings'.

  USA Producer Price Index by Industry.

We have not identified price indices for 'software licences', 'software maintenance contracts' or 'software as a service (software in the cloud)' (SaaS). The change in the prices of these services (for a given quality of service) is a complex mixture of increases in labour costs (usually faster than the CPI), declines in hardware costs (often faster than the change in labour costs) and the business model of the supplier.

Since we did not find any robust predictors to provide forecasts for "PPI - Published output commodities 'Electricity: commercial consumers'" and "PPI Outputs 'Non-Residential Property Operation'", we choose "Producers Price Index – Outputs for all industries (PPI-O All industries)" as the more broad relevant index.

Other metals costs should be benchmarked against the World Bank Metals and Minerals price index. EDBs buy a variety of metals in addition to those already mentioned above. This variety commends the use of a general international benchmark which can capture broad changes in costs due to fundamental shifts in global supply and demand in the metals and minerals sector.

Labour costs

Labour-related costs are the largest expenditure item, and require escalation based on three different groupings with distinct cost drivers:

- ICT maintenance and operations, consultants and contractors,
- Network maintenance contractors,
- 'other labour costs' comprising all other costs, principally those associated with Asset Management and Operations, and Business Support expenditure categories (direct personnel costs and third party costs),[14]
- insurance costs need to be considered based on the levels of uncertainty experienced over the last years and the risks expected for the DPP4 period.[15]

[14] These are non-capitalised internal labour costs.

[15] This level of uncertainty accounts for the known unknown. The consideration of deep uncertainty requires a different process of decision-making as explored by Principal Economics (2023).

Four categories of labour costs were identified for cost escalation based on the size of expenditure and similarity of cost drivers in each cost category.

These costs are indexed by Statistics New Zealand labour cost indices (LCIs). LCIs are chosen because they are adjusted for the composition of labour and therefore capture price effects and not quality changes. The LCIs chosen are industry level indices. Industry level indices were chosen because they reflect costs faced by EDBs while being sufficiently high-level to capture market conditions.

The LCIs are forecasted using econometric models which capture two effects:

- the extent to which trend labour costs tend to rise more quickly in some industries than in the economy as a whole,
- cyclical cost pressures.

The real series will incorporate the uncertainties led by inflation. As discussed, we will consider an upper and lower forecast for CPI to deal with uncertainty. There are various sources of uncertainty, and our approach accounts for uncertainty driven by supply chain issues, which is predicted based on fluctuations in oil price.[16]

Table 3.3 Labour cost escalation factors

Cost item	Applied to	Index measure
Network opex Labour	Labour for Preventive Predictive, Corrective, and Proactive maintenance-	LCI for Electricity, Gas and Water industry (LCI EGW)
Network capex Labour	Labour for network Capex portfolios	LCI Construction
Network Capex Labour - design consultants	Labour for network capex portfolios design consultants	LCI Professional and Technical Services industry
ICT labour	Labour for ICT capex and ICT opex portfolios	LCI Professional and Technical Services industry
Internal Labour	Asset Management & Operations; Business Support	LCI for Electricity, Gas and Water industry (LCI EGW)

Source: Adopted from Torshizian (2020)

Capital Expenditure

For capital expenditure we initially identified five material categories of cost requiring escalation:

- metals are collectively a material share of expenditure and the volatility of individual prices means that metals should be considered individually:
    - Aluminium
    - Copper
    - Steel
    - other metals

16 As discussed in our report on the methods for dealing with uncertainty, there are four levels of uncertainty ranging between known unknowns and unknown unknowns (deep uncertainty). Our approach does not account for the impact of deep uncertainty. For example, during the pandemic period, the border closure led to a pause to migration of skilled workers. Our forecasts consider the historic (natural) unemployment rate but do not account for unforeseen labour shortages that we experienced during the pandemic. This could be an extension of the current project to list a wider range of uncertainties and investigate their potential impact on different indices and cost categories.

- Construction costs are a large share of expenditure and are commonly considered for escalation.
- Network labour costs are a material share of expenditure.[17]
- ICT labour costs are a material share of expenditure.
- ICT hardware and software costs are a material share of expenditure.

Metals

Two metal categories are selected for escalation. These are presented as individual cost items because of their size and volatility. International prices are chosen to index metals prices as these reflect general market conditions. Forecasts of metals prices are based on futures market prices, low-, mid- and high-points of international consensus forecasts and World Bank metals and minerals forecasts.

Table 3.4 Metal expenditure indices

Cost item	Index measure
Copper	LME copper price (US$/mt)
Aluminium	LME aluminium price (US$/mt)
Steel	Asia Hot-Rolled Coil (HRC) US$/t [18]
Other metals	World Bank Metals & Mineral Price Index

Source: Adopted from Torshizian (2018)

Construction costs

The Producers Price Index – Outputs (PPI-O) for Heavy and Civil Engineering has been selected for indexing construction costs. Construction costs are a large component of network capital expenditure. The selected price index is a generalised representation of the price of the specialist mixture of services provided by the civil construction industry for EDBs' capital works.

The PPI for Heavy and Civil Engineering is forecasted using an econometric model which captures:

- trend inflation due to trends in input costs,
- cyclical cost pressures.

17 This should be considered as a single category of cost, rather than split into components, due to practicality of matching costs and indices.

18 Identifying an appropriate international benchmark price is complicated by the fact that steel is traded under long term contracts and there are few international publicly available spot or wholesale price benchmarks (as there are for copper and aluminium). In addition, benchmarks such as the Asian HRC price have limited histories. We have analysed historical movements in prices by constructing an index which combines the World Bank Steel price index with movements in the US dollar price of Hot-Rolled Coil in Asia. The World Bank series, which was discontinued in 2012, provides a useful reference point for understanding long term prices (stretching back to the 1960s).

IST software and hardware

Information Services and Technology (IST) expenditure on hardware and software is indexed to the All groups CPI. The CPI is a very general measure of inflation. More specific indices do not adequately capture differences between price effects and quality changes.

Table 3.5 Operational expenditure price indices

Proposed narrow price index measure

Area	Breakdown of activities/inputs	Narrow index
Network	Rent	PPI - Published output commodities 'Rent of commercial land and buildings'
	Electricity	PPI - Published output commodities 'Electricity: commercial consumers'
	Field technicians (standard, external)	LCI 'Professional and Technical Services'
	Project management (internal)	LCI 'Professional and Technical Services'
Technology	Network electronics service agreements	PPI Outputs 'Electronic and Electrical Equipment Manufacturing'
	IT technical staff (internal)	LCI 'Professional and Technical Services'
	IT project management (internal)	LCI 'Professional and Technical Services'
Business Support	Legal	LCI 'Professional and Technical Services'
	Accounting	LCI 'Professional and Technical Services'
	Communications	LCI 'Professional and Technical Services'
	Product design	LCI 'Professional and Technical Services'
	Marketing	LCI 'Professional and Technical Services'
	Strategy	LCI 'Professional and Technical Services'
	Customer experience	LCI 'Professional and Technical Services'
	Human resources	LCI 'Professional and Technical Services'

Source: Adopted from Torshizian (2020)

Table 3.6 Capital expenditure price indices

Proposed narrow price index measure

Area	Breakdown of activities/inputs	Narrow measure
IT Capex	IT technical staff (internal)	LCI Professional and Technical Services
	IT project management (internal)	LCI Professional and Technical Services
POA connections	In-property hardware (e.g. ONTs)	PPI Outputs 'Electronic and Electrical Equipment Manufacturing'
	Field technicians (standard, external)	LCI 'Professional and Technical Services'
	Metals (Aluminium, Copper, Steel and others)	LME aluminium price (US$/mt), LME copper price (US$/mt), Asia Hot-Rolled Coil (HRC) US$/t, World Bank Metals & Mineral Price Index
Network electronics	IT technical staff (internal)	LCI 'Professional and Technical Services'
	Network electronics hardware	PPI Outputs 'Electronic and Electrical Equipment Manufacturing'

	Network electronics service agreements	PPI Outputs 'Electronic and Electrical Equipment Manufacturing'
Greenfield expansion	Ducts	PPI Outputs 'Heavy and Civil Engineering Construction'
	Field technicians (standard, external)	LCI 'Professional and Technical Services'
	Metals (Aluminium, Copper, Steel and others)	LME aluminium price (US$/mt), LME copper price (US$/mt), Asia Hot-Rolled Coil (HRC) US$/t, World Bank Metals & Mineral Price Index
	Civil labour (digging)	PPI Outputs 'Heavy and Civil Engineering Construction'
IFRS15 customer	IT technical staff (internal)	LCI 'Professional and Technical Services'
	Call centre staff	LCI 'Administrative and Support Services'
Poles Capex	Field technicians (higher spec, external)	LCI 'Professional and Technical Services'
Network sustain	Civil labour (digging up roads)	LCI 'Construction' or PPI Outputs 'Heavy and Civil Engineering Construction'
	Field technicians (standard, external)	LCI 'Professional and Technical Services'
	Replacing equipment	Possibly 'PPI Outputs 'Electronic and Electrical Equipment Manufacturing'
Building and services	Building maintenance	PPI Outputs 'Non-Residential Property Operation'
	Building services	PPI Outputs 'Non-Residential Property Operation'
Hybrid	Site leases	PPI - Published output commodities 'Rent of commercial land and buildings'

Source: Inspired by Torshizian (2020)

3.3 Sources of uncertainty

As highlighted in various submissions, there has been a significant increase in cost uncertainty over the last few years, which is expected to continue during the DPP4 period. The major trends affect the accuracy and usefulness of the current DPP forecasts include a range of regulatory (decarbonisation), economic (inflation), supply chain (international conflicts and trade barriers) and network factors (resilience). There are various technical complexities with incorporating these fluctuations into forecasts of cost indices. This includes, for example, the interdependencies across sources of uncertainty, and the unavailability of timely updates of the latest policy decisions and their impacts.

As highlighted in the submissions, the electrification (required for decarbonisation and network resilience) will require extra capacity on electricity network. With the recent change of government in New Zealand, the Clean Car Discount is scrapped, and the Clean Car System retains. There are mixed impacts from these on the available forecasts used in the Government's modelling of the impact of emission budgets (Ministry for the Environment, 2022) does not provide information about the recent changes.

The most important source of uncertainty is with inflation. There has been a significant increase in the CPI over the last couple of years. While real price indices exclude inflation impacts, this is done by subtracting the price indices by CPI, which highlights the importance of the CPI figures considered. The limitation with almost all available series of CPI is their assumption that the CPI converges to the targeted level of 2 percent within 3 or 4 years – see for example The Treasury's Half Year Economic and Fiscal Update (The Treasury, 2023, p. 4). This is a significant assumption with significant impact on real price indices particularly over the last 3 years (given that the CPI is assumed fixed at 2 per cent). We suggest that a more useful approach to incorporate the uncertainty raised by inflation is to consider the lower and upper forecasts and revise the considered RPEs annually depending on the observed trend – this requires close monitoring of the CPI over the DPP period.

The most important source of uncertainty is with inflation. There has been a significant increase in the CPI over the last couple of years. While real price indices exclude inflation impacts, this is done by subtracting the price indices by CPI, which highlights the importance of the CPI figures considered. The limitation with almost all available series of CPI is their assumption that the CPI converges to the targeted level of 2 percent within 3 or 4 years – see for example The Treasury's Half Year Economic and Fiscal Update (The Treasury, 2023, p. 4). This is a significant assumption with significant impact on real price indices particularly over the last 3 years (given that the CPI is assumed fixed at 2 per cent). To incorporate the uncertainty raised by inflation we consider the lower and upper forecasts and suggest that the considered RPEs need to be annually updated depending on the observed trend – this requires close monitoring of the CPI over the DPP period.

For some users, our approach to incorporate CPI into our indices may be confusing because the focus of this report is on *real* price indices. However, any calculation of real indices requires subtracting the nominal values by the CPI values, and hence CPI plays a significant role in the construction of real indices. Hence, our approach to consider upper and lower bounds of CPI affects all real indices.

As highlighted in the submissions, the electrification (required for decarbonisation and network resilience) will require extra capacity on electricity network. With the recent change of government in New Zealand, the Clean Car Discount is scrapped, and the Clean Car System retains. There are mixed impacts from these on the available forecasts used in the Government's modelling of the impact of emission budgets (Ministry for the Environment, 2022) does not provide information about the recent changes.

3.4 Methodology

Our overall methodology for forecasting indices is by using timeseries econometric analysis. In addition to the usual lags (for the auto-regressive regression), we use LCI All Industries and PPI All Industries for predicting other LCI and PPI series. The framework considered for predicting LCI and PPI indices is based on economic theory and the law of demand and supply. The specific variables chosen for our econometric analysis depends on the relevance and best available projections to cover the DPP 4 period. We have considered a range of variables and chosen the most suitable ones accordingly.

Technically, all indices are modelled using an Autoregressive Integrated Moving Average (ARIMA), which uses time series data to predict future trends. The number of lags chosen for each index is chosen based on the goodness of fit measures – to reach the best model fit. Except for the all-industry series, we separate the trend and cycle of series using the Hodrick-Prescott filter.[19] Then for the (long-term) trend component, we used Fully Modified Least Squares method, and for the cycle component we used the autoregressive method. More specific information about the methodology used for each index is provided in Table D.4 and Table D.5 (in Appendix D:).

3.4.1 LCI All Industries

The forecast for the LCI All Industries is developed in conjunction with other pivotal macroeconomic indicators. This forecasting process entails a thorough examination of demand and supply dynamics, institutional frameworks, and the impact of global demand shifts or local supply disruptions. It is characterised by an iterative approach to capture the multi-faceted nature of economic activity.

This forecast comprises two primary components: a long-term trend and a cyclical element. The long-term trend is projected based on the interplay between CPI inflation and overall wage inflation. Cyclical fluctuations around this trend are influenced by variations in the output gap, which measures the disparity between actual economic output and productive capacity growth. These fluctuations impact labour costs by influencing wage demands and the proportion of wage expenses attributed to overtime rates.

19 There are other methods available for separating trend and cycle, which could be further investigated in future reports.

Additionally, forecast cycles account for the delayed effects of heightened labour demand on unemployment, employment, and subsequently, wage inflation. The growth in the LCI typically lags behind increasing labour demand by approximately 18 to 24 months.

The generic econometric equation for LCI All Industries involves a combination of variables to capture the various factors influencing labour costs. A simplified version of such an equation is as follows:

$$LCI = \beta_0 + \beta_1 \cdot CPI + \beta_2 \cdot WageInflation + \beta_3 \cdot OutputGap + \beta_4 \cdot LaborDemand + \epsilon \quad \text{(Equation 3.1)}$$

Where:

- LCI represents the Labor Cost Index for All Industries.
- CPI denotes the Consumer Price Index, reflecting overall inflation.
- Wage Inflation is the rate of wage inflation.
- Output Gap measures the difference between actual output and potential output.
- Labour Demand captures the level of labour demand in the economy.
- β_0 to β_4 are coefficients to be estimated.
- ϵ represents the error term, accounting for unobserved factors and measurement error.

3.4.2 PPI-Output All Industries

The forecast for the PPI-outputs index across all industries is determined through an iterative forecasting method that takes into account various factors, including demand and supply dynamics of the macroeconomy, institutional settings, and economic disruptions stemming from global demand fluctuations or local supply perturbations.

This forecast can be aptly characterised by two primary components: a long-term trend and a cyclical element. The trend component is projected by analysing the correlation between CPI and overall PPI inflation, providing insight into the underlying long-term trajectory.

The generic econometric equation that relates to the described estimation of the PPI (Producer Price Index) for All Industries typically involves a combination of variables to capture the factors influencing producer prices across various sectors. A simplified version of the equation is as follows:

$$PPI = \alpha_0 + \alpha_1 \cdot CPI + \alpha_2 \cdot Demand + \alpha_3 \cdot Supply + \varepsilon \quad \text{(Equation 3.2)}$$

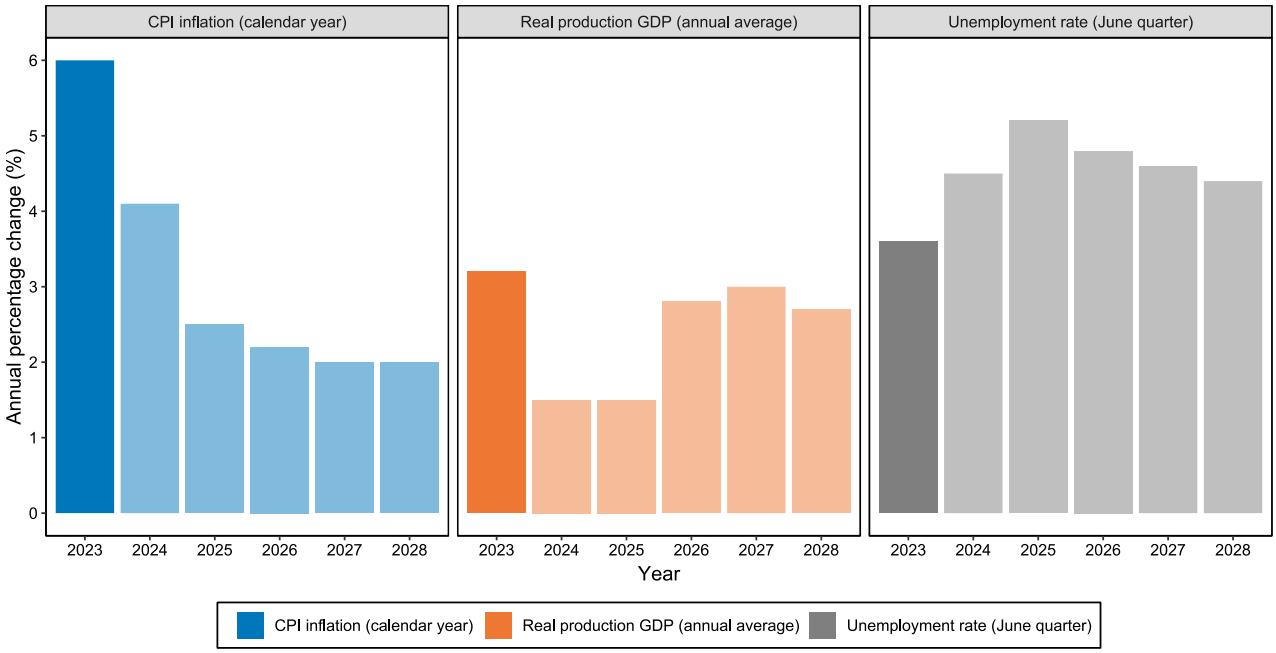
Where:

- PPI represents the Producer Price Index for All Industries.
- CPI denotes the Consumer Price Index, reflecting overall inflation.
- Demand captures the demand-side factors affecting producer prices.
- Supply represents the supply-side factors influencing producer prices.
- α_0 to α_3 are coefficients to be estimated.
- ε represents the error term, accounting for unobserved factors and measurement error.

3.4.3 Inflation and its uncertainty

As discussed, CPI is partly considered in all RPE series when the nominal series are subtracted by CPI to derive the real indices. For the CPI forecasts available from The Treasury's Half Year Economic and Fiscal Update (The Treasury, 2023).

Figure 3.2 CPI projections, Real GDP Growth and Unemployment rate



Source: The Treasury (2023)

For incorporating uncertainty with inflation, we suggested to use an upper and lower forecast driven by fluctuations in oil prices. For that we use our Macro-econometric model of New Zealand Economy, which allows for the interaction between New Zealand and the global economy. Over the period of January 2014 and January 2024, the monthly WTI futures oil price varied between USD$16 and USD$114 with a mean of USD$63.5. We apply this range to our Macro-econometric model to identify the potential variation in CPI. Then we use this range to extrapolate the (variation in) LCI and PPI All Industires and other series.

For the direct impact of oil prices, we use the multipliers available from Stats NZ's reweighting of CPI for petrol, which is 3.85. The RBNZ's article on direct and indirect impact of oil prices on CPI, suggests that for a 10 cents per litre increase in the petrol price, the calculated indirect effect would add another 0.2 to 0.3 per cent on to the direct effect (Delbruck, 2005). Based on the 10-year variation in oil prices, and the short-run relationship between pump price and crude oil price, the oil price variation could lead to an increase in CPI by upto 1.3 percent and a decrease in CPI by about 2.31 percent lower than the September 2023. This provides us with an understanding of the potential variation in CPI compared to the base, that we will use for investigating impacts of uncertainty with inflation.

3.4.4 The impact of climate policy

Parallel to this project, we are investigating the impact of emission reduction plan (ERP) for the Government. For that analysis we used Principal Economics' Climate model (PE-Climate), which is a dynamic Computable General Equilibrium (CGE) model of New Zealand designed for greenhouse analysis. The CGE model provides estimates of the impact of ERP on LCI and PPI-Output. As described, LCI and PPI All Industries are predictors for all other indices. Hence, we provide forecasts of the impact of climate policy by using the LCI and PPI figures (and extrapolating other indices). The impact of climate policy is identified from the divergence from the baseline as a result of all ERP interventions (across all industries).

4 Real price indices

This chapter provide brief description of identified indices and their forecasts. While all provided real indices in this section incorporate the impact of climate policy, the modelling outputs for the impact of emission budget is not directly depicted in the provided data and graphs due to its confidentiality.[20] The results of econometric analysis used for the construction of forecasts are presented in Appendix D:.

4.1 LCI indices

A critical aspect of this forecast approach was the empirical representation of the expectation that an increase in engineering construction activities, especially large electricity transmission projects, would elevate prices in real terms. This was attributed to materials supply constraints and a scarcity of experienced personnel in the sector. The statistical analysis established linear relationships between each price index (adjusted to real terms by deflating with CPI) and a set of significant drivers. Growth in the LCI indices is a function of two competing effects. Population growth increases demand for services and this puts pressure on costs. At the same time, population growth increases labour supply and this reduces cost pressure. The combined impact is different across series. For example, if our model results show an increase in an LCI index, that indicates that the demand effect predominates, ie population growth increases cost pressure.

4.1.1 LCI for All industries

The projection of the 'LCI All Industries' is based on other key indicators of macroeconomic performance. This forecast is generated through an iterative process that considers various factors such as demand and supply dynamics in the macroeconomy, institutional frameworks, and economic shocks affecting global demand or local supply.

The forecast exhibits both a long-term trend component and a cyclical component. The trend component is projected based on the correlation between CPI inflation and overall wage inflation. Cyclical variations around this trend are influenced by fluctuations in the output gap, representing the difference between actual economic output growth and growth in productive capacity. These fluctuations impact labour costs by influencing wage demands and the share of wage costs attributed to overtime rates. Additionally, forecasted cycles incorporate the delayed effects of increased labour demand on unemployment, employment rates, and subsequently wage inflation. The growth in the LCI typically lags behind rising labour demand by approximately 18 to 24 months.

Over the DPP4 period, we forecast that LCI All will grow 1.0 percent more than the CPI. The solid red line in Figure 4.1 shows the LCI All actual for the period of June 2009 – December 2023.[21] While the population will be growing at a higher rate compared to the last few years[22], The Treasury's 2023 HYEFU[23] suggests that CPI is forecasted to decrease over the DPP period. Hence, our forecasts for the period of 2024q1-2030q2 show an increase in LCI-All but at a slower pace than the last few years. Our forecasts suggest that real LCI All, shown by dotted black line on the right-hand side vertical axis, will fluctuate around the mean of the last few years. It is important to note that in addition to the projections of the drivers of LCI All, including population, output gap and CPI, the real index accounts for the impact of climate policy. Our sensitivity testing for the impact of inflation is based on the lower and upper CPI range as described in 3.4.3 and is shown by the grey shaded area. Accordingly, real LCI All could range between -3.7 and +3.4 percent.

20 Principal Economics is currently assessing the impact of climate budget with a focus on ERP2 (2026-2030). The outputs of the work will be released in November 2024.

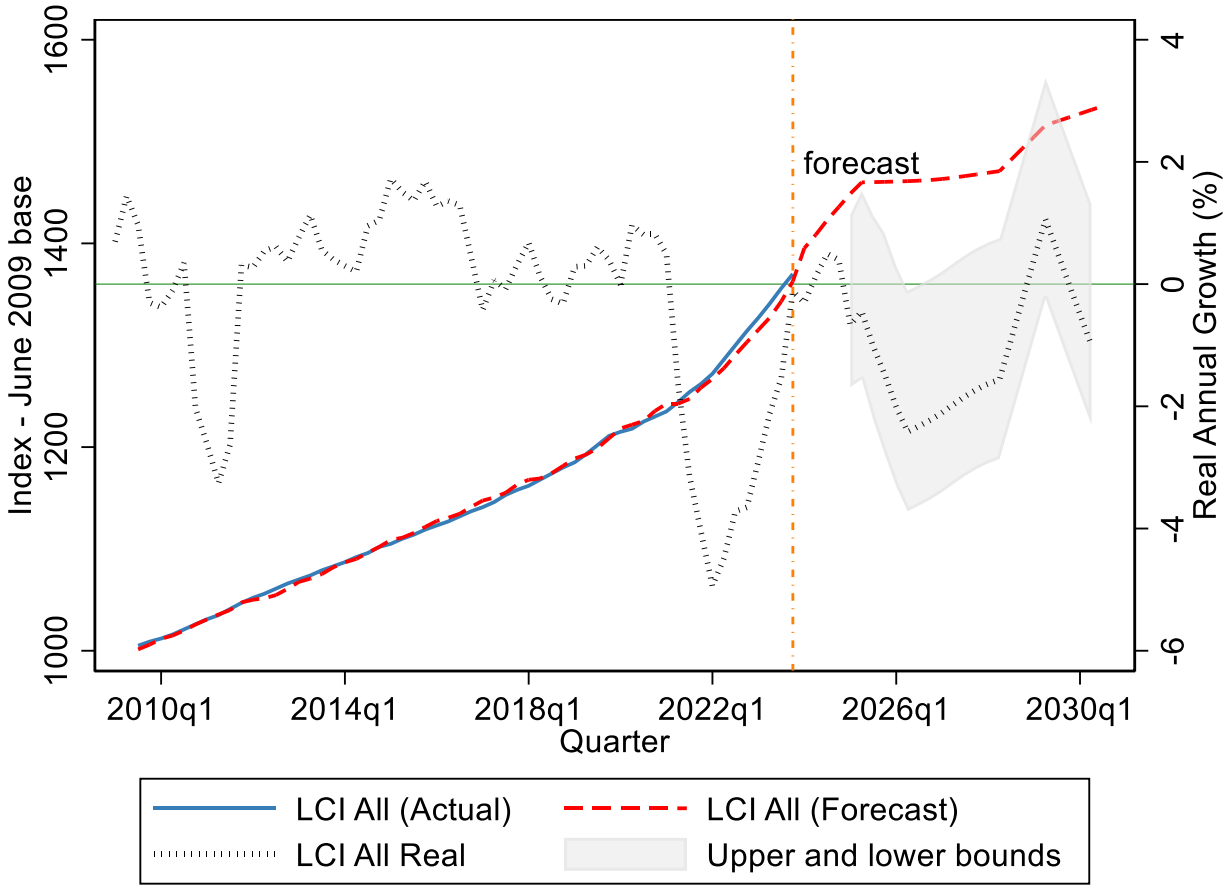
21 The actual data used for econometric analysis covers the period of 1995q1-2023q4.

22 Population is based on Stats NZ's projection.

23 Half Year Economic and Fiscal Update.

Figure 4.1 LCI All actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Stats NZ, Principal Economics analysis

Note: For the forecasts the data used include LCI All for the period of 1995q1-2023q4 sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. We suggest this is a useful approach, given that the variation in the historic data is useful for improving predictive power of our models (and because the index level in earlier years does not affect our model significantly). CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. We also tested the use of output gap, but did not identify it useful for improving the predictive power of our model.

4.1.2 LCI for the Electricity, Gas and Water industry

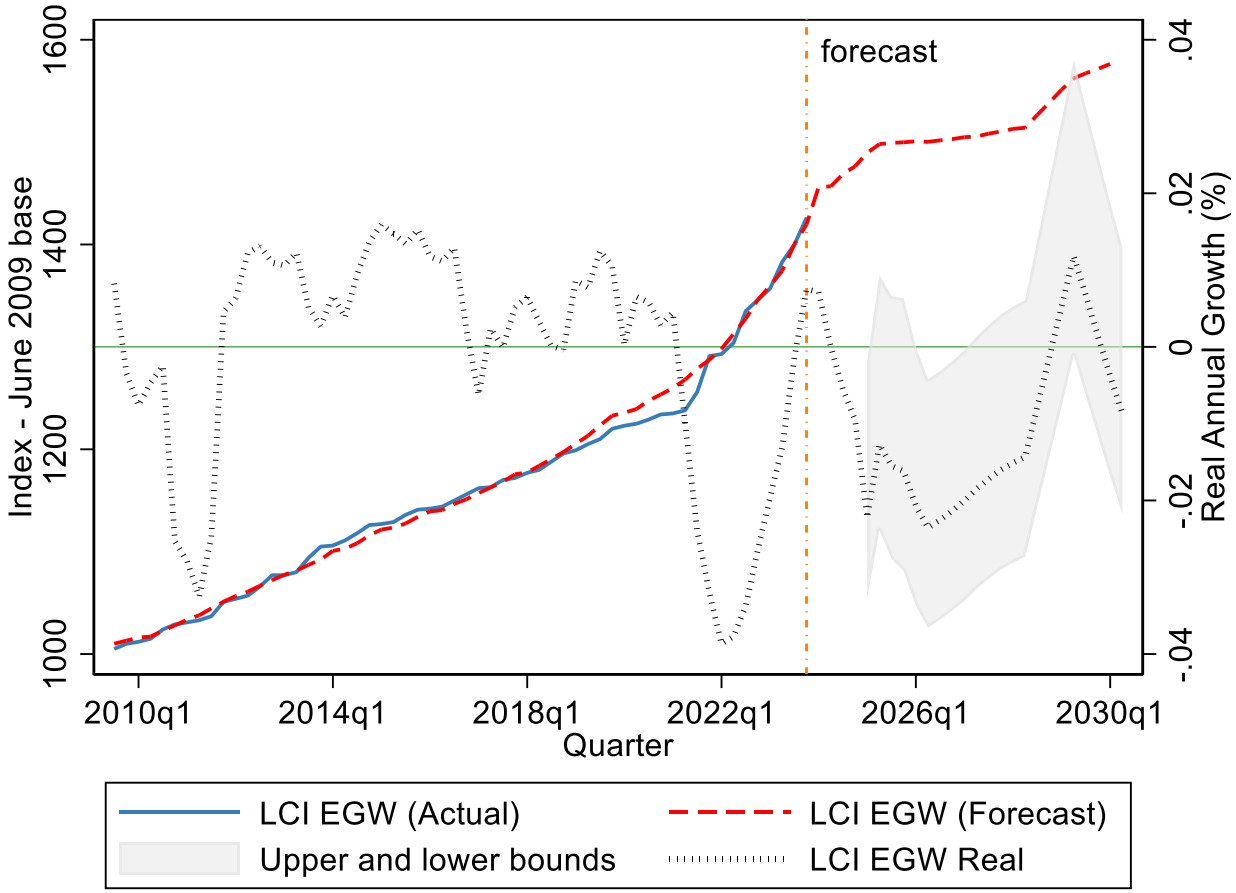
The forecasting of the LCI EGW involves an econometric model comprising two components:

- A model depicting the long-term trend in the LCI EGW, which is determined by various factors including the LCI of all sectors, salary and wage rates, and population growth. This component serves as a generalised measure of demand for EGW industry output.
- A model capturing short-term and cyclical fluctuations in the LCI EGW, which is influenced by changes in net migration and the EGW industry output gap. Output gaps for EGW and other sectors under consideration are established by applying a Hoddrick Prescott filtered trend to industry activity, facilitating the measurement of cycles. These cycles gradually diminish over time, allowing our forecasts to primarily rely on long-term trends.

Over the DPP4 period, LCI EGW is forecasted to have 1.1 percent higher growth than the CPI. The solid blue line in Figure 4.2 shows the LCI EGW (actual) for the period of June 2009 – December 2023. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. The forecasts suggest that nominal LCI EGW will increase until 2026q1, then stagnates until 2028q1 and raises again between 2028q3 and 2030q2. The real LCI EGW is shown by dotted black line. Our forecasts of the impact of inflation uncertainty suggests that, over the DPP period, the real LCI EGW index could range between -4.1 and +3.8 percent.

Figure 4.2 LCI EGW actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Stats NZ, The Treasury 2023 HYEFU, Principal Economics analysis

Note: LCI EGW for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. We suggest this is a useful approach, given that the variation in the historic data is useful for improving predictive power of our models (and because the index level in earlier years does not affect our model significantly). For the forecasts the data used actual and forecasted values for LCI All for the period of 1995q1-2030q2 sourced from Stats NZ and Principal Economics. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023.

4.1.3 LCI for the Construction industry

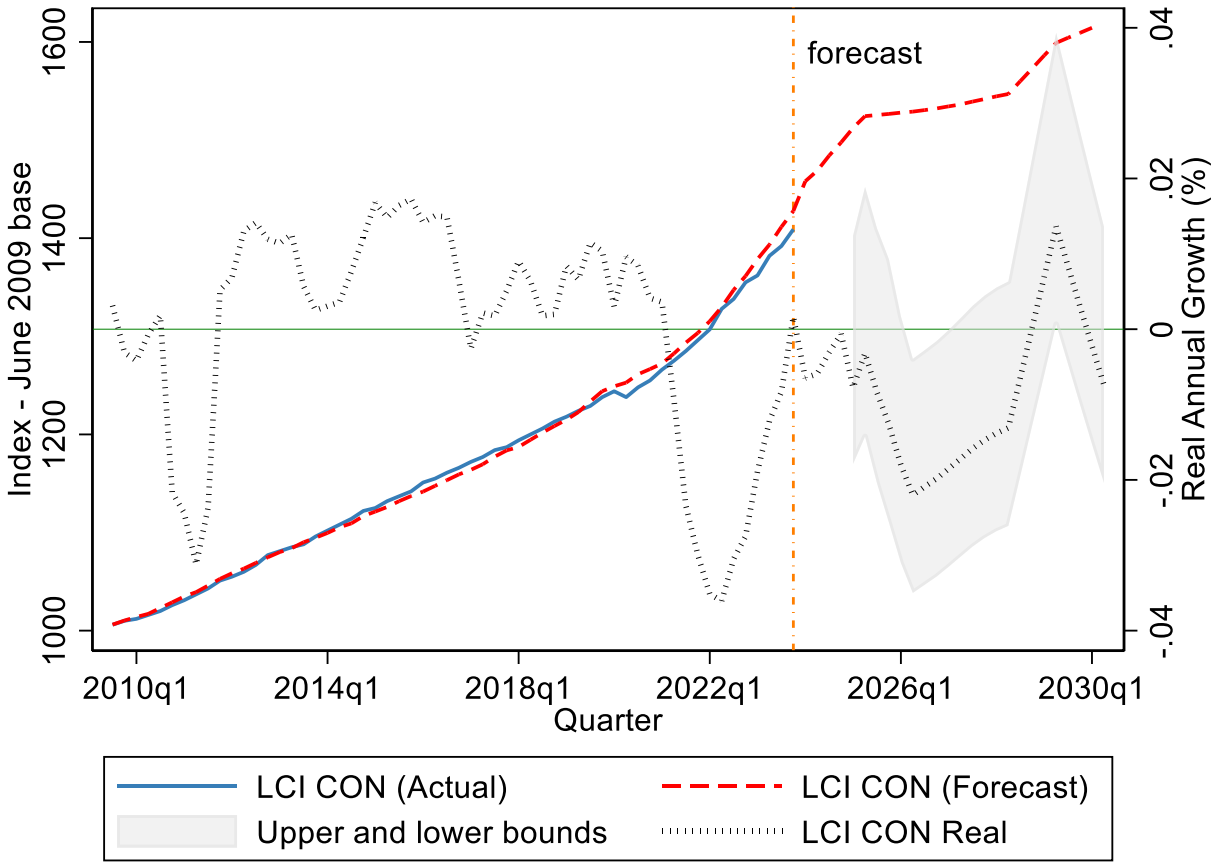
The forecasting methodology for the LCI Construction follows a similar framework to that of the LCI EGW. Specifically, it employs an econometric model comprising two components:

- A model focused on projecting the long-term trend in the LCI Construction. This component considers various factors, including the LCI of all sectors, salary and wage rates, and population growth, to serve as a generalized measure of construction demand.
- A model aimed at capturing short-term and cyclical fluctuations in the LCI Construction. These variations are influenced by changes in net migration and the construction industry output gap. To establish these output gaps, a Hoddrick Prescott filtered trend is applied to industry activity, enabling the identification and measurement of cycles. Over time, these cycles gradually diminish, allowing our forecasts to predominantly rely on long-term trends.

Over the DPP4 period, our forecasts suggest that LCI for the construction industry will grow 1.2 percent more than the CPI. The solid blue line in Figure 4.3 shows the actual "LCI Construction" (LCI CON) index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts and aligns closely with the actual data. The real LCI CON is shown by dotted black line. Our forecasts of the potential impact of inflation uncertainty suggest that, over the DPP period, the real LCI CON index could range between -4.0 and +4.5 percent.

Figure 4.3 LCI Construction actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Stats NZ, The Treasury 2023 HYEFU, Principal Economics analysis

Note: LCI CON for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. We suggest this is a useful approach, given that the variation in the historic data is useful for improving predictive power of our models (and because the index level in earlier years does not affect our model significantly). For the forecasts the data used actual and forecasted values for LCI All for the period of 1995q1-2030q2 sourced from Stats NZ and Principal Economics. CPI is based on Stats NZ's All Group Consumer Price Index and the

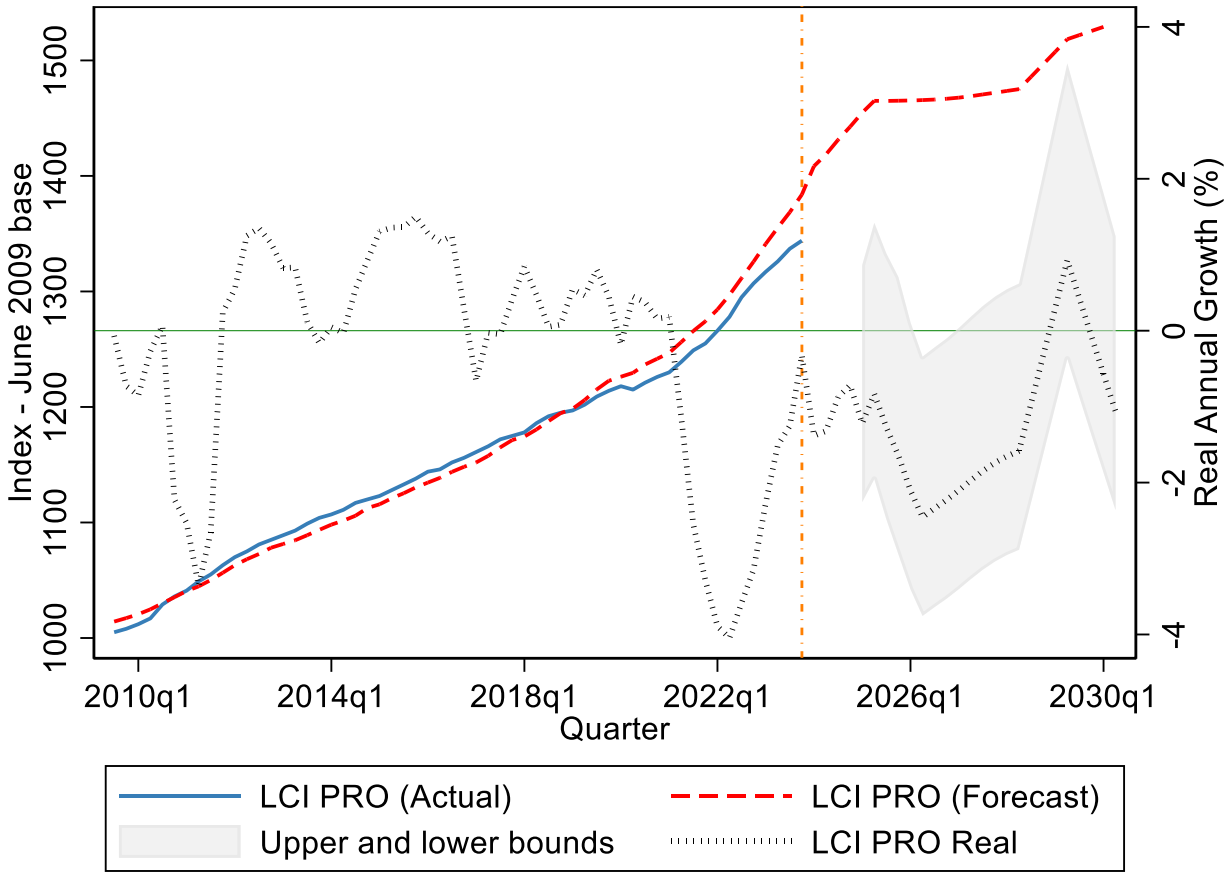
forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from The Treasury's HYEFU 2023 and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.1.4 LCI for the Professional and Technical Services industry

The forecasting methodology for the LCI Professional and Technical Services industry is similar to that of LCI CON and LCI EGW. Over the DPP4 period, our forecasts suggest that LCI for the construction industry will grow 1.2 percent more than the CPI. The solid blue line in Figure 4.4 shows the actual "LCI Professional and Technical Services industry" (LCI PRO) index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts and aligns closely with the actual data. The real LCI PRO is shown by dotted black line. Our forecasts of the potential impact of inflation uncertainty suggest that, over the DPP period, the real LCI EGW index could range between -3.6 and +3.1 percent.

Figure 4.4 LCI Professional actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Stats NZ, The Treasury 2023 HYEFU, Principal Economics analysis

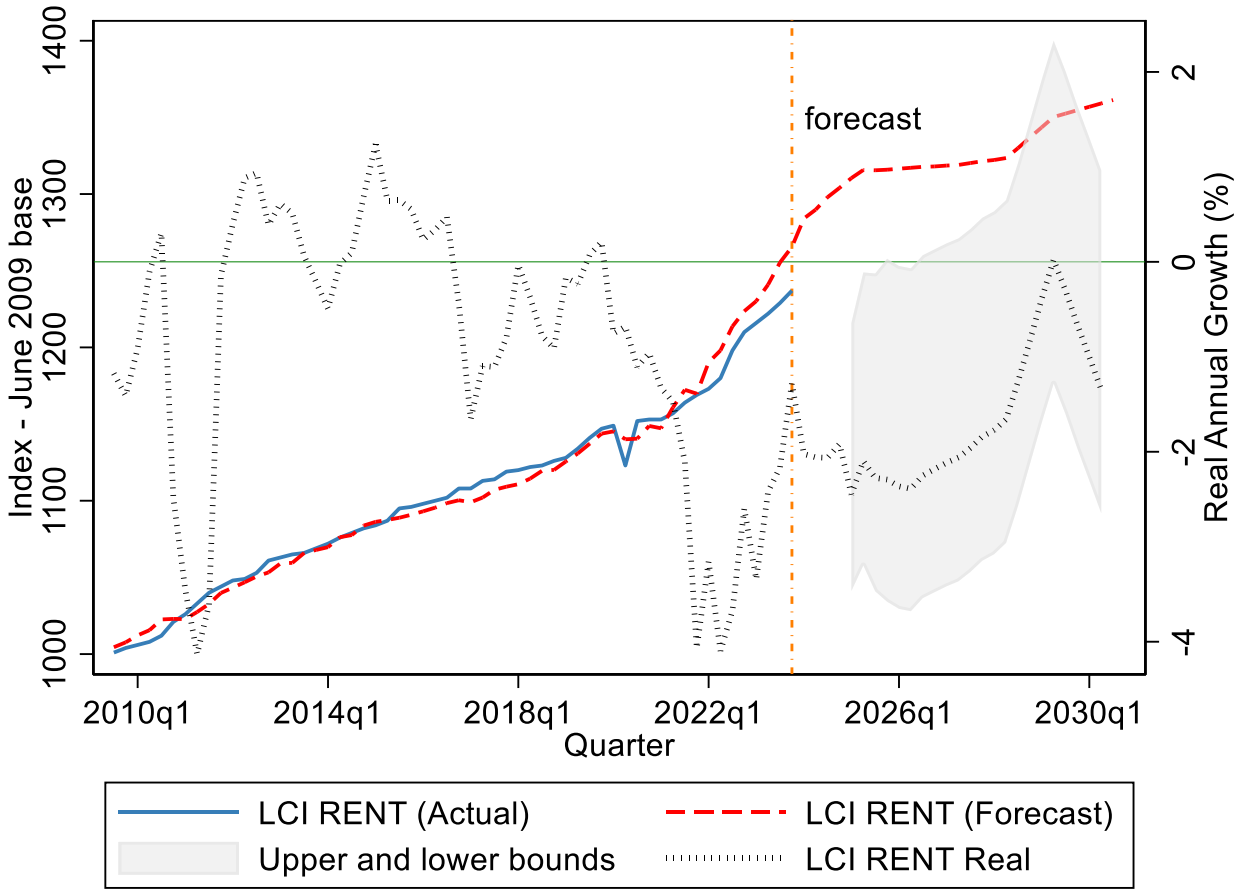
Note: LCI PRO for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. For the forecasts the data used actual and forecasted values for LCI All for the period of 1995q1-2030q2 sourced from Stats NZ and Principal Economics. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap actual is sourced from various RBNZ updates (from 1997 onwards) and the latest Treasury's HYEFU 2023 and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.1.5 LCI for rent of commercial land and buildings

Over the DPP4 period, LCI RENT is forecasted to have 0.7 percent higher growth than the CPI. The solid blue line in Figure 4.5 shows the actual LCI 'Rent of commercial land and buildings' (LCI RENT) index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. The forecasts suggest that nominal LCI RENT will increase until 2025 and then stagnate. The real LCI RENT is shown by dotted black line. Our forecasts suggest that, over the DPP period, the real LCI RENT index will range between -3.7 and 2.3 percent.

Figure 4.5 LCI Commercial rent actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Principal Economics

Note: LCI RENT for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. For the forecasts the data used actual and forecasted values for LCI All for the period of 1995q1-2030q2 sourced from Stats NZ and Principal Economics. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from The Treasury's HYEFU 2023, for the period of 2010q2-2028q2, and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.2 PPI indices

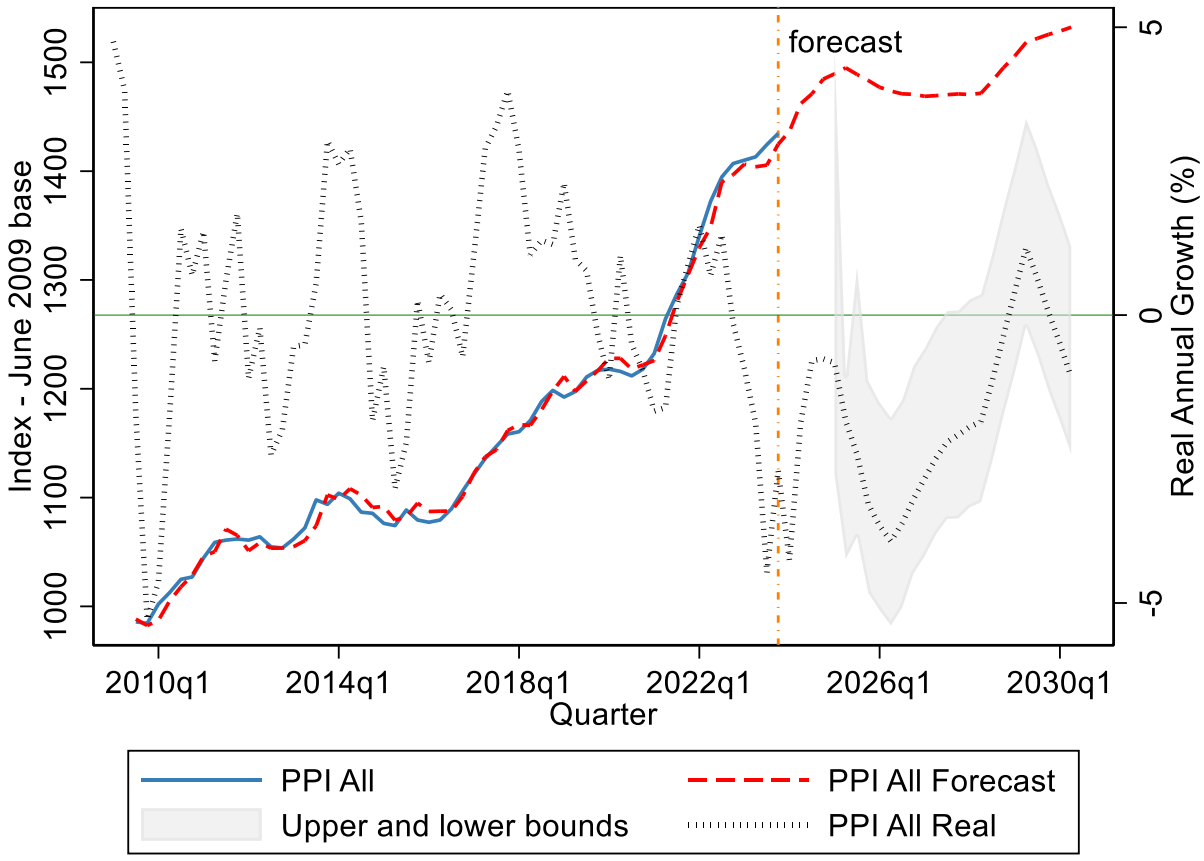
4.2.1 PPI-outputs index for all industries

The forecasting of the PPI-outputs index across all industries takes into consideration various factors such as demand and supply dynamics in the macroeconomy, institutional frameworks, and economic shocks impacting global demand or local supply. This forecast comprises both a long-term trend component and a cyclical component. The trend component is projected based on the correlation between CPI and overall PPI inflation.

Figure 4.6 shows actual and fitted values for the PPI-outputs index for all industries (PPI All). The solid blue line is the actual index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. Our forecasts suggest that nominal PPI All will increase until 2025 and then fluctuates. The real PPI All is shown by dotted black line and, over the DPP4 period, it is forecasted to grow 0.5 percent higher than the CPI. The relatively low level of PPI All for the DPP4 period is partly explained by the impact of climate policy (ERP2). Our forecasts suggest that, over the DPP period, the real LCI EGW index will range between -0.05 and 0.02 percent.

Figure 4.6 PPI All actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Principal Economics

Note: PPI All for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from

The Treasury's HYEFU 2023, for the period of 2010q2-2028q2, and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.2.2 PPI-outputs index for heavy and civil engineering

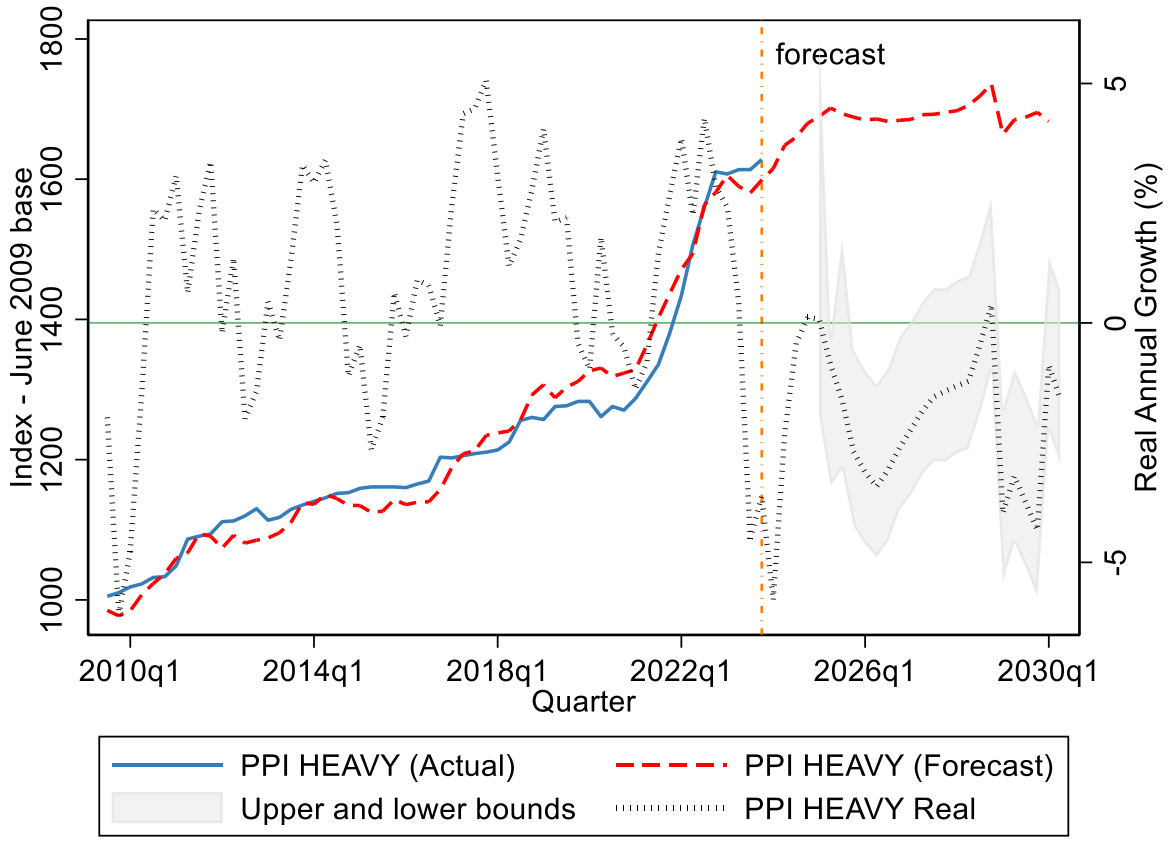
The forecasting methodology for the PPI-outputs index in the heavy and civil engineering sector employs an econometric model structured into two components:

- A model dedicated to projecting the long-term trend in the PPI-outputs index for heavy and civil engineering. This component utilizes the Producers Price Index for inputs across all sectors and the LCI Construction as determining factors.
- A model aimed at capturing short-term and cyclical fluctuations in the PPI-outputs index for heavy and civil engineering. This aspect considers changes in net migration, the output gap within the construction sector, and the output gap within the professional services sector as influencing factors.

Figure 4.6 shows actual and fitted values for the PPI Heavy index. The solid blue line is the actual index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. Our forecasts suggest that nominal PPI Heavy will increase until 2025 and then stagnates. The real PPI Heavy is shown by dotted black line and, over the DPP4 period, it is forecasted to grow 0.1 percent less than the CPI. The lower growth of the PPI Heavy is partly due to the estimated dampening impact of climate policy (ERP2). Our forecasts suggest that, over the DPP period, the real LCI EGW index will range between -5.1 and 4.0 percent.

Figure 4.7 PPI HEAVY actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Principal Economics

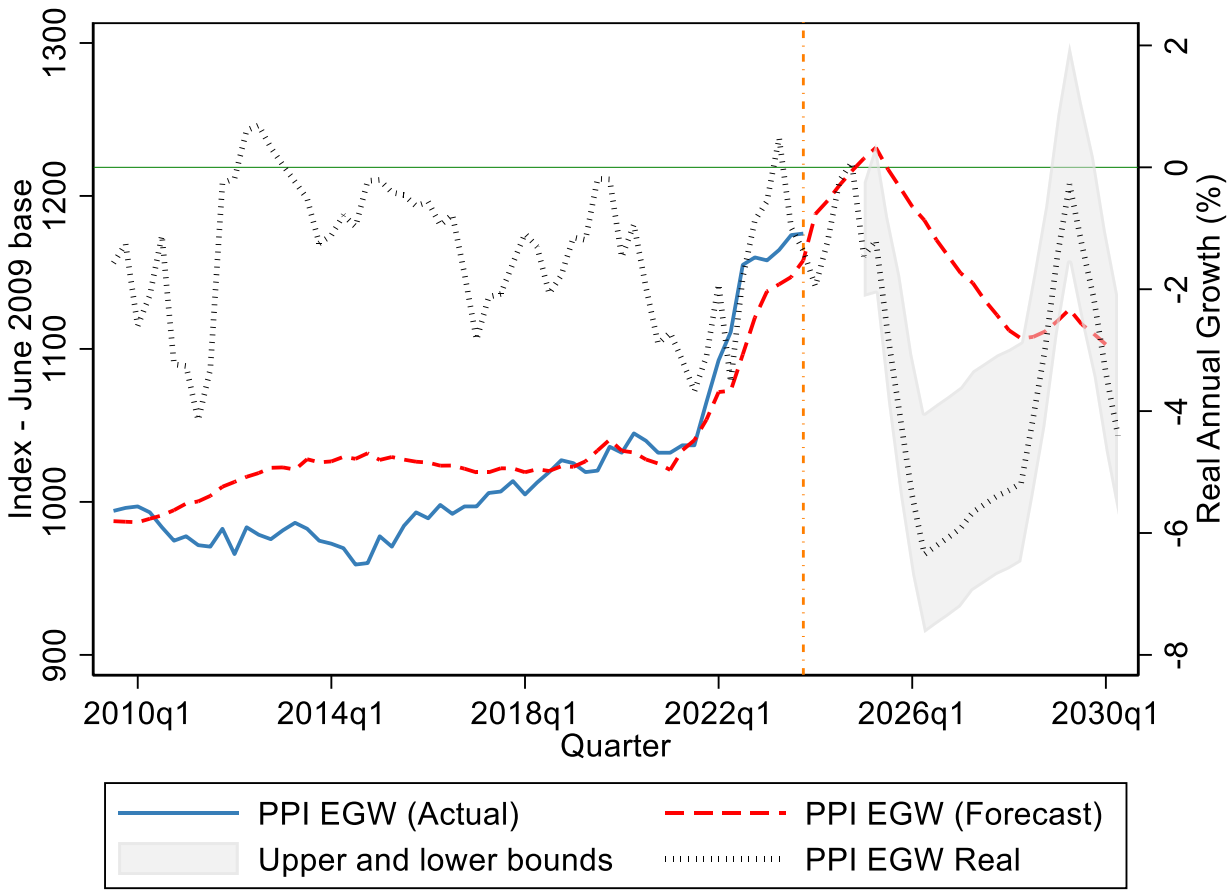
Note: PPI Heavy for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from The Treasury's HYEFU 2023, for the period of 2010q2-2028q2, and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.2.3 PPI-outputs commodities 'Electricity: commercial consumers'

The PPI-outputs index for 'Electricity: commercial consumers' (PPI ECC) is forecasted using a similar approach to PPI Heavy. Figure 4.8 shows actual and fitted values for the PPI ECC index. The solid blue line is the actual index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. Our forecasts suggest that nominal PPI ECC will increase until 2025 and then drops. The real PPI ECC is shown by dotted black line and, over the DPP4 period, it is forecasted to grow 2.3 percent less than the CPI. Our forecasts suggest that, over the DPP period, the real LCI ECC index will range between -7.6 and 2.1 percent.

Figure 4.8 PPI ECC actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Principal Economics

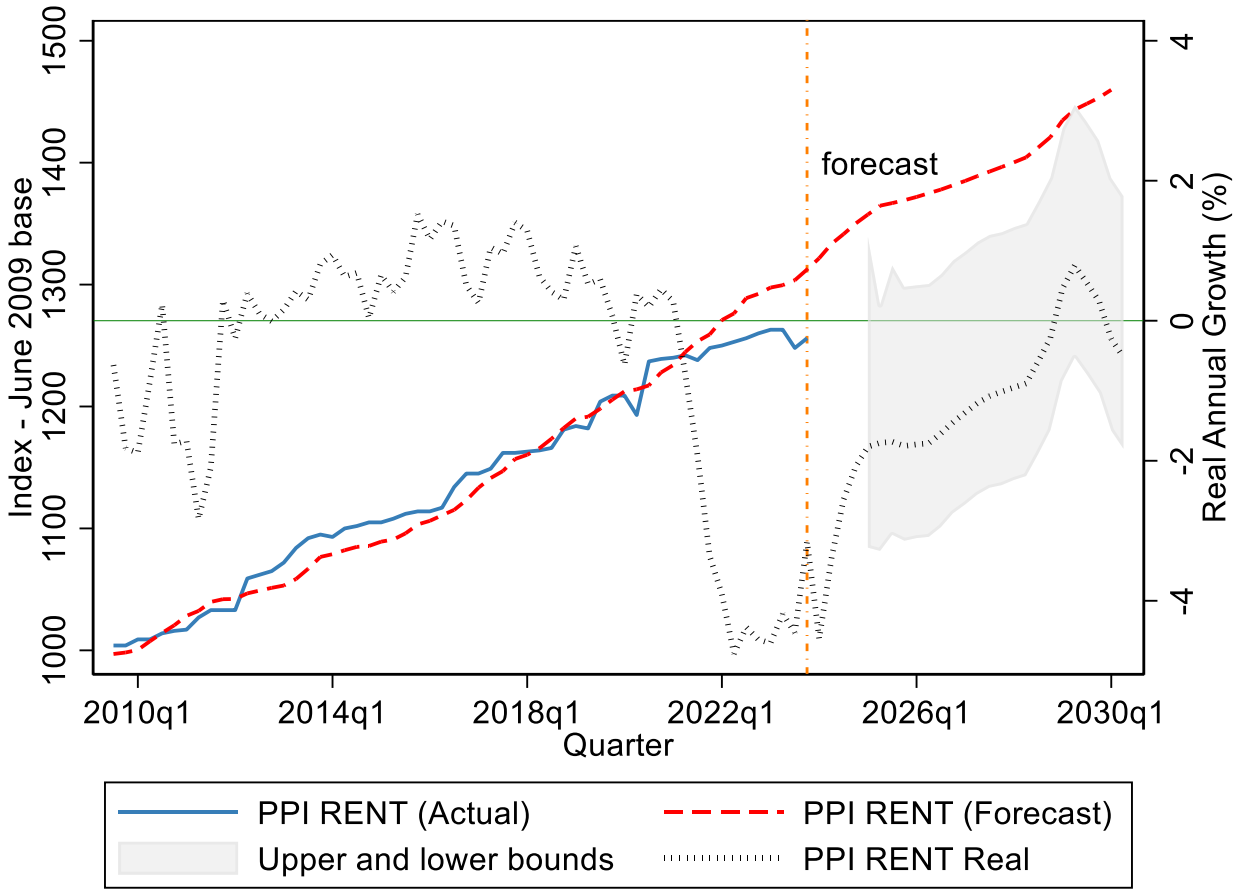
Note: PPI ECC for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q2. We have merged this with the previously available data for the earlier years. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from The Treasury's HYEFU 2023, for the period of 2010q2-2028q2, and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.2.4 PPI-outputs index for rent of commercial land and buildings

Figure 4.9 shows actual and fitted values for the PPI RENT index. The solid blue line is the actual index for the 2009q2-2023q4 period. The dashed red line is our fitted values and forecasts. The fitted values closely align with the actual data. Our forecasts suggest that nominal PPI RENT will increase until 2025 and during the DPP4 period. The real PPI RENT is shown by dotted black line and, over the DPP4 period, it is forecasted to grow 1.4 percent more than the CPI. Our forecasts suggest that, over the DPP period, the real LCI ECC index will range between -3.3 and 3.8 percent.

Figure 4.9 PPI RENT actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: Principal Economics

Note: PPI RENT for the period of 1995q1-2023q4 is sourced from Stats NZ. The Stats NZ has recently restructured their provided data, which is only available from 2009q4. We have merged this with the previously available data for the earlier years. CPI is based on Stats NZ's All Group Consumer Price Index and the forecasts provided by The Treasury's HYEFU 2023. Output Gap (actual and forecast) is sourced from The Treasury's HYEFU 2023, for the period of 2010q2-2028q2, and we have further modelled for deriving quarterly forecasts for the period of the DPP4.

4.3 Metal indices

The approach to forecasting metals prices entails several components:

- Utilisation of futures market prices for copper and aluminium, typically forecasting 1 to 2 years ahead. (Futures prices are not available for steel.)
- Integration of average consensus forecasts for steel prices, as well as copper and aluminium prices beyond the futures market horizons.
- Incorporation of World Bank forecasts to predict the World Bank metals and minerals price index.

To ensure the forecasts align with market fundamentals, we adjust using World Bank and OECD global income growth forecasts. This process verifies that long-term market positions correspond with underlying economic factors. Futures prices are prioritised as forecasts, where available, as they are widely acknowledged as the most reliable expectation of future prices based on current knowledge and market conditions.

We complemented our forecasts using Consensus forecasts' low-, mid- and high- forecasts which represent a synthesis of diverse perspectives and forecasting methodologies. This approach captures a broader spectrum of information and more robustly formed expectations compared to individual forecasts. This is particularly crucial for international forecasts, where price determinants vary across numerous economies.

The overarching projection for metals prices suggests a relatively stagnant global price growth trajectory in US dollars, at least when contrasted with the preceding decade, albeit with some variability among the different metals forecasted.

4.3.1 Copper

The forecasting methodology for copper prices includes using the average settlement prices for copper futures on the London Metals Exchange from the March 2024 quarter to the June 2029 quarter.

The volatility of futures market prices has shown a tendency to remain relatively constant on average. Analysts attribute the recent higher prices to increased demand from the electric vehicle industry and the current global deficit. Copper prices have also increased due to persistent industrial relations issues and the geographical concentration of production in politically and economically unstable countries. Historical price movements, such as the surge in prices in 2011 and the recent increases in 2018, illustrate these risks.

The record prices observed in 2011 were driven by resurgent demand following the global financial crisis, coupled with supply constraints resulting from a combination of industrial conflicts, power shortages, and adverse weather conditions in South America and Indonesia. Similarly, higher prices in 2018 were associated with a trade war between the US and China.

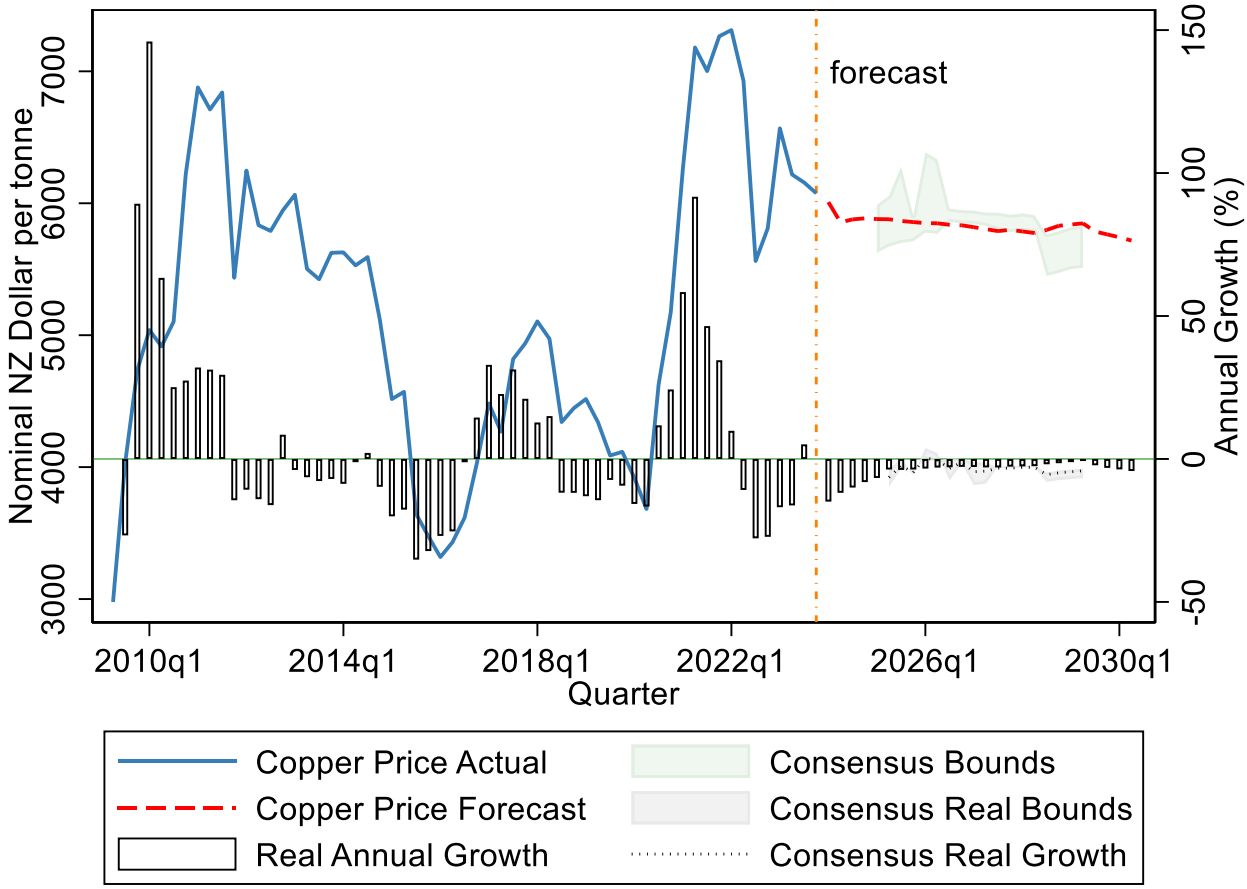
Figure 4.10 shows actual and forecasted copper prices (NZD per tonne) and its real growth rate. The real growth are based on the conversion of the US dollar figures to NZ dollar using exchange rate (TWI) forecasts.[24] Record prices in 2011 reflected resurgent demand after the global financial crisis at the same time as supply constraints caused by a combination of industrial conflicts, power shortages, and adverse weather conditions in South America and Indonesia. Similarly a trade war between the US and China was associated with higher prices in 2018. China's Copper consumption has accounted for about 50 per cent of global Copper consumption. Unprecedented levels of government stimulus boosted demand growth beyond supply growth, providing momentum for metals prices to

[24] The relationships were estimated based on quarterly observations since 2010, with the TWI data being converted to a quarterly series by averaging monthly data. An autoregressive distributed lag (ARDL) model structure, estimated by least squares, was employed to capture the lagged effects of input changes on output prices. The process involved testing and optimising lag lengths of up to eight quarters, guided by minimising the Akaike Information Criterion (AIC).

recover past pre-COVID-19 levels. The global economic outlook has been weakening because of the Russia-Ukraine war and tighter monetary policy to curb rising inflation. It is noteworthy that such supply shocks are not factored into the forecast, as they are inherently unpredictable.

Figure 4.10 Copper price actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: COMEX Futures, LME, Consensus Economics, Principal Economics analysis

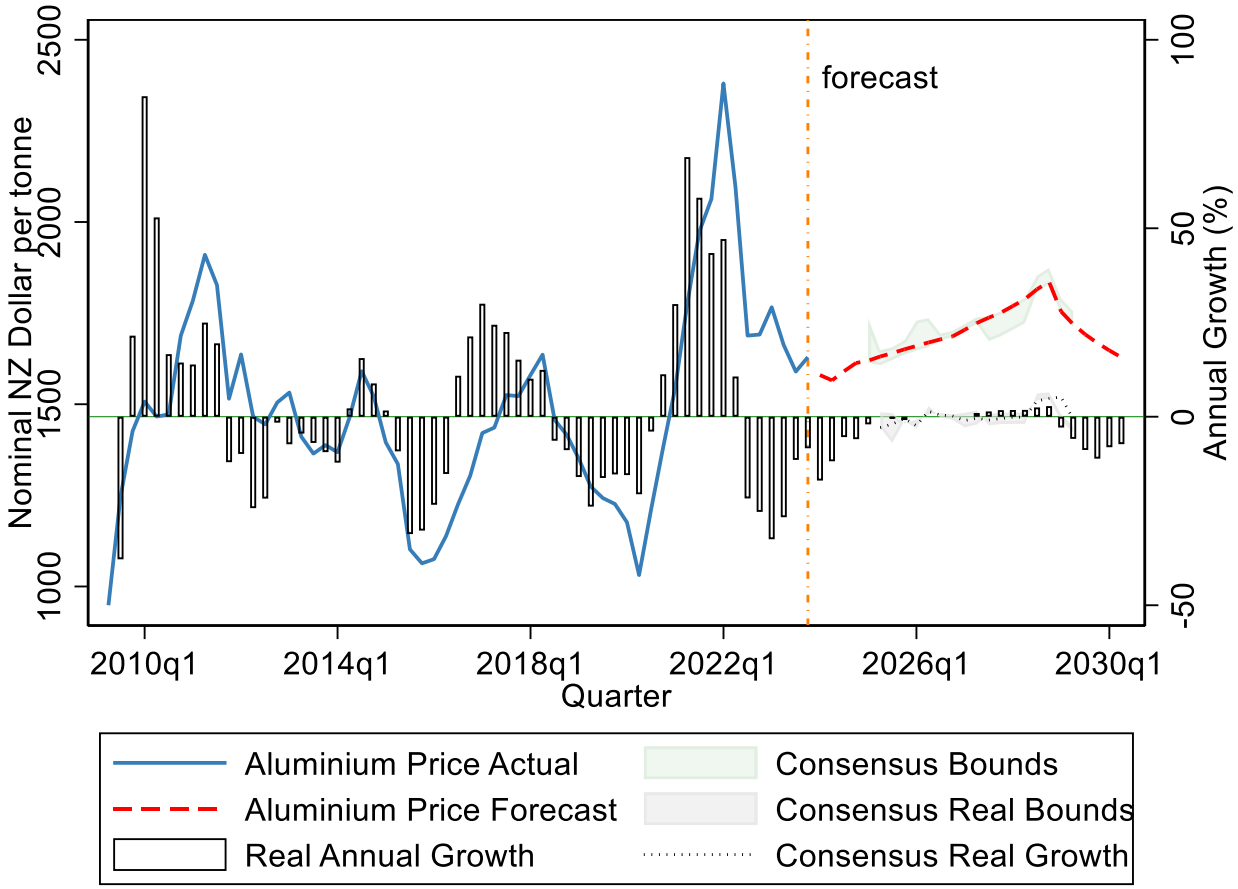
4.3.2 Aluminium

The forecasting process for aluminium prices involves utilising the average settlement prices for aluminium futures on the London Metals Exchange from the 2024 March quarter to the March quarter 2029. For the additional year, until June 2030, we have used an autoregressive regression.

After experiencing declines in 2020, aluminium prices stabilised after the pandemic period. Notably, in 2022, aluminium prices surged to levels not seen since June 2010. The global aluminium market has been impacted by Chinese smelter shutdowns attributed to pollution concerns, resulting in a deficit in the global market. Additionally, analysts anticipate that the rise in demand for electric vehicles will contribute to increased demand for aluminium in the forthcoming years. Figure 4.11 shows the actual and forecasted aluminium price (NZD). The futures price suggests and increase in prices until 2029.

Figure 4.11 Aluminium price actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: COMEX Futures, LME, Consensus Economics, Principal Economics analysis

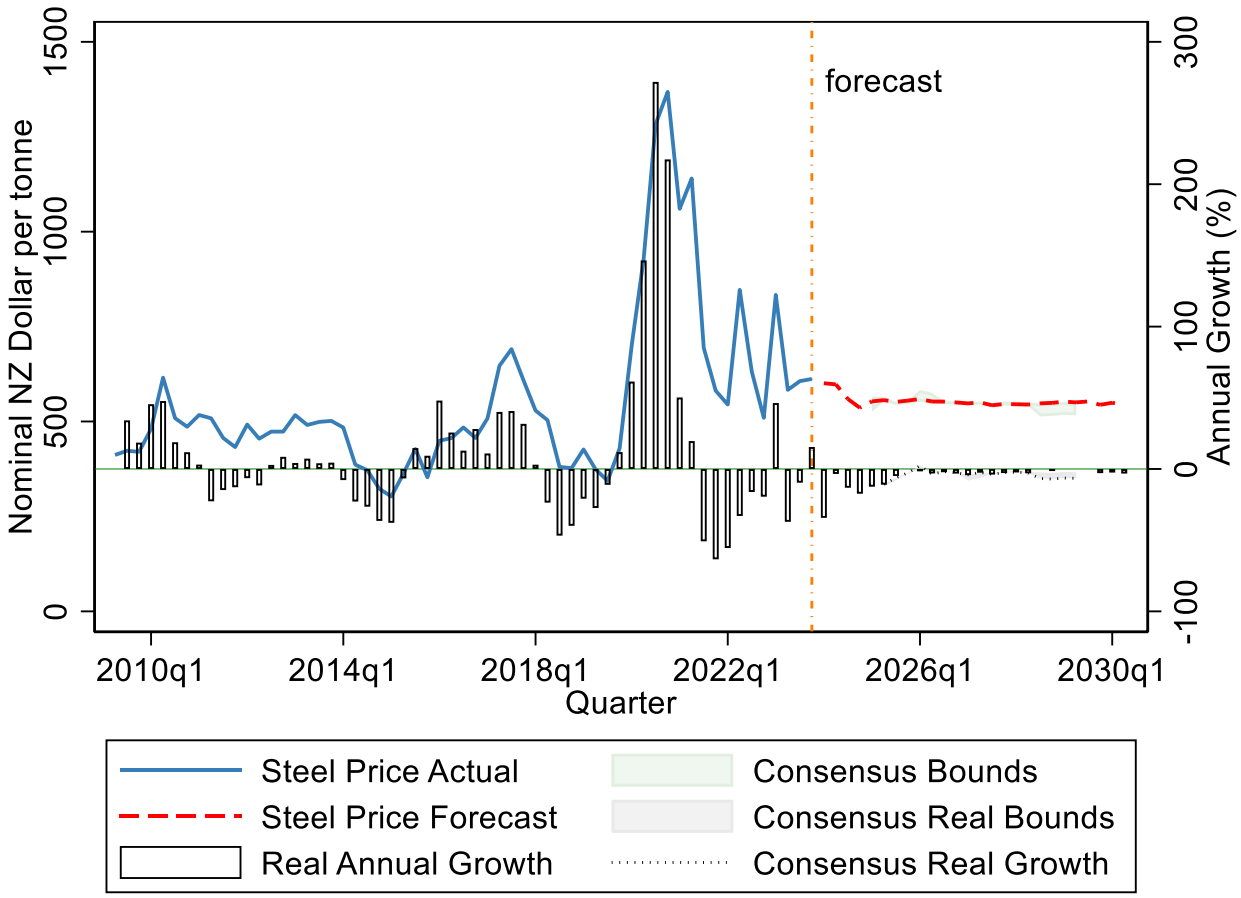
4.3.3 Steel

Steel prices are forecasted based on the future markets and the expected growth of other metals. Increases in inventories of iron ore and higher efficiencies in new plant are both likely to prevent prices from growing rapidly in the medium term. Except for the volatilities during the pandemic period, the prices have been relatively stable and as demand growth is not going to be anywhere near as strong as in the 2000s with growth in investment in China expected to moderate from unprecedented highs.[25]

[25] In our previous report (Torshizian, 2018) we suggested that "the demand for consumer appliances and other products will continue to grow in Asia and thus we do not expect any lower prices, at least for stainless steel. Steel prices have eased due to past over-supply from China. China, however, has announced that they will decrease steel production by 2020. Hence, the market is expected to face a supply shortage during the RCP3 period, which is likely to lead to a price spike in 2021." This is evident from the graph.

Figure 4.12 Steel price actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



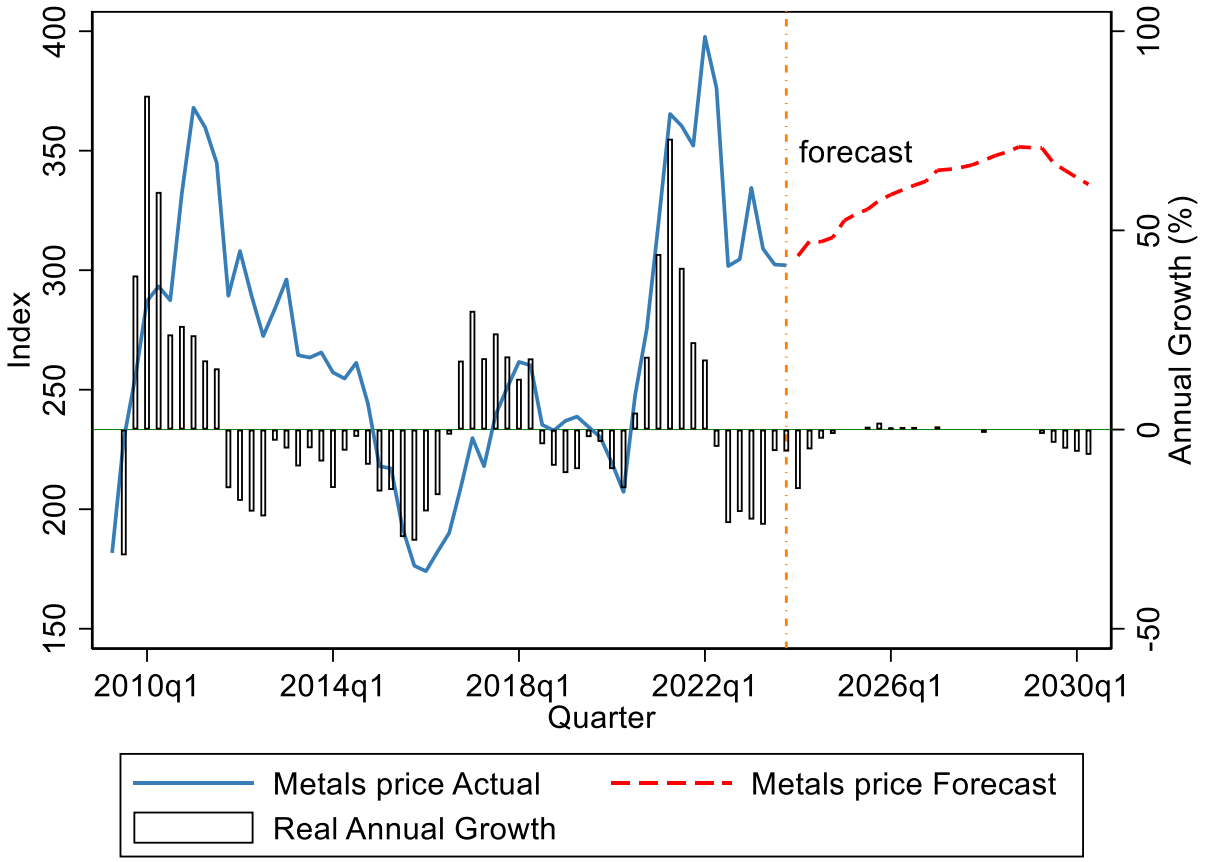
Source: LME, Consensus Economics, Principal Economics

4.3.4 Other metals

Other metals costs are benchmarked against the World Bank Metals and Minerals price index. This index is sourced from the World Bank's "Metals and Minerals" index, which is available until December 2023. The forecasts are based on the future price of other metals, collected from various sources. The forecasts are presented in Figure 4.13.

Figure 4.13 Other metals index actual and forecast June 2009 – June 2030

Actual: 1995q1-2023q4; Forecast: 2024q1-2030q2



Source: World Bank, Principal Economics

4.4 Insurance index

Existential threats, such as catastrophic climate change, the increase in cybercrime, and concern over vast uninsured and underinsured infrastructure, are driving many insurers to reconsider their premiums for the coming years across all segments prevent or to encourage mitigating risks before they occur, rather than merely paying to rebuild and recover after the fact, which is also costly to the EDB sector. In this section we provide an insurance index that accounts for the average growth of insurance premiums for different categories of risk, including infrastructure and buildings, global market and reinsurance trends, and cybercrime. This is based on the available information on the latest risks and threats, informed by the submissions and our expert judgement.

We synthesise insights from Deloitte's (2024) global insurance outlook, Marsh's Q3 2023 Index[26], and Transpower's RCP4 report[27], covering three key areas: infrastructure and building, global market and reinsurance trends, and the escalating costs associated with cybercrime insurance. Additionally, the final section of this report addresses key suggestions derived from submissions and cross-submissions from stakeholders regarding insurance increases for the DPP4 period.

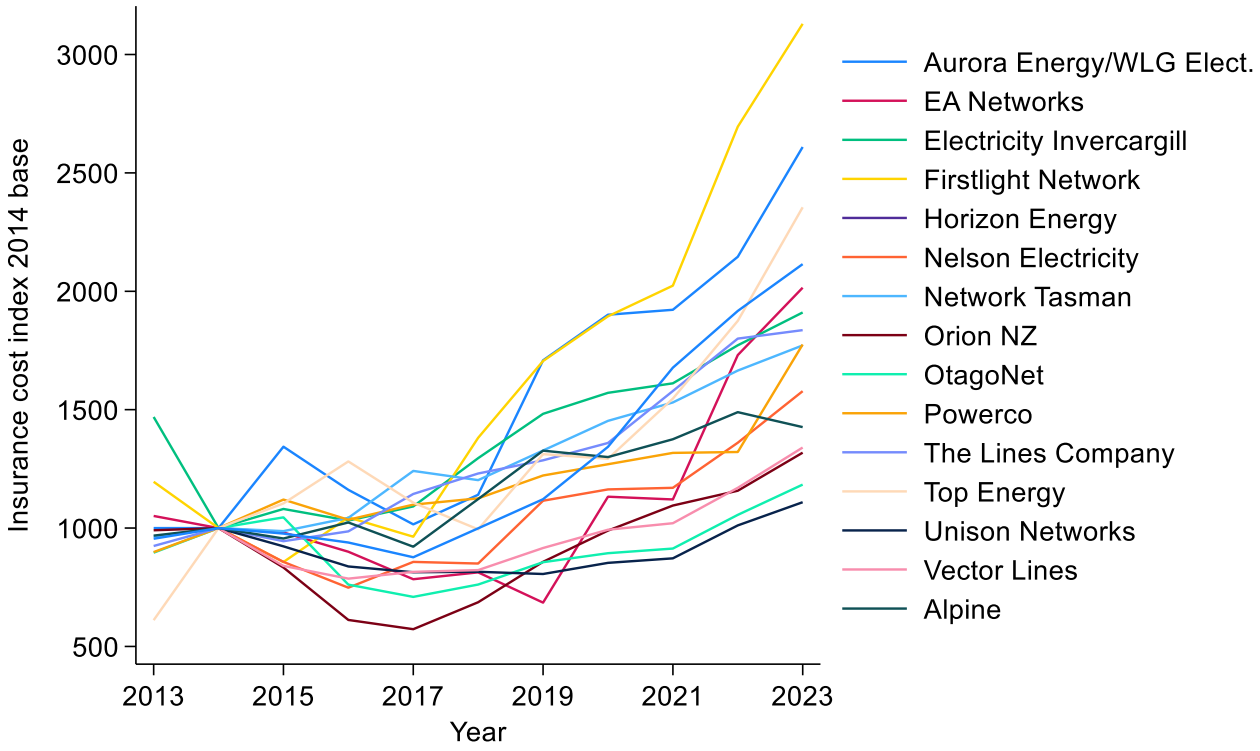
26 Global Insurance Market Index 2023 | Global Insurance Market Index | Marsh

27 Commerce Commission - 2025 Transpower individual price-quality path (comcom.govt.nz)

Figure 4.14 shows the insurance cost index (2014 base) for EDBs for the period of 2013-2023. Our findings from various sources of information are provided in Appendix C:. As evident from the significant differences in insurance costs across EDBs, their insurance cost depends on various local features and challenges, including increased natural disaster risks impacting property premiums, global reinsurance market dynamics, and the evolving cybercrime landscape. Premiums are expected to reflect both regional and global trends, with a general inclination towards an increase across various risk categories. With climate change escalating the frequency and severity of such events, premiums are consequently on the rise.

Figure 4.14 Insurance cost index of EDBs 2013 – 2023

Actual 2014 base



Source: Commerce Commission Information Disclosure; Principal Economics analysis

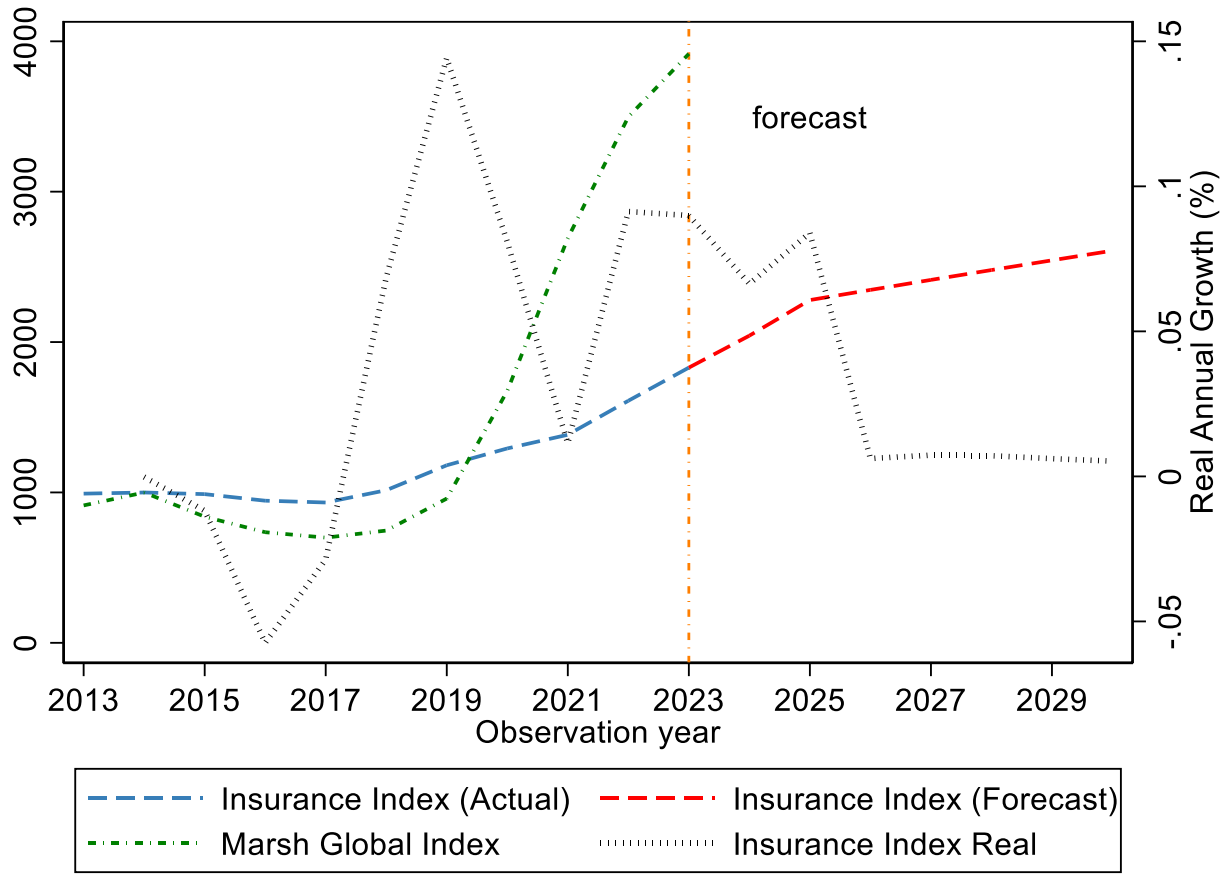
Marsh's global insurance rate change peaked at 22 percent (and 31 percent in the Pacific region) in 2020q4 and continuously dropped to 2 percent (and 0 percent in the Pacific region) in 2023q4. Locally, with climate change escalating the frequency and severity of such events, premiums have been on the rise, but not at relatively low rates. Figure 4.15 shows the average insurance index for EDBs, Marsh's Global Insurance Market Index[28], our forecasts of nominal and real EDB insurance index. Accordingly, the historic pattern of growth in insurance cost of EDBs is similar to the global pattern. However, there is a large gap between the EDBs' cost index and the Marsh's Global index. While the Marsh index covers all commercial insurances, ie is not limited to EDBs, the overall significant increase in the global index is an indication of a possible lagged impact for the New Zealand market, which will be passed on to the

[28] The Composite insurance pricing change includes the major coverage lines, such as Global Property, Global Casualty, and Global Financial and Professional Lines (Starting with the third quarter of 2022, the quarterly index presents the cyber data separately from financial and professional lines data). And the reported pricing changes are averages and that the data used to estimate the changes cover a wide range of clients in terms of size, industry, location, claims history, and other parameters.

EDBs in short-term. Hence, we suggest that the rate of growth experienced over the last few years will continue until 2025. The average annual growth rate for the 2020-2023 period is equal to 11.6 percent, which we assume will be effective until 2025. For the DPP4 period, there are mixed factors at play. Overall, most modelling of climate policy for this period suggests increased allocative efficiency. There are various other factors, such as the recent increase in insurance premium that indicate an upward trend. This is partly addressed by the initial increase between 2023 and 2025, which will lead to a higher base for the DPP period. For the 2025-2030 period, the mix of the impacts reviewed in Appendix C would lead to a growth in insurance index at its trend level.[29] The observed drop in real insurance index from 2026 onwards is driven by the trend of insurance index being closely aligned with inflation.

Figure 4.15 Average insurance cost index and Marsh Global Insurance Market Index 2013 – 2023

Actual 2014 base



Source: Commerce Commission Information Disclosure; Marsh Global Index, Principal Economics analysis

Note: Insurance Index for the period of 2013-2023 is sourced from the Information Disclosures of the Commerce Commission. Using Hoddrick Prescott filter, we have distinguished between the trend and cycle of the index. For the 2023-2025 period, we suggest a catching

29 The cycles could be predicted but given the uncertainty involved with the prediction of insurance premiums, we could assume a lower and upper bound based on the cycles experienced over the last decade. However, the wide cycle identified using Hoddrick Prescott filtered trend indicates a large gap between upper and lower bounds, which is inherent to the nature of uncertainty involved. This large gap does not provide useful information and hence we do not present in the figure.

up effect based on the difference observed between the New Zealand and global insurance market. For the DPP4 period, we suggest the trend will continue.

5 Next steps

As described, AEMO's database provides information on an extensive list of indices. The advantage of this approach is to provide frequent information about cost escalation. However, adopting this approach requires extensive information about cost areas. Also, there is a need for frequent update and monitoring. While our approach for cost escalation provides relatively a detailed understanding of cost areas and relevant indices, we suggest that a future report should further consider the advantages of a more granular approach in New Zealand.

An important topic for EDB is efficient investment and how it is dealt with in the DPP resets. The Commission's Statement of Intent (SOI) clarifies the importance of consideration of climate change across different sets of infrastructure that the Commission oversights. It is difficult to judge the efficiency of investments of the regulated monopolies, that often come at a cost to consumers – which is more prominent in short- and medium-terms. This increases the risk that the cost efficiencies will be prioritised to long-term social gains. We suggest that the Commission provides further technical and strategic guidance for the regulated monopolies. This should build based on the current Building Block Model.

The submissions highlighted the need for considering local features, which vary across EDBs. This is an important and technically challenging task that is beyond the scope of our report. Given the consumer welfare focus of the Commission, we suggest that further exploration of affordability/price sensitivity at a local level will be useful for understanding the balance between cost of improved resilience and the affordability pressure to local communities. Torshizian and Meade (2020) proposed a methodology for further exploring demand elasticities at a sub-regional level, which provides a useful approach for understanding the price response that complements the usual supply-focused regulatory requirements.

Principal Economics (2023) investigated various methods available for addressing high-level of uncertainty[30] (with a focus on climate change) in decision-making. The findings were adopted by NZTA Waka Kotahi for their prioritisation of investment (using their cost benefit manual). Accordingly, a useful approach for addressing uncertainty is to adopt an adaptive approach, with defining various thresholds, pathways and actions – see Principal Economics (2023, p. 28) for example. We suggest adopting a similar approach for DPP4 will be useful for avoiding issues raised in the submissions about the increased gap over the previous regulatory periods, particularly DPP3. Currently, the Commission mainly monitors inflation, and that does not address various cost pressures applied to the EDBs and, technically, the deterministic RPE series[31]. We suggest that this topic needs to be investigated further for DPP4.

While we used the most likely climate policy packages, as of 7th February 2024, to inform the DPP4 forecasts, these policy packages are still being refined and are not final. Given the significant impact of climate policy as identified in our report, we suggest an update of this report once the economic impact of ERP2 report will be released by the Government in November 2024.

30 Also known as 'deep uncertainty'.

31 Our report addressed this by providing forecast ranges for variation in CPI.

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Appendix A: Identified cost areas, indices and data sources from the literature

The tables below provide a list of the identified cost areas, indices, and data sources for cost escalation of electricity *transmission*.

Table A.1 Cost areas

Cost areas	Description	Components
Plant	Involves the supply of primary material assets necessary for the construction of the transmission infrastructure.	Includes steel towers, various types of equipment, conductors, switchgear, and cables.
Civil and Structural Works	Encompasses the supply and installation of civil infrastructure assets.	Covers earthworks, buildings, foundations, busbars, gantries, site clearing, and access tracks.
Electrical Works	Pertains to the supply of electrical installation works integral to the transmission system.	Involves stringing, fitting, termination, jointing, and lighting.
Secondary Systems	Deals with the supply of secondary system material assets.	Includes relays, control panels, protection panels, SCADA systems, and station batteries.
Design and Survey	Encompasses engineering and environmental design and survey works, typically conducted in the initial phase of the project.	Focuses on planning, designing, and environmental assessment necessary for project initiation.
Testing and Commissioning	Involves assurance works for electrical, civil, and structural components, performed before the operational approval of constructed assets.	Includes various testing and validation procedures to ensure compliance and functionality.
Contractor Project Management and Overheads	Covers the management and administrative aspects of the project undertaken by hired contractors.	Includes site supervision, resource mobilisation, site set-up, and overall project management expenses.
Easement and Property Acquisition Costs	Refers to the costs associated with procuring easement rights of way and land acquisitions necessary for the project.	Encompasses legal, negotiation, and transaction costs related to land and easement acquisition.
Environmental Offset Costs	Accounts for the costs incurred to compensate for unavoidable environmental and biodiversity impacts resulting from the project.	Includes a variety of mitigation and compensatory measures to address environmental impacts.

Source: Mott MacDonald (2023, p. 19)

Table A.2 Selected indices

Index	Description	Application
Consumer Price Index - CPI	Measures household inflation and includes statistics about price change for categories of household expenditure.	Equipment and Materials

Iron smelting and steel manufacturing	Bar, iron, or steel manufacturing. Steel alloy manufacturing. Structural steel shape manufacturing.	Equipment and Materials
Basic non-ferrous metal manufacturing	Alumina production, aluminium smelting, and copper.	Equipment and Materials
Other electrical equipment manufacturing	Batteries, electric motors, generators, electricity transmission or distribution equipment, switchgear, switchboards, transformers or other electrical machinery, equipment, supplies or components not elsewhere classified.	Equipment
Electric cable and wire manufacturing	Co-axial cable, fuse wire, non-ferrous cable, optical fibre cable, telecommunications cable, and wire or electric cable.	Materials
Petroleum refining and petroleum fuel manufacturing	Refining heavy and light component crude oil, manufacturing and/or blending materials into petroleum fuels, and manufacturing fuels from the liquefication of petroleum gases.	Equipment
Other heavy and civil engineering construction Australia	Construction of transmission and distribution electricity lines, electrical machinery, heavy, installation (on-site assembly) and electricity power plant (except buildings).	Services
Engineering design and engineering consulting services	Specialised engineering services: electrical, mechanical, civil, construction, geotechnical, and others.	Services
The Australian dollar trade-weighted index (TWI)	The price of the Australian dollar in terms of a group (or 'basket') of foreign currencies based on their share of trade with Australia. TWI provides a broader measure of whether the Australian dollar is appreciating or depreciating against the currencies of its trading partners.	Equipment and Materials
Australian farmland values	The Farmland Values Reports track the Australian farmland sales over the past 24 years for each state.	Easement/property costs
Legal services	Providing legal representation and advice and the preparation of legal documents. Also included are units mainly engaged in establishing the legal ownership of a property such as title-searching services.	Services
Real estate services	Valuing, purchasing, selling, managing, or renting real estate for others.	Services

Source: Mott MacDonald (2023, p. 14)

Table A.3 Input data sources

Category	Data Source	Application
Commodity Prices	Resources and Energy Quarterly	Calculating prices of steel and relevant commodities for transmission projects.
Labour Costs	ABS Wage Price Indices	Cost of labour in construction and technical services.
Supply Constraints/Demand	ABS 8762.0 Table 1	Assessing demand for resources relative to construction activity volume.
Future Commodity Prices	Resources and Energy Quarterly (Forecasts)	Informing future commodity price projections.
Future CPI and TWI	Resources and Energy Quarterly (Forecasts)	Assumptions for future CPI and TWI values.
Future Labour Costs	Assumption	Projecting labour costs considering long-term productivity increases and skills shortages.
Future Construction Activity	Projection	Forecasting construction activity levels.

Land Values	State-based farmland values and growth rates	Calculating easement and property acquisition costs.

Source: Mott MacDonald (2023, p. 46-48)

Appendix B: Summary of submissions

This summary highlights key points relevant to sector-specific input price escalation forecasts, focusing on areas such as finance-ability, consumer impacts, forecasted capital and operational expenditures, setting revenue allowances, and other issues like the undercharging mechanism and IRIS incentives.

B.1 Finance-ability Concerns in DPP Forecasting

A key aspect underscored in the submissions is the concept of finance-ability and its impact on the effective planning and execution of Default Price-Quality Path (DPP) forecasts for Electricity Distribution Businesses (EDBs). The submissions highlight the need for the new DPP to adequately forecast and incorporate costs, ensuring EDBs can finance their investments and operations efficiently. This involves a thorough evaluation of key regulatory mechanisms, including the implementation of P0 changes, revenue smoothing, and the management of wash-up account drawdowns. Notably, the submissions point out that inflation has led to greater-than-anticipated wash-up balances in DPP3, signalling the importance of meticulous financial planning for DPP4.

Additionally, the submissions call on the Commission to carefully consider the potential unintended effects of any modifications in access pricing methodologies by the Authority, particularly regarding capital contributions. Stakeholders suggest that the Commission should look into finance-ability best practices in other jurisdictions to refine their strategy in New Zealand. They also seek more definitive guidance on regulated EDB cashflow profiles for DPP4, including details on the upcoming regulated Weighted Average Cost of Capital (WACC) rate reset on 1 April 2025. The aim is to ensure that EDBs remain financially viable and effective amidst changing economic and regulatory conditions.

Recent cost increases, driven by legislative changes, the pandemic, and supply chain disruptions, press EDBs financially. These increases have implications for allowances set by the regulatory body, with penalties for overspending becoming a real threat. Maintaining investor confidence in New Zealand's EDBs is vital, considering the substantial investments required for the energy transition.

B.1.1 Industry Adaptation and Allowance Adequacy

There is a clear emphasis on the need for adequate capital expenditure (capex) and operational expenditure (opex) allowances. These should consider the evolving needs of EDBs, including non-traditional solutions, decarbonization, electrification, resilience, and innovation. The current environment of high inflation and supply chain pressures necessitates sufficient opex allowances to support efficient investments benefiting consumers in the long run. Additionally, there is criticism of the current regulatory framework's reopeners as slow and inefficient, with suggestions for more flexible allowances in areas like flexibility and demand-side management.

B.1.2 Revenue Recovery and Financial Hardship

Submissions point to the lag between forecast revenue and the determination of wash-up balances, stressing the need for revenue recovery within the regulatory period to minimize carryover and financial strain on EDBs. This tension between consumer price shocks and EDB financial hardship is critical. Delays or abandonment of beneficial investment programs, increased debt costs, and risk of underinvestment are potential consequences if EDBs face financial challenges. These issues impact not only current operations but also have long-term implications for consumers.

B.1.3 Proposed Solutions and Approaches

To address these challenges, there is a call for the introduction of a financeability test in the Input Methodologies, providing a more granular assessment of price shocks and a fairer alternate rate of change. This test should consider EDB-specific alternative rates of change and offer more certainty in revenue caps and smoothing mechanisms. The

aim is to ensure that regulatory settings support the necessary cash flows for investment and innovation, aligning with the long-term interests of consumers. Additionally, the submissions suggest that assessing the impact of regulatory decisions on credit ratings and borrowing costs is crucial, as these factors directly affect EDBs' ability to finance operations and investments.

B.2 Prioritising Consumer Impact in Decision Making

A recurring theme in the submissions is the paramount importance of centring consumer impact in the decision-making process, especially in the context of the Electricity Distribution Businesses (EDBs). The submissions urge the Commission to carefully balance the potential price shocks to consumers against the financial needs of suppliers, while also fostering the appropriate incentives for investment. A critical concern is the significant delay between investments and the realization of increased cash flows to support these investments, which could potentially hinder further investment.

Moreover, the submissions stress that broader macro societal issues, such as energy affordability and energy hardship, should remain under the purview of the government rather than the Commission. This delineation of roles is seen as vital to maintaining a clear focus and responsibility. In terms of practical measures, it's recommended that the Commission thoroughly examines the impact of network price increases on the consumers' overall "energy wallet." This examination should consider the proportion of household expenditure on electricity relative to other expenses, acknowledging the context of the household budget and external economic factors such as mortgage rate increases, grocery bill inflation, and petrol price volatility, especially post events like the Ukraine invasion.

Furthermore, the submissions propose that consumer, iwi, and stakeholder engagement expenditures be considered as a component of an opex step change in setting the EDBs' opex allowances. This approach reflects a holistic view of consumer impacts, ensuring that the financial decisions of the Commission do not operate in isolation but are attuned to the real-world implications for consumers.

B.3 Revised Approach to Capex Forecasting for EDBs

The submissions call for a revised approach to setting capital expenditure (capex) allowances in response to an evolving investment environment. Recognising the necessity for significant changes in investment, stakeholders propose a flexible framework. *This includes categorising capex into two distinct groups: 'supported' investments with high certainty in terms of need and timing, and 'unsupported' investments requiring closer scrutiny.* Such categorisation facilitates differential treatment of investments, aligning them with network reliability and performance requirements. Additionally, there is a suggestion to focus on increasing the utilisation of existing assets, such as connecting local generation to distribution networks, to efficiently meet growing demand.

B.3.1 Consideration of Asset Management and Regulatory Mechanisms

Submissions emphasise the importance of Asset Management Plans (AMPs) in capex forecasting. AMPs reflect network-specific requirements and provide evidence for investment needs, though they may not fully capture rapidly evolving demands like electric vehicle uptake or gas transition. Concerns are raised about the current capex cap of 120%, deemed arbitrary and potentially restrictive in light of the detailed AMP reviews. Stakeholders suggest that the Commission should relax or remove this cap, especially considering the necessity for EDBs to invest in decarbonization. Additionally, *the submissions recommend introducing flexibility mechanisms within the Default Price-Quality Path (DPP) to accommodate uncertainties in decarbonisation and resilience needs, mirroring approaches used by other entities like Transpower*.

B.3.2 Policy Changes and Future Capex Needs

The submissions also highlight the potential impact of policy changes on EDB-funded expenditures, especially in relation to capital contributions. There is a call for a mechanism within DPP4 allowing EDBs to adjust their capex allowances in response to legislative or regulatory changes. Furthermore, stakeholders express that historical expenditure is unlikely to reflect future capex needs due to significant changes facing regulated EDBs. They advocate for a reliance on up-to-date AMPs and minimal dependence on past spending levels to determine future capex allowances, arguing that this approach would better reflect the current and emerging challenges in maintaining and upgrading network infrastructure.

B.3.3 Connection Pricing and Contributions

The submissions emphasize the importance of capital contributions as a tool to ensure that new connectors pay the true cost of their connection without being subsidized by existing users. This is in response to varying views on the efficiency of EDBs' contributions policies. The lack of clear guidance from the Electricity Authority on efficient, cost-reflective approaches to contributions is noted. To enhance transparency, an interactive map detailing EDB connection policy is being introduced, highlighting the commitment to cost-effective and efficient connection practices.

B.3.4 Forecasting Connection Capex and Non-Network Alternatives

A new approach is suggested for forecasting connection capex, acknowledging the difficulty in predicting consumer connection expenditures, especially those driven by decarbonization initiatives. The submissions propose excluding connection capex from certain regulatory frameworks and incorporating specific flexibility mechanisms within the DPP. Additionally, there's a call for the Commission to delve deeper into how EDBs are considering Customer Energy Resources (CER) as non-network alternatives, and to integrate the potential for tariffs that incentivize consumer behaviour to reduce network costs. This reflects a broader view that EDBs should leverage non-network alternatives and advanced tariffs to optimize network efficiency and investment.

B.3.5 Capex, Deliverability, and Resilience

The submissions support the view that historical spend levels may not be indicative of future expenditure profiles due to structural changes facing regulated EDBs. There is advocacy for removing arbitrary capex limits and for mechanisms that recognize the unique deliverability considerations of each distributor. The need for regulatory support to boost market confidence in the EDBs' increasing work program is highlighted, alongside the importance of balanced capital contribution policies and the potential of technology in meeting demand more cost-effectively.

B.4 Revamping opex Forecasting

The submissions highlight a need for reevaluating the Commission's approach to opex forecasting, especially considering the opex base step and trend approach. Stakeholders argue this method fails to adequately account for new costs emerging in the Default Price-Quality Path (DPP4) or those escalating from DPP3. *A significant shift is recommended from the base step trend approach to incorporating EDBs' own non-network opex forecasts, allowing for a more accurate and responsive planning process*. Additionally, there's a call for clarity on the process and criteria for opex step changes, especially for costs that are difficult to verify and fall outside the scope of standard mechanisms like reopener, CPP, or IPA/INTSA applications.

B.4.1 Emerging opex Challenges: Data Management, Cybersecurity, and Insurance Costs

Submissions emphasize emerging opex challenges such as the rising costs of data acquisition and management, driven by new information disclosure requirements and the need for enhanced low voltage network visibility. The increasing reliance on smart meter data and the associated costs for acquisition, management, and protection of this data are

noted as significant. Cybersecurity is another major area of concern, with costs doubling in the past five years and expected to increase further. This rise is attributed to the need for advanced protection services against evolving cyber threats. Additionally, there has been a notable increase in insurance costs, attributed to heightened risks from extreme weather events. These factors, considered exogenous, are argued to warrant a step change in opex allowances.

B.4.2 Scaling Factors and Consideration for Network opex

The submissions also touch on the importance of selecting appropriate scaling factors for network opex, suggesting alternatives such as peak capacity and volume conveyed, to reflect structural changes in the energy sector. The increasing uptake of technologies like solar PV, battery storage, and EVs necessitates a more nuanced approach to scaling network opex. Historical spend levels may no longer be indicative of future needs in an environment experiencing significant structural changes. Stakeholders urge the Commission to consider a disaggregated view of expenditure categories rather than relying on aggregated baseline calculations, ensuring opex allowances are reflective of the evolving operational environment and the incremental requirements of new asset maintenance.

B.4.3 Addressing New and Uncertain Costs in opex Forecasting

There is a call to review the opex base step and trend approach to ensure it accounts for genuinely new costs arising in DPP4 and for those escalating from DPP3. This includes costs that are hard to assess within a low-cost regime and do not meet criteria for reopener or Customised Price-Quality Path (CPP) applications. Submissions also highlight the need for the Commission to recognize the increase in energy delivery from existing connections and the relationship between increasing opex costs and new growth, which may not be evident in historic datasets.

B.5 Balancing Affordability and Investment in Setting Revenue Allowances and Price Impacts

The submissions stress the crucial need to balance consumer affordability with adequate investment by Electricity Distribution Businesses (EDBs) for supporting electrification. While emphasising that distribution services must stay affordable, they must also allow EDBs to maintain their social license amidst increasing investments. To address affordability, a multi-dimensional approach is suggested, including price smoothing to mitigate the effects of inflationary price increases. The submissions recognise that managing significant price increases, particularly those driven by inflation, is essential for garnering customer support for electrification in a context of rising living expenses.

Regarding revenue allowances, the submissions propose a model that distributes costs across the long lifespan of assets, recognising the role of EDBs in managing cashflow disparities between regulatory revenue and expenditures. This model would encompass funding for increased capex spending and price smoothing mechanisms. However, there is a caution that price smoothing must follow a framework ensuring financial capital maintenance for networks, thereby compensating for heightened debt costs. Retention of a default X-factor of 0% and integrating productivity adjustments within the building blocks analysis are recommended, despite challenges in accurately measuring productivity.

Additionally, assessing price shocks for consumers should centre on the real year-to-year changes in aggregate distribution revenue, particularly across regulatory periods. This method involves translating revenue shifts into tangible impacts on electricity bills and overall household energy costs. Submissions note that while EDBs have limited control over external household and business costs, they can contribute to affordability through strategic pricing. Distinguishing between investment adjustments due to inflation and new investments is crucial for clear communication with stakeholders and customers about the reasons behind price increases.

In conclusion, the submissions call for a nuanced approach in setting revenue allowances and managing price impacts, ensuring that EDBs can sustain their operations and investments sustainably while keeping distribution services both affordable and valuable for consumers.

B.6 Revaluation of the Undercharging Mechanism and IRIS Incentives

A thorough re-evaluation of the voluntary undercharging amount foregone mechanism is advocated by stakeholders, originally implemented to mitigate the risk of substantial wash-up balances leading to consumer price shocks. They argue that this risk is more theoretical than practical, especially forprofit maximising EDBs, and that the mechanism might unjustifiably limit EDBs' revenues. They propose more targeted and proportionate methods to manage potential price shocks, such as imposing limits on annual price increases for EDBs with significant wash-up balances or enacting special measures in case of ownership changes. Additionally, stakeholders urge a reassessment of the IRIS mechanism's incentive structure, highlighting that its emphasis on minimizing expenditure could inadvertently hinder efficiency. They suggest that the Commission should critically assess the effectiveness of IRIS by considering the accuracy of expenditure forecasts and the real-world influence of the incentives, aligning them with long-term consumer interests.

Appendix C: Insurance cost

C.1 Infrastructure and building risk have been increasing due to climate uncertainty

Deloitte's Perspective: Insurance premiums for infrastructure and buildings are influenced by various factors including climate change, natural disasters, and construction costs. Deloitte's report indicates a strategic shift towards proactive loss prevention and mitigation, suggesting that insurers may offer more competitive premiums to businesses that invest in risk management and resilience against climate-related events (Deloitte, 2023).

- Implication: For EDBs, this might translate into potential premium benefits for enhanced network reliability and investment in resilient infrastructure.

Marsh's Perspective: Marsh (2023) suggests that property insurance premiums are increasing¬¬ globally, with the Pacific region seeing a rise, although the rate of increase has moderated. In New Zealand, particularly, the prevalence of flood risk has led to greater scrutiny by underwriters regarding coverage and pricing.

- Implication: It is likely that for EDBs, which are heavily invested in physical infrastructure, insurance premiums could continue to escalate due to such natural disaster risks, albeit at a moderated pace. Insurers' demand for formal valuations and adequate inflation loadings could also impact premium costs.

Transpower's Perspective: Transpower's approach to managing risks associated with infrastructure and building involves a blend of self-insurance, external insurance, and captive insurance through Risk Reinsurance Limited . Given the forecasted increase in premium rates and the value of insured assets, EDBs can expect similar pressures on insurance premiums for infrastructure and buildings. With the increasing occurrence of severe weather events, attributed in part to climate change, premiums are expected to rise to account for the greater risk (Transpower, 2023a, 2023b).

- Implication: For EDBs, this translates to a need for prudent forecasting and possibly higher set-asides for insurance costs in their financial planning.

C.2 The global market risk has been on the rise

Deloitte's View: The global insurance market is experiencing a hardening phase, with premiums rising due to a combination of factors such as macroeconomic volatility, higher claims costs, and a shift in the reinsurance market (Deloitte, 2023).

- Implication: For the EDB sector, which often requires substantial reinsurance to cover large-scale infrastructure risks, this could mean increased premium costs. However, as interest rates and inflation are expected to stabilize, there might be a potential easing of premiums later in 2024. The report's reference to a potential increase in M&A activity could also affect market capacity and pricing, depending on whether the result is increased competition or consolidation within the industry.

Marsh's View: Globally, insurance pricing is stabilising, but property lines remain challenging, indicating a sector that has not yet reached equilibrium (Marsh, 2023).

- Implication: This could imply that while EDBs might face steadier premiums in the general market, reinsurance, particularly for catastrophic-exposed risks, could still see fluctuations. The return of some competition in the market, as noted by the introduction of new capacity, may offer some relief in premium increases.

Transpower's View: The global insurance market's response to catastrophic events influences premium rates, which are reflected in Transpower's strategic insurance procurement. As these rates respond swiftly to global events, the

impact on reinsurance trends will likely see premiums rising, especially in high-risk zones prone to natural disasters such as earthquakes and floods (Transpower, 2023b).

- Implication: EDBs should remain vigilant about the international insurance market's health and any regulatory changes affecting reinsurance practices.

C.3 Cybercrime has been a significant factor and will continue to be an important risk

Deloitte's Perspective: Cybercrime poses a growing risk, particularly as infrastructure becomes more interconnected and reliant on digital technology. The Deloitte report underscores the insurance industry's role in mitigating the severity of cyber risks (Deloitte, 2023). It is probable that premiums for cyber insurance will continue to rise due to the increasing frequency and sophistication of cyber-attacks. However, companies that demonstrate robust cybersecurity measures may be able to negotiate better rates.

- Implication: EDBs can potentially mitigate the cost increases in cyber insurance premiums that they might face by implementing and maintaining robust cybersecurity measures.

Marsh's Perspective: For cyber insurance, the pricing trend is increasing, although the pace of increase has slowed, with a 6% rise compared to 8% in the previous quarter (Marsh, 2023). As EDBs become more reliant on digital technologies, the need for cyber insurance grows.

- Implication: The trend towards better coverage options and the importance of risk management in mitigating threats like ransomware suggests that EDBs could benefit from improved policy terms if they have strong cybersecurity measures in place.

Transpower's Perspective: Transpower has acknowledged the growing financial risks associated with cybercrime. While they do not detail the impact of cybercrime on their insurance premiums, the global trend indicates an uptick in cyber insurance costs (Transpower, 2023a, 2023b).

- Implication: EDBs in New Zealand, with their increasing reliance on digital infrastructure, should anticipate higher premiums for cyber risk coverage. The focus will be on risk management and mitigation strategies to keep these costs in check.

C.4 We expect a moderate growth over the DPP4 period

Transpower's insurance strategy for RCP4 balances external insurance with self-insurance to effectively manage financial risks. This strategy is realised through their use of Risk Reinsurance Limited, a captive insurer, for retaining manageable risks internally while externalizing more substantial risks. For instance, of their $750 million coverage for material damage and business interruption, $740 million is secured through external insurers, with $10 million retained within their own reinsurer.

Crucially, insurance premiums, a key element of their operational expenditure, are influenced by various factors beyond simple inflation. These include the perceived risk, past loss experience, availability of capital, and the value of insured assets. Importantly, premium rates are highly responsive to catastrophic events such as earthquakes, hurricanes, and floods.

For RCP4, the primary determinants of insurance opex are the type of insurance, the volume purchased, and prevailing market prices. Transpower anticipates an increase of nearly $50 million in insurance costs for RCP4 compared to RCP3, partly attributed to enhanced coverage for bushfire risks amidst growing climate change concerns. This forecast, based on expert advice, includes adjustments for rising premiums and the increased value of their assets. Also, In the upcoming RCP4, Transpower has forecasted a substantial 36 percent increase in insurance costs, as part of its overall 20 percent rise in opex. This increase is from $1,632.6 million in RCP3 to $1,957.6 million in RCP4.

It is noteworthy that despite these anticipated increases, Transpower's proposed resilience expenditure for RCP4 is not expected to impact on their insurance premiums immediately. The absence of business interruption cover (except for HVDC substations) and the nature of the resilience expenditure suggest that any potential reduction in claim values might only be reflected in insurance premiums from RCP5 onwards. The following table summarises Transpower's base-step-trend for forecasting the insurance premiums.

C.5 Findings from submissions

I. Transpower forecasted a 43 percent increase in nominal non-network opex insurance cost for the RCP4 period – ie an annual CAGR of around 7.4 percent. Based on the submissiosns, Orion NZ suggested that insurance cost constitutes 4 percent of their opex and their total insurance premiums has increased by 62 percent over the 2018-2023 period – this is equal to an annual CAGR of around 10 percent.

II. Electricity Networks Aotearoa (ENA) points out that over the last five years, the expenditure on insurance by EDBs has escalated by 63%. This upward trend is likely to not only continue but also accelerate due to insurers increasingly accounting for the heightened risks and impacts of extreme weather events in their pricing models. EDBs are confronted with a tough choice: either continue to shoulder the rising insurance premiums or consider reducing or dropping their coverage altogether. As EDBs essentially have no influence over insurance pricing, the substantial increase in costs is evidently noticeable in their Individual Disclosure disclosures, reflecting their vulnerability to the evolving insurance market. Consequently, ENA argues that insurance costs should be acknowledged as an exogenous factor, meriting a step change in pricing or a specific pass-through or escalator clause to accommodate these changes.

III. Unison Networks Ltd has highlighted to the Commission the ongoing rise in insurance costs, attributing it to increases in asset values, which escalate as the asset base of Electricity Distribution Businesses (EDBs) expands, thereby boosting the insurance coverage needed. Additionally, they point out that the rate hikes reflect the insurers' pricing for risk. Also, Unison Networks Ltd urges the Commission to assess the insurance costs of EDBs during DPP3 and their influence on the overall exceedance of operational expenditure, factoring in inflation. It's likely apparent that EDBs have strived to keep operational expenses under control, notwithstanding the significant step-up in insurance costs. They also draw attention to a potential link between the accepted IRIS (Individual Revenue Incentive Scheme) penalties for continuing to insure assets, which serves the long-term interests of consumers. This is because the IRIS introduces an additional cost beyond the premium, stemming from the under-recovery of costs and penalties incurred.

Appendix D: Estimated equations

Table D.4 illustrates the estimated equation for trend (tr) and cycle (cyc) of each LCI series. Where trend and cycle are not presented, we have used Fully Modified Ordinary Least Squares (FMOLS) for the trend component, which consists of a constant and a linear trend term along with the quadratic term. The cycle is estimated based on an ARIMA model and as usual, the number of lags is chosen based on the goodness of fit.

Table D.4 Estimated equations for LCI series

Predictors	All	EGW tr	EGW cyc	CON tr	CON cyc	PRO tr	PRO cyc	Comm
Method	ARIMA	FMOLS	ARIMA	FMOLS	ARIMA	FMOLS	ARIMA	ARIMA
log_pop (-4)	1.40***	-0.00		-0.02		0.02		-0.51***
	(0.11)	(0.04)		(0.18)		(0.18)		(0.08)
log_lci_all		1.00***		1.03***		0.95***		1.02***
		(0.03)		(0.11)		(0.12)		(0.05)
Net Migr (-4)			0.02		0.01		0.00	
			(0.04)		(0.03)		(0.02)	
OutputGap (-4)			0.01		0.22		0.15	0.01
			(0.28)		(0.14)		(0.15)	(0.01)
OutputGap (-1)								0.01**
								(0.00)
CPI (-1)	0.02							
	(0.07)							
CPI (-2)	0.07							
	(0.06)							
CPI (-3)	0.07							
	(0.05)							
CPI (-4)	0.07							
	(0.05)							
Constant	-14.50***	0.00	0.57	0.00	0.35	0.00	0.68	7.61***
	(1.73)	(0.67)	(0.79)	(2.89)	(0.41)	(2.94)	(0.37)	(0.93)
ARMA								
L.ar	1.00***		0.78***		0.47**		0.76***	
	(0.01)		(0.11)		(0.15)		(0.12)	
Constant	0.01***		0.92***		1.14***		0.58***	0.01***
	(0.00)		(0.07)		(0.18)		(0.08)	(0.00)
N	116	115	42	115	45	115	43	115
R squared		0.9996		0.9992		0.9991		

Source: Principal Economics

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.5 Estimated equations for PPI series

Predictors	All	HEV tr	HEV cyc	ELE tr	ELE cyc	RENT tr	RENT cyc
Method	ARIMA	FMOLS	ARIMA	FMOLS	ARIMA	FMOLS	ARIMA
log_pop (-4)	1.56***	-0.61**		-0.53		0.09	
	(0.22)	(0.19)		(0.60)		(0.31)	
log_ppi_all		2.37***		2.21***		0.80***	
		(0.12)		(0.39)		(0.20)	
Net Migr (-4)			-0.03		-0.03		-0.01
			(0.03)		(0.03)		(0.02)
OutputGap (-3)	0.00		0.10		0.38***		0.07
	(0.00)		(0.15)		(0.11)		(0.12)
CPI (-1)	0.54***						
	(0.15)						
CPI (-2)	0.07						
	(0.13)						
CPI (-3)	0.26*						
	(0.13)						
CPI (-4)	0.03						
	(0.18)						
Constant	-17.04***	0.00	2.16***	0.00	1.93***	0.00	1.32***
	(3.30)	(3.17)	(0.41)	(9.84)	(0.33)	(5.04)	(0.29)
ARMA							
L.ar	0.99***		0.60***		0.38*		0.46*
	(0.01)		(0.10)		(0.15)		(0.20)
Constant	0.01***		0.87***		0.97***		0.79***
	(0.00)		(0.08)		(0.10)		(0.11)
N	124	115	45	115	46	115	42
R squared		0.9973		0.9731		0.9969	

Source: Principal Economics

Standard errors in parentheses

* p < 0.05, ** p < 0.01, *** p < 0.001