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Forecast of PPI and LCI, and Uncertainty of Forecast

A review of the Commerce Commission Draft Decisions Paper: Reset of Starting Prices, CPI Adjustment and Other Amendments

Report to Powerco

Date 18th August 2011

About NZIER

NZIER is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice to clients in the public and private sectors, throughout New Zealand and Australia, and further afield.

NZIER is also known for its long-established Quarterly Survey of Business Opinion and Quarterly Predictions.

Our aim is to be the premier centre of applied economic research in New Zealand. We pride ourselves on our reputation for independence and delivering quality analysis in the right form, and at the right time, for our clients. We ensure quality through teamwork on individual projects, critical review at internal seminars, and by peer review at various stages through a project by a senior staff member otherwise not involved in the project.

NZIER was established in 1958.

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Executive summary

The Commerce Commission has published a draft decision paper on resetting the starting price for Electricity Distribution Businesses (EDBs) for the 2010-2015 Default Price-Quality Path (DPP). Central to resetting the starting price is the projection of EDBs' future profitability. This is based on the projections of CPI, real revenue growth, operating expenditure (opex) growth, and capital expenditure (capex) growth.

NZIER has been asked by Powerco to:

- provide an independent expert review on the Labour Cost Index (LCI) and Producer Price Index (PPI) forecasts used by the Commerce Commission in determining opex growth;
- review if there are any issues in using a sector specific forecast of PPI or LCI rather than an economy-wide forecast;;
- consider whether or not forecast uncertainty should be considered in all the forecasts used by Commerce Commission;
- assess the combined effects of forecast errors associated with each individual factor, such as LCI, PPI, GDP, etc., on the Commerce Commission's forecasts of real revenue and opex growth.

This report sets out NZIER's methodology in forecasting PPI and LCI, and has explored the forecast performance of major economic indicators, such as GDP growth. One conclusion from this is that forecasts of economic indicators are always associated with uncertainty and there is a need for caution in using forecasts.

We have made customised electricity and gas sector-specific forecasts of PPI and LCI. We find that in long run, sector specific PPI and LCI have similar trends as economy-wide PPI and LCI, however sector-specific PPI is more volatile in the short term. Sometimes, the divergence of sector-specific PPI from economy-wide PPI can be significant. This could affect EDBs' profitability under the regulatory regime proposed in the Commission's draft decision paper. We suggest that the Commission take into account the sector specific PPI changes, while using economy-wide PPI for input cost indexation.

All forecasts are associated with risks and uncertainties. We find that the Commission uses only point estimates and takes the point forecasts as precise forecasts in setting up the starting price for EDBs. Consequently, EDB's actual costs and revenues may be higher or lower than required to enable EDBs to earn a normal return. This may impact EDBs' incentives to invest and to share profits with consumers. Uncertainties are part of normal business life. The problem is how, in a regulated environment, these uncertainties can be managed within the price control period. We suggest that the Commission incorporate forecast uncertainty into its price resetting, and explore the impacts and combined impacts of uncertainties associated with the forecasts used by the Commission. We recommend that the Commission use a maximum allowable revenue within a range.

We have experimented with incorporating some degree of forecast uncertainty into starting price resetting by completing some sensitivity testing. We have found that forecast uncertainty will indeed have impacts on EDBs' starting price and future profitability. The combined effects of uncertainty associated with several forecasts could be even higher.

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1. Introduction

The Commerce Commission has published a draft decision paper on resetting the starting price for EDBs for the 2010-2015 Default Price-Quality Path (DPP). Central to resetting the starting price is the projection of EDBs' future profitability. This is based on the projections of CPI, real revenue growth, operating expenditure (opex) growth, and capital expenditure (capex) growth.

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2. Review of LCI and PPI used

The Commerce Commission has adopted the NZIER forecasts of the LCI and PPI, as these forecasts are seen as independent and reputable. In this section, we explain NZIER's methodology in forecasting LCI and PPI, and discuss the need for caution in using forecasts, as they cannot incorporate all risks – in particular, those risks Donald Rumsfeld coined the "unknown unknowns".

2.1 Methodology

NZIER publishes its economic forecasts for the next 5 years in its *Quarterly Predictions* publication. The general method to forecast inflation is to combine the impact of external factors (commodity prices and exchange rate movements) with local conditions (pace of economic growth).

2.1.1 Forecasting PPI inflation

The forecasts for PPI inflation build on NZIER's forecasts for the CPI. PPI and CPI inflation are closely correlated and are driven by the same forces. PPI is measured at the producer level, while the CPI is measured at the final consumer purchase level.

NZIER forecasts inflation in its components. The best way to think about inflation is in two parts, inflation in tradable goods prices and in non-tradable goods. Tradable

inflation is related to global price movements (particularly oil and soft commodity prices), but non-tradable inflation is generated by domestic market growth pressures. If the economy is growing rapidly then inflation will build over time, generally with a lag of around six to twelve months.

PPI = f(Global Commodity Prices, Exchange Rate, Output Gap)

2.1.2 Forecasting LCI inflation

The Labour Cost Index is a measure of labour costs to businesses. It is driven by changes in the supply and demand for labour. When economic growth is strong wages tend to rise. Wage increases accelerate further if there are shortages of suitable labour.

NZIER estimates real wage inflation (wage inflation excluding CPI inflation) using a combination of employment growth and measure of labour supply. CPI inflation is then added to real wage inflation estimates to arrive at nominal LCI wage inflation.

LCI = f(CPI, Employment Growth, Labour Shortage)

2.2 Risks and caveats[1]

Forecasting the future performance of the economy is a mix of science and art. The economy is complex and inter-related; as a result simplified models of the economy often require judgements to reflect current economic trends and likely 'surprises'. However, unexpected 'shocks' obviously cannot be accounted for ahead of time.

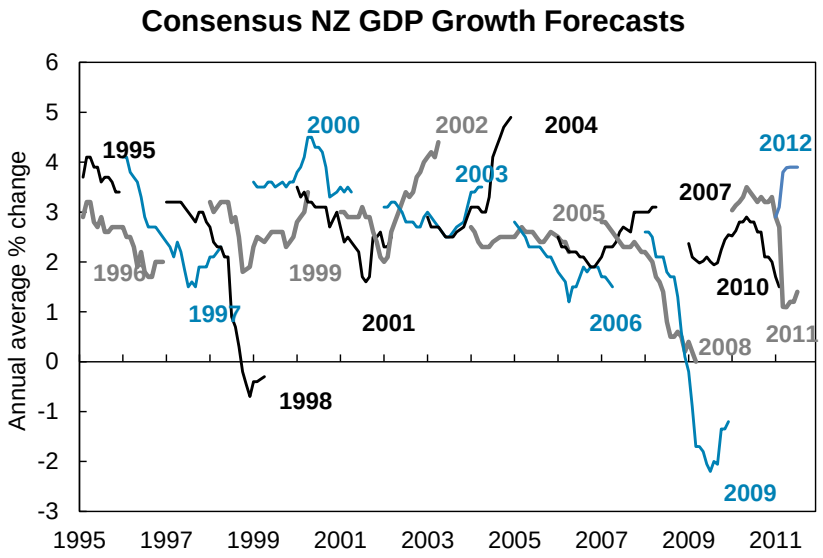
In spite of the difficulties, forecasts are essential for many institutions – they have to have a 'view' of the future. Forecasts provide a baseline scenario for planning purposes for businesses, government and the Reserve Bank of New Zealand (RBNZ). Businesses will not invest in new capacity, hire more staff or pay higher wages unless they think there will be demand for their products and ability to recoup their investments. The government needs to know the outlook for the economy so that it can budget for its planned expenditures and revenue collection. The RBNZ needs to forecast the economy to have a view on the likelihood that inflation will become a problem or if the economy is likely to slowdown.

In using forecasts it is essential to understand that each of the numbers produced is the mid-point of a range. In other words, each point forecast is surrounded by a standard error. Forecasters attempt to incorporate all current information and possible future direction of drivers of the economy. Forecasters attempt to incorporate the 'known' uncertainties, such as the direction of interest rates. However, there are also 'unknown' uncertainties like the Global Financial Crisis – the timing and severity of which could not have been predicted with accuracy beforehand.

[1] This section is sourced from the forthcoming book: Lattimore R. and S. Eaqub (2011), The New Zealand Economy: An Introduction, Auckland University Press

For all these reasons it is helpful to appreciate the extent of past forecast errors. Forecasters need to evaluate their past errors in order to improve forecasting systems. The following graph illustrates past GDP forecast errors in New Zealand. The forecasts of GDP in Figure 1 are consensus forecasts – the average of past forecasts made by the major forecasting institutions. The graph clearly shows that forecasters are routinely taken by surprise.

Figure 1 Forecast errors over time[2]



Source: Consensus Economics

For example, the line labelled 2009 in Figure 1 shows the progression in consensus forecasts from October 2008 to the final forecast of the 2009 year in December 2009. In October 2008 (23 months before the target date) forecasters expected the New Zealand economy to grow by +1.3 percent in 2009. By July 2009 they revised this forecast down to -2.2 percent. In the end the economy contracted by -1.7 percent, in part helped by an unprecedented reduction in interest rates and efforts by authorities around the world to boost economic growth. Forecasters tend to overshoot or undershoot with their forecasts as they did for 2009. However, initial estimates for 2000 were fairly reliable.

2.3 Adjusted vs. unadjusted LCI inflation

The LCI index forecasted is the All industries/occupations combined - All sectors combined (SG53Z9) index which reflects "movements in base salary and ordinary time wage rates, and overtime wage rates for a fixed quantity and quality of labour

[2] Each line shows the trajectory of GDP growth forecasts and eventually the actual GDP growth rate for the year as labelled beside the line. For example, the line labelled 2000 shows the trajectory of GDP growth forecasts for 2000 starting from 1998 and the actual GDP growth rate in 2000.

input. This means that changes in pay rates due to the performance of employees and promotions, among other things, are not shown in the index"[3].

The increasing engineering and regulatory complexities that Powerco faces is likely to require an increasing number of more highly qualified staff to be employed, and therefore a reasonable measure of future labour cost increases must account for quality changes in the workforce.

The adjusted LCI index used does not accommodate such quality improvement demands, such as improvements in the performance of employees (and associated performance pay), changes in qualification, duties, responsibilities, numbers of hours worked and levels of experience of length of service. These are all quality aspects that Powerco must remunerate in the coming years to fulfil increasing quality output and productivity demands.

If the adjusted LCI index is used then Powerco would not be adequately compensated by regulation for rewarding the productivity gains of its employees. As a result, there is no incentive to improve the relative efficiency and effectiveness of Powerco's employees.

2.4 Summary

NZIER is a reputable organisation, it produces highly regarded *Quarterly Predictions*. The Commerce Commission has adopted NZIER's forecasts of the LCI and PPI for resetting EDBs' DPP. NZIER's predictions of LCI and PPI are based on sound economic theory and has a good record of forecasting performance. However, as any other forecasting organisations, NZIER's forecasts are subject to forecast errors, so the forecasts must be used with caution.

3. Forecasting electricity industry specific LCI and PPI

Powerco has asked NZIER to review if there are any issues in using a sector specific forecast of PPI or LCI rather than an economy-wide forecast. . The most sector specific LCI forecast we can make will be at the level of Electricity and Gas, and Water industry rather than at the level of electricity distribution. The most sector specific PPI forecast we can make will be at the level of the electricity and gas industry. Because the historical LCI and PPI data at electricity distribution business level are not available.

3.1 Economy-wide vs. industry level indicators

There are some similarities between the LCI and PPI indices specific for the electricity and gas industries when compared with all industries. Over the medium

[3] Statistics New Zealand website, *A comparison between the adjusted and unadjusted labour cost index, July 2008.*

term, they tend to reflect similar growth rates, but the electricity and gas series are more volatile, particularly for PPI input inflation. Sometimes, the divergences between industry specific costs and economy wide measures are rather significant. The two key areas difference could be in:

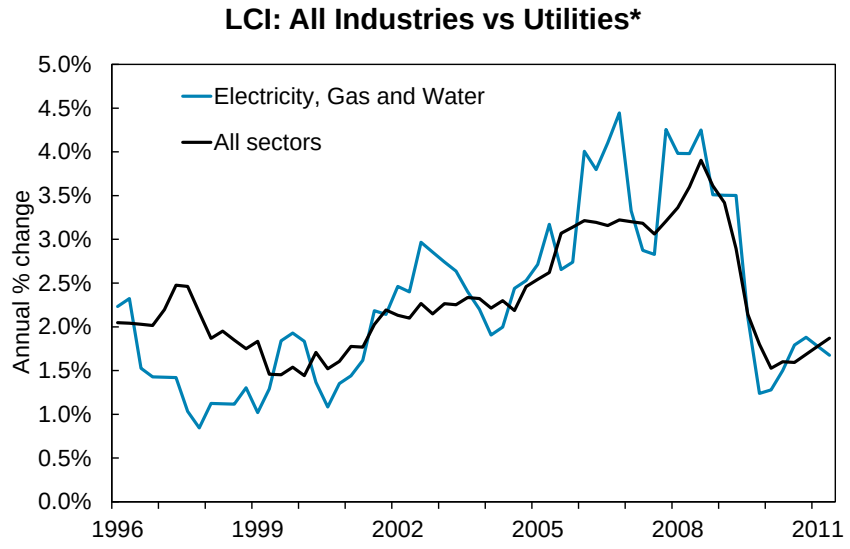
- volatility of inflation
- average rate of inflation.

Figures 3 to 6 compare the trend of sector-specific vs. economy-wide PPI and LCI inflation. Simple analysis of the inflation rates in the LCI and PPI from 1996-2011 shows that:

- Electricity, Gas and Water sector LCI inflation has been around 0.2%pt higher than the economy wide average over the past decade and it is more volatile; and
- Electricity, Gas, Water and Waste Services PPI input inflation has been similar over the past decade, but significantly more volatile

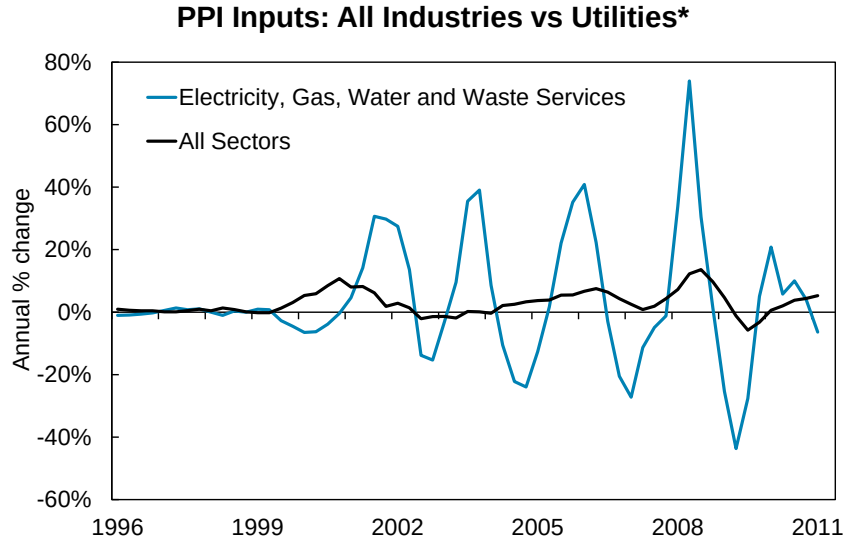
In forecasting, the influencing factors differ between the electricity and gas sectors and other industries. The inputs involved are similar, but the weights and sensitivity differ. This produces highly variable forecasts for the PPI index for electricity and gas.

Figure 2 LCI wage inflation



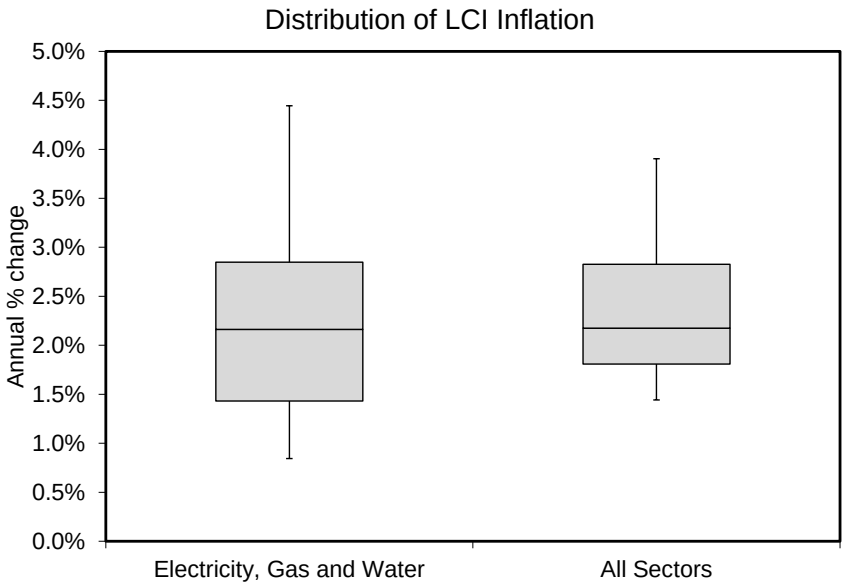
Source: Statistics NZ, NZIER (*Electricity, Gas and Water)

Figure 3 PPI input inflation



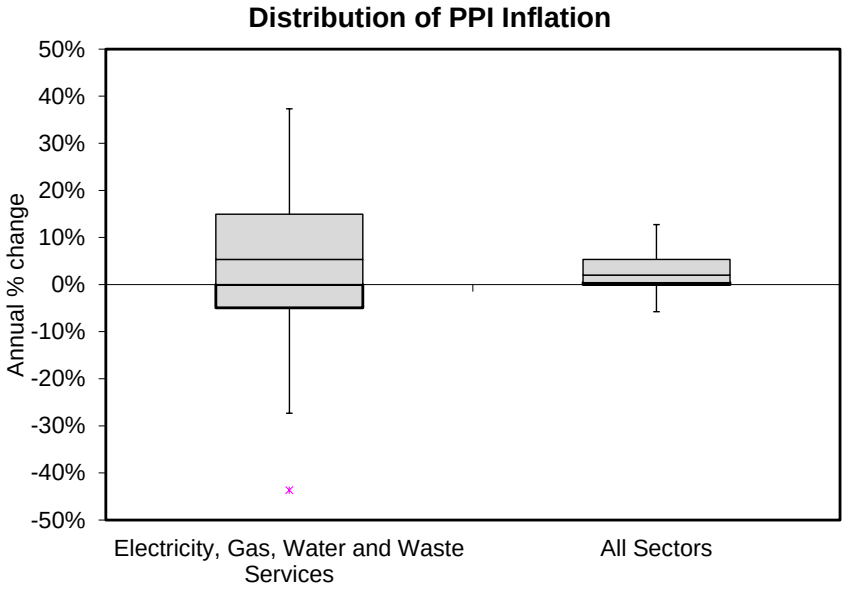
Source: Statistics NZ, NZIER (*Electricity, Gas and Water)

Figure 4 Distribution of LCI inflation



Source: NZIER

Figure 5 Distribution of PPI inflation



Source: Statistics NZ, NZIER

3.2 Industry specific forecasts

Data is not available for the specific industry levels, so proxies have been used that most closely represent the electricity and gas sector. More specifically:

- LCI: Electricity, gas, water, and waste services sub-index
- PPI inputs: Electricity and gas supply sub-index.

As with the all industry series forecasts, NZIER's *Quarterly Predictions* provides the inputs used in the analysis.

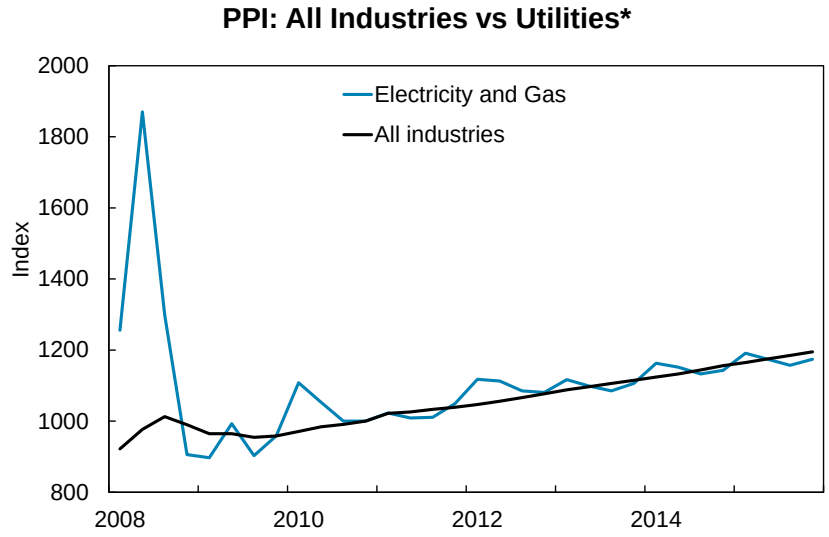
3.2.1 Comparison of PPI input forecasts

Forecasts for PPI input inflation are presented in two graphs. The first graph of the index levels reflects how the series tends to follow a similar growth path over the medium term. Due to some of the spikes appearing in the data, a dummy variable was introduced for June 2008 where the index spiked 600 points for one quarter. This was different to previous price increases which usually persisted for several quarters before prices eased.

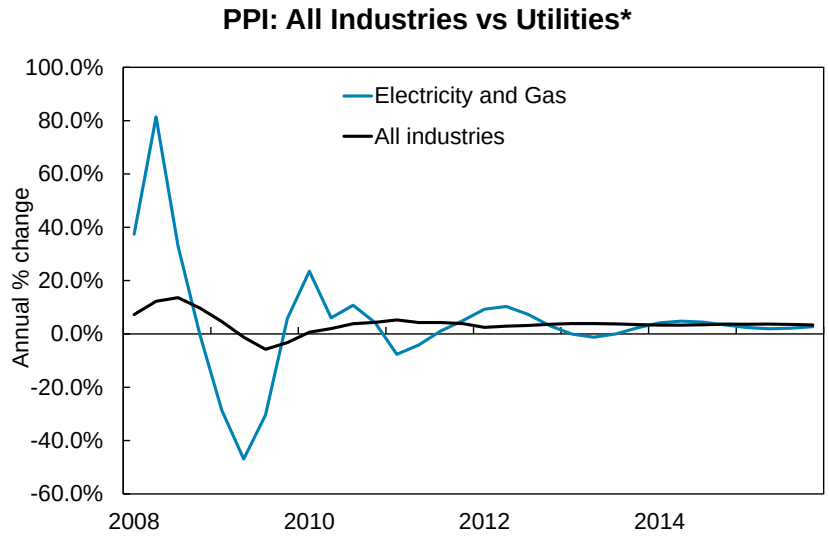
The growth rate forecasts for PPI reflect that after short spikes in the electricity and gas series, growth rates slow and converge back towards the all industry series. This variation has occurred through the history of the electricity and gas supply sub-index.

The timing and variability of the electricity and gas forecasts provides a large point of difference between the series. Temporary shocks and spikes are possible beyond what is incorporated in the forecasts. However, growth rates would be expected to return to normal levels shortly after.

Figure 6 PPI input inflation



Source: Statistics NZ, NZIER (*Electricity and Gas)



Source: Statistics NZ, NZIER (*Electricity and Gas)

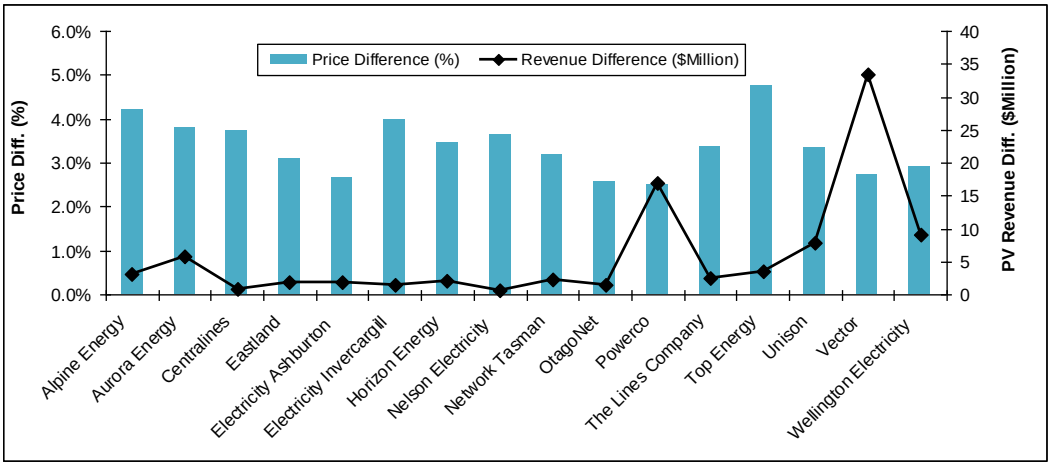
3.3 Implications of PPI shocks on Starting Price

The electricity and gas industry specific PPI index tends to be more volatile than the economy-wide index. Short term sector specific shocks tend to have bigger impacts on sector-specific PPI than on the economy-wide PPI. In 2008, the sector-specific PPI increased by around 80%; at the same time, economy wide PPI increased by less than 20%; by 2009, sector specific PPI has returned to its long term trend. This sharp input price increase will affect EDBs' input costs.

To estimate the potential impacts of a similar shock on EDBs' profitability, using the Commission's price reset model, we have simulated the impacts of this shock and the consequent increase in input costs on starting price adjustment and the present value of the maximum allowable revenue between 2012/13 and 2014/15, assuming

that at 2012, the electricity sector is to experience a similar shock in PPI, with PPI increasing by 80% in 2012, and decreasing by 45% in 2013, and increasing again by 20% in 2014. The results are shown in Figure 8.

Figure 7: The differentials resulting from the hypothetical PPI shocks



Source: NZIER

As a result of this shock and the consequent increase in input costs, all the EDBs' starting prices should be adjusted upward compared with the starting price adjustment under the Commission's current assumptions to enable them to earn a normal return. For Powerco, this shock will lead to a 2.5% differential in starting price adjustment for 2012/2013 and the PV of revenue forecast to increase by more than $16.8 million between 2012/13-2014/15.

By doing this, we are trying to estimate what would be the maximum allowable revenue for EDBs, experiencing such an unexpected input price shock, to achieve at least a normal return, rather than suggesting the Commission use a sector-specific PPI index instead of economy-wide PPI for input cost indexation.

This simulation suggests that economy-wide PPI may not fully capture unexpected shocks and EDBs' input cost increase will be under-recovered. We suggest that in setting up the starting price and the DPP, it may be necessary for the Commission to take sector-specific shocks into account, while still using economy-wide PPI for input cost indexation. The advantage of this is to protect EDBs from being exposed to risks outside the control of EDBs.

4. Dealing with forecast uncertainty

As we have explained in section 2, any forecast involves risks and uncertainties. This may have impacts on EDBs' future profitability as has been illustrated with the hypothetical PPI shocks in section 3. However, the Commerce Commission's current methodology does not consider uncertainty associated with the forecasts. The starting price adjustment in the draft decision is based on the point forecasts of: opex, capex, real revenue, and the CPI.

4.1 Sources of forecast uncertainty

While CPI and capex are individually forecast by RBNZ and EDBs respectively, opex and real revenue forecasts are constructed as combinations of forecasts of other economic, demographic indicators at national, regional, or individual EDB level, such as regional population growth, GDP growth, electricity demand growth, etc.

The ex-ante nature of the forecasting process will mean that there will always be risk and uncertainty associated with these forecasts. The risks and uncertainty come from three sources:

- exogenous assumptions – for example, electricity demand forecasts are driven by a number of assumptions on future economic activities, such as GDP growth, population growth, etc, which will not necessarily be accurate and produce errors in outcomes, especially in the current situation of economic uncertainty associated with the global financial crisis;
- stochastic model error – it is usually impossible to perfectly estimate the relationship between all possible factors and electricity demand (random effects); and
- non-stochastic error – such as bad input data and misspecification of the forecasting model, etc.

A recent New Zealand Treasury working paper[4] has investigated its forecasting performance of GDP and CPI against 13 other forecasting organisations, including NZIER. The paper found that all the forecasts have forecast errors, and none of the foresters predicted the recession beginning from March 2008.

4.2 Impacts of forecast uncertainty

Uncertainties will impact EDBs' future profitability, their ability to earn a normal return, their incentives to invest, and eventually the price paid by consumers over time. The impacts could come from various sources:

- on the revenue side – actual real revenue growth may be lower/higher than forecast. Consequently, EDBs' revenue could be lower or higher than necessary to cover the cost and to allow EDBs to earn normal returns. Changes in demand could also affect a firm's operating costs, and may mean that more capex is required or some capex is unnecessary.
- On the production cost side – actual opex and capex growth may be lower or higher than the forecasts due to unexpected increases in material and wage costs. There may also be unexpected investment in repairs and replacement, etc.
- Investment side – uncertainty will impact on EDBs' incentive to invest, leading to underinvestment in the electricity network, and higher consumer prices over time.

4.3 Dealing with forecast uncertainty in regulation

These uncertainties are a normal part of doing business. The question is how, in a regulated environment, these uncertainties can be managed within the price control

[4] New Zealand Treasury (2011), Treasury's Forecasting Performance, 7th July 2011,

period. There are many different approaches in dealing with uncertainty in regulation, including, among other things:

- Constructing a confidence interval around point estimates, and incorporating the forecast uncertainty into the price resetting process as the Commission has already done with WACC by using the 75th percentile rather than the mid point; or
- Having a dead band around the starting price adjustment, such that an adjustment would only be made where it passed a ex-ante prescribed materiality threshold with an ex-ante prescribed size adjustment.

Introducing a mechanism to cope with uncertainty may lower the financing cost, reduce EDBs' financial concerns, and reduce both EDBs' and consumers' exposure to forecasting uncertainty.

4.4 Summary

In this section, we have discussed the sources and the impacts of forecast uncertainties on EDBs' future profitability, and have identified approaches to deal with uncertainty under regulation.

We suggest that the Commission incorporate forecast uncertainty into its price resetting process by constructing confidence intervals around each forecast used by the Commission, and to explore the impacts of forecast uncertainty on setting up starting price and DPP, and may come up with a range of allowable revenue or starting price within which EDBs should operate.

5. Assessing the impacts and combined impacts of forecast uncertainty.

In this section, we are going to gauge the effects, and the combined effects, of uncertainties associated with the forecasts used in the Commission's price reset model. Based on the available information and for illustration purpose only, we have chosen the following forecasts to explore the effects and combined effect of forecast uncertainty:

- sector specific PPI shocks (to capture the real material input cost increases). The assumptions of the shocks are the same as in section 3.2;
- CPI forecast; we have constructed a 75% confidence interval around the CPI forecasts as below, based on RBNZ's historical CBI forecast performance:

Table 1: CPI forecasts with 75% Confidence Interval

	ΔCPI, 8 index, lagged 18 months			ΔCPI, 2 index, March - March, no lag, 2009 forecast		
year	CC Assumption	Lower Bound	Upper Bound	CC Assumption	Lower Bound	Upper Bound
2009/10	3.92%	3.40%	4.43%	1.72%	1. 1%	2.24%
2010/11	2.47%	1.95%	2.98%	1.98%	1.46%	2.50%
2011/12	1.70%	1.18%	2.22%	2.43%	1.92%	2.95%
2012/13	2.07%	1.56%	2.59%	2.43%	1.91%	2.94%
2013/14	2.45%	1.93%	2.96%	2.43%	1.91%	2.94%
2014/15	2.43%	1.91%	2.94%	2.43%	1.91%	2.94%

Notes: This calculation is based on RMSE (Root Mean Squared Error) reported in the Treasury Working paper, and assumes normal distribution of forecast error with mean of zero.

Source: NZIER

- We would also like to include uncertainty of regional GDP forecast. However, there is not enough information to develop a confidence interval for regional GDP forecasts as we have done for CPI; so we exclude GDP forecast uncertainty from the analysis.

Using the Commission's price reset model, we have simulated the impacts of forecast uncertainty in 6 scenarios for Powerco. The 6 scenarios are as the follows:

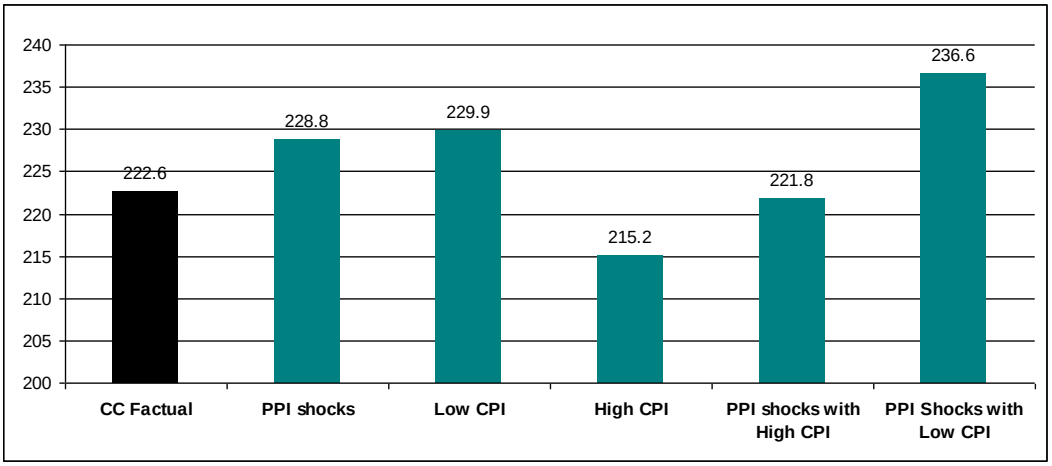
- Commerce Commission's current assumption, which is used as the baseline scenario for the other 5 scenarios to compare with;
- Sector-specific PPI shocks, PPI increases by 80% in 2012, drops by 45% in 2013, and increase by 20% in 2014;
- Higher CPI increase (upper bound of 75th confidence interval);
- Lower CPI increase (lower bound of 75th confidence interval);
- PPI shocks together with high CPI increase; and
- PPI shocks together with low CPI increase.

The simulated maximum allowed net revenue and indicative price adjustment in 2012/13, and the simulated present value (PV) of forecast revenues as at 1 April 2012 are shown in the Figure 9-11. The simulated results suggested that:

- The Commission's price reset model is very sensitive to CPI uncertainty. For example, there is only 1% point difference between high CPI and low CPI scenarios, however there is around a $15 million difference in maximum allowed net revenue in 2012/13, 9% difference in indicative price adjustment in 2012/13, and more than $30million difference in the present value of forecast revenues.
- The combined effects of forecast uncertainty are even more significant. For example, comparing with the Commission's baseline scenario, under the scenario with industry-specific PPI shocks and low CPI increase, Powerco would have $14

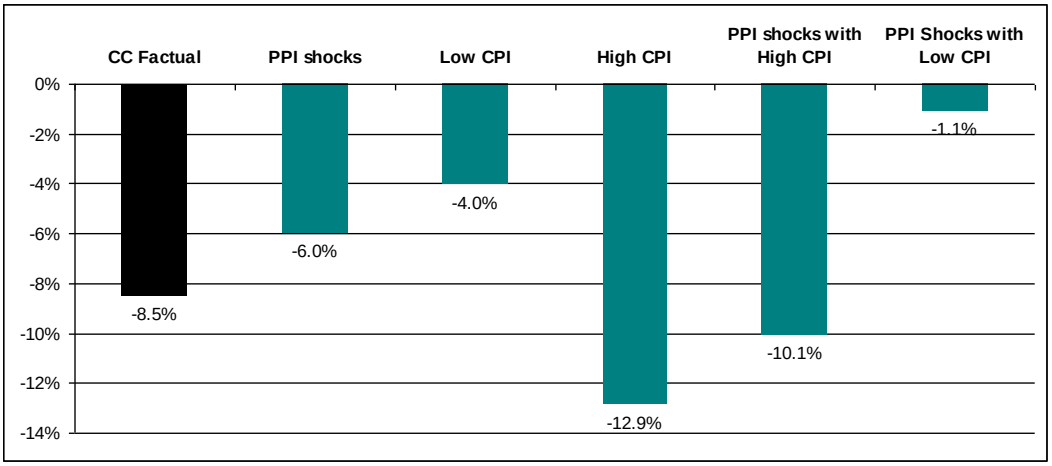
Million more allowed net revenue in 2012/13, and have $30 million more of PV forecast revenue, and would only need to adjust the starting price down by 1.1%.

Figure 8: 2012/13 maximum allowed net revenue($Million)



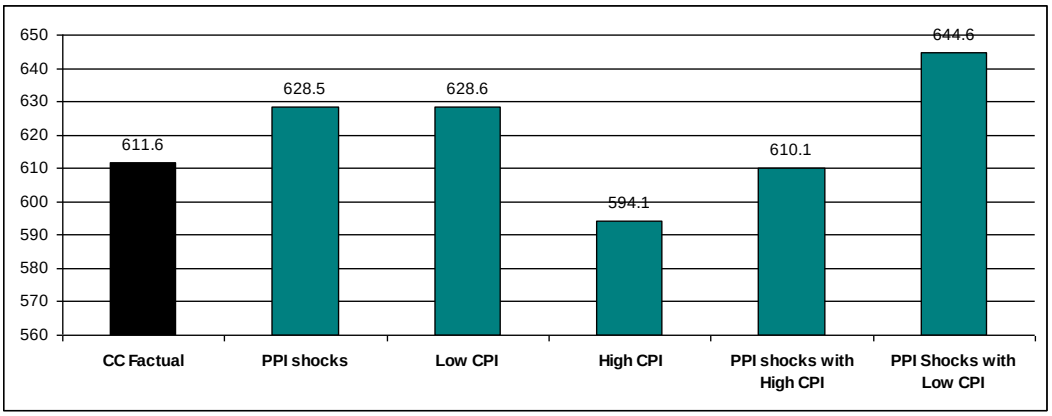
Source: NZIER

Figure 9: Indicative adjustment to net revenue in 2012/13



Source: NZIER

Figure 10: PV of forecast revenues as at 1 April 2012 ($Million)



Source: NZIER

We have found that forecast uncertainty will indeed have impacts on EDBs' starting price and future profitability. The combined effects of uncertainty associated with several forecasts could be even higher. Therefore, we suggest that the Commission take forecast uncertainty into account in resetting starting price and DPP.

6. Conclusions

In this report, we have reviewed NZIER's methodology in forecasting PPI and LCI, and have explored the forecast performance of major economic indicators, such as GDP growth. One conclusion is that forecasts of economic indicators are always associated with uncertainty and that there is a need for caution in using forecasts.

Then we have examined customised electricity and gas sector-specific forecasts of PPI and LCI. We find that in the long run, sector specific PPI and LCI have similar trends as economy-wide PPI and LCI, however sector-specific PPI is more volatile in the short term. Sometimes, the divergence of sector-specific PPI from economy-wide PPI can be significant, which could affect EDBs' profitability under the regulatory regime proposed in the Commission's discussion paper.

All forecasts are associated with risks and uncertainties. We find that the Commission uses only point estimates and takes the point forecasts as precise forecasts in setting up the starting price for EDBs. Consequently, EDBs' actual cost and revenue may be higher or lower than required to enable EDBs to earn a normal return, which may have impacts on EDBs' incentives to invest and to share profits with the consumers. Uncertainties are part of normal business life. The problem is how, in a regulated environment, these uncertainties can be managed within the price control period. We suggest that the Commission should incorporate forecast uncertainty into its price resetting, and explore the impacts and combined impacts of uncertainties associated with the forecasts used by the Commission, and come up with a maximum allowable revenue with a range.

We have experimented with incorporating some degree of forecast uncertainty into starting price resetting by doing some sensitivity testing. We have found that forecast uncertainty will indeed have impacts on EDBs' starting price and future profitability. The combined effects of uncertainty associated with several forecasts could be even higher. Therefore, we suggest that the Commission take forecast uncertainty into account in resetting starting price and DPP.