Limitations in regional GDP projections

Implications for forecasting non-residential electricity demand

NZIER report to Wellington Electricity

August 2014

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Each year NZIER devotes resources to undertake and make freely available economic research and thinking aimed at promoting a better understanding of New Zealand's important economic challenges.

NZIER was established in 1958.

Authorship

This report was prepared at NZIER by John Stephenson.

The assistance of Dr Erwin Corong and Shamubeel Eaqub is gratefully acknowledged.

Limitations in regional GDP

We have been asked to comment on limitations in using NZIER's regional GDP projections for projecting electricity demand.

Aggregation and averaging obscures important dynamics

The main limitation in NZIER's regional GDP projections, for the purposes of forecasting demand on distribution networks, is that headline regional GDP obscures important dynamics behind electricity demand.[1]

This aggregation problem can be divided into:

- **Industry aggregation**: shifts in industry composition are important drivers of GDP forecasts and of electricity demand but these cannot be seen in the aggregate GDP numbers.
- **Regional aggregation**: regional level aggregations hide large differences within regions and across distribution networks which do not map one-to-one with regions.

Impacts of aggregation can be reduced

All high-level data and forecasts suffer from aggregation problems but if these limitations are taken into account and adjustments made to minimise their effects then regional GDP can be a useful input for forecasting electricity demand.

NZIER's regional GDP forecasts are constructed using underlying variation in industry growth and regional variations. Electricity forecast methods which adopt a similar approach can therefore be both consistent with NZIER's regional GDP projections and control for inaccuracies due to aggregation problems.

Commerce Commission's forecast methods make matters worse

The Commerce Commission's forecast methods do not take account of underlying variation. This means the limitations inherent in our regional GDP forecasts are made worse. It also means the Commission's approach is inconsistent with our regional GDP forecasts.

More generally, the Commission's forecast methods are poor. We have not been asked to comment on this but the validity of the overall method is relevant to our consideration of the limitations in the use of regional GDP.

Discussion below elaborates on the inconsistencies between NZIER's methods and the Commission's methods and the extent to which these inconsistencies exacerbate aggregation issues inherent in NZIER's regional GDP projections.

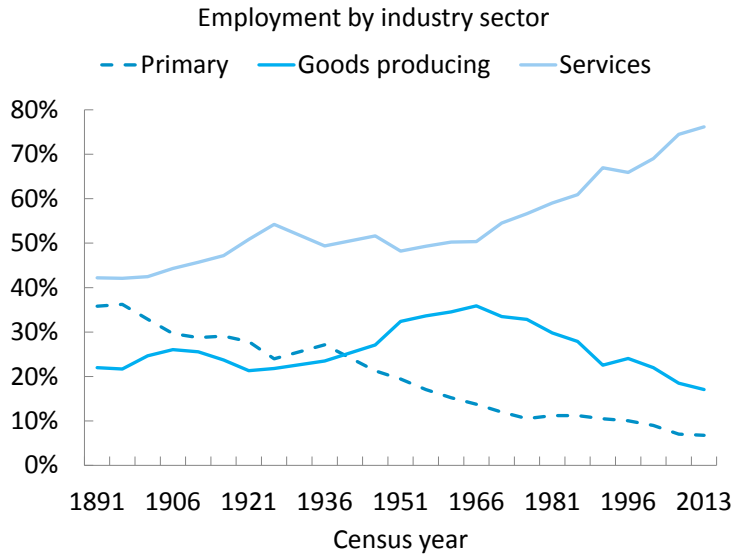
[1] A relatively minor point is that the Commerce should use GDP excluding the household contribution (Owner Occupied Dwellings, approximately 5% of production GDP) as growth in this component is explicitly not related to non-residential demand.

NZIER forecasts reflect observed trends and persistent variation

Forecasts should be able to account for trends over time and persistent variations. Accordingly, the main drivers of our regional GDP projections are:

- long term trends in industry shares of GDP including the increasing shares of services in overall economic activity (see Figure 1)
- existing regional variations in industry composition ('regional comparative advantages').

Figure 1 Long term rise of services sector



Source: NZIER, Statistics New Zealand

Electricity demand forecasts should incorporate similar dynamics

A reasonable electricity demand forecast method should adopt a similar approach – even if it is conducted at a high level and based on simple methods.

Electricity demand forecasts should be able to account for market trends and geographical variations. This means using methods that can account for:

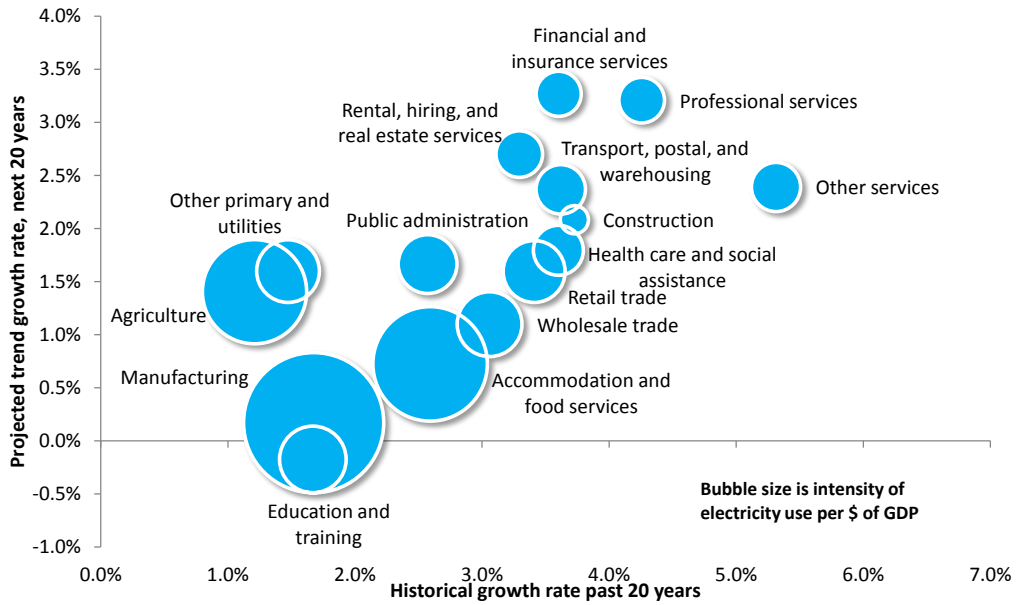
- declining electricity use (intensity) relative to economic activity
- changes in the industry composition of economic activity
- large differences in economic growth and electricity demand across regions.

Note also that these drivers imply that the relationship between our GDP projections and energy demand should vary by region and should be reducing in strength over time.

The intuition behind this can be seen in the growth trends charted Figure 2. High growth sectors, past and present, are sectors with low electricity use per unit of GDP.

A model which holds the relationship between GDP and electricity constant over time is thus inconsistent with our regional GDP forecasts.

Figure 2 Industry growth and intensity of electricity use



Source: NZIER

Commission's methods need attention to observed trends

The Commerce Commission's forecast method holds the relationship between GDP and electricity constant over time and is thus inconsistent with our regional GDP forecasts.

Declining intensity of energy use reflects two trends in the economy. One is the declining share of GDP from industrial and primary sector activities. That is, activity has shifted from more to less energy intensive sectors.[2]

The other trend is declining energy intensity in all sectors of the economy. These are clear long term trends.

Together these trends imply a changing (or non-linear) empirical relationship between electricity demand and economic growth.

The Commerce Commission has used NZIER's regional GDP projections, multiplied by a growth factor, to forecast non-residential electricity demand on distribution networks.

Regional GDP thus plays a significant role in the Commission's forecasts. It is, for example, the only predictor used for projecting non-residential demand. The relationship between regional GDP and regional non-residential electricity demand is assumed to be large constant over time with a 0.72% change in electricity demand

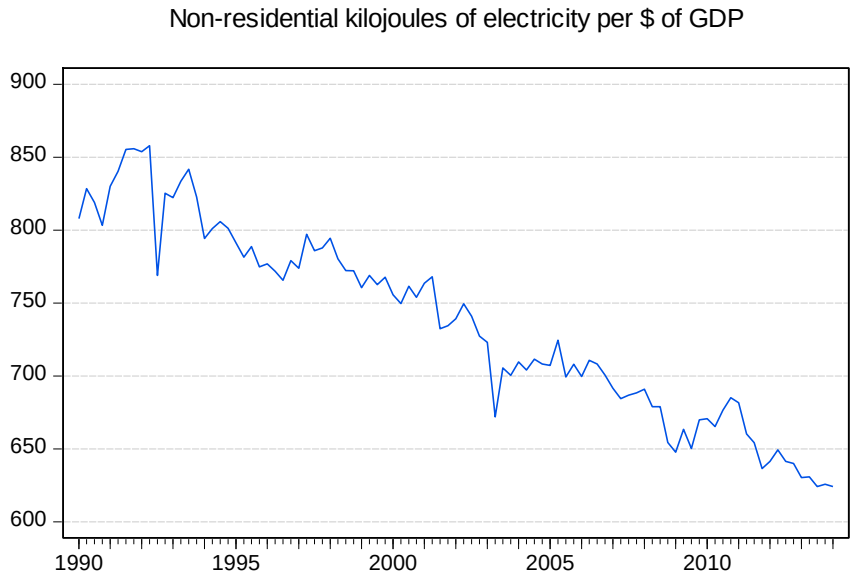
[2] Note that this is only true in relative terms. Industrial and primary sector activity has continued to grow but more slowly than other sectors.

for every 1% change in regional GDP. This relationship is assumed to be the same for all regions and is assumed to remain constant over time.

We question the validity of the Commission's overall method. In our view, the assumed relationships between regional GDP and non-residential electricity are not reasonable and the econometric model(s) used to estimate these relationships are not fit for purpose.

The Commerce Commission's recent update of its econometric model for non-residential demand has produced the particularly curious result of increasing the assumed rate at which demand grows relative to GDP, from 0.52 to 0.73. As shown in Figure 3, this updated information is very hard to square with what we see in the data. We would have expected new information to cause a reduction in the relationship rather than an increase.

Figure 3 Long term decline in intensity of electricity use



Source: NZIER, MBIE, Statistics New Zealand

Inconsistencies from reasoning on regional averages

EDB networks do not map one-to-one with standard geographical boundaries. In some regions of New Zealand there are multiple EDB networks. In other cases EDB networks span multiple regions. This means that in order to forecast EDB real revenue growth a concordance is required for mapping drivers of real revenue growth, such as GDP and population statistics, to EDBs.

The Commission maps regional growth rates according to shares of energy demand by region. This approach is understandable in terms of its simplicity but it is an inconsistent application of our regional GDP forecasts.

NZIER's regional GDP projections are a generalisation of economic trends across an entire region given the industrial composition of the entire region. Implicit in our projections is a wide variation within regions.

As shown in Table 1, variation in economic activity within regions is larger than across regions. This is partly due to large differences in the size and scale of regions. Sparsely populated regions, such as Otago, exhibit large degrees of volatility across the region.

Table 1 Growth within regions more variable than across regions

Compound annual rates of growth in employment 2001 to 2013[3]

Region	Lowest District growth rate	Regional growth rate	Highest District growth rate
Northland	0.6%	0.9%	1.2%
Auckland	1.2%	1.6%	2.5%
Waikato	-0.6%	1.2%	2.0%
Bay of Plenty	-1.8%	1.2%	2.4%
Gisborne-Hawke's Bay	-0.8%	0.5%	1.0%
Taranaki	-0.3%	1.2%	1.8%
Manawatu-Wanganui	-1.3%	0.3%	1.1%
Wellington	-0.7%	1.0%	1.8%
Upper South Island	0.8%	1.1%	2.1%
Canterbury	0.3%	1.5%	4.3%
Otago	-0.1%	1.2%	4.2%
Southland	-0.5%	0.5%	1.0%

Source: NZIER

Variations in economic activity and growth rates within regions are also reflected in variations in electricity demand within regions – as shown in Figure 4 and Figure 5.

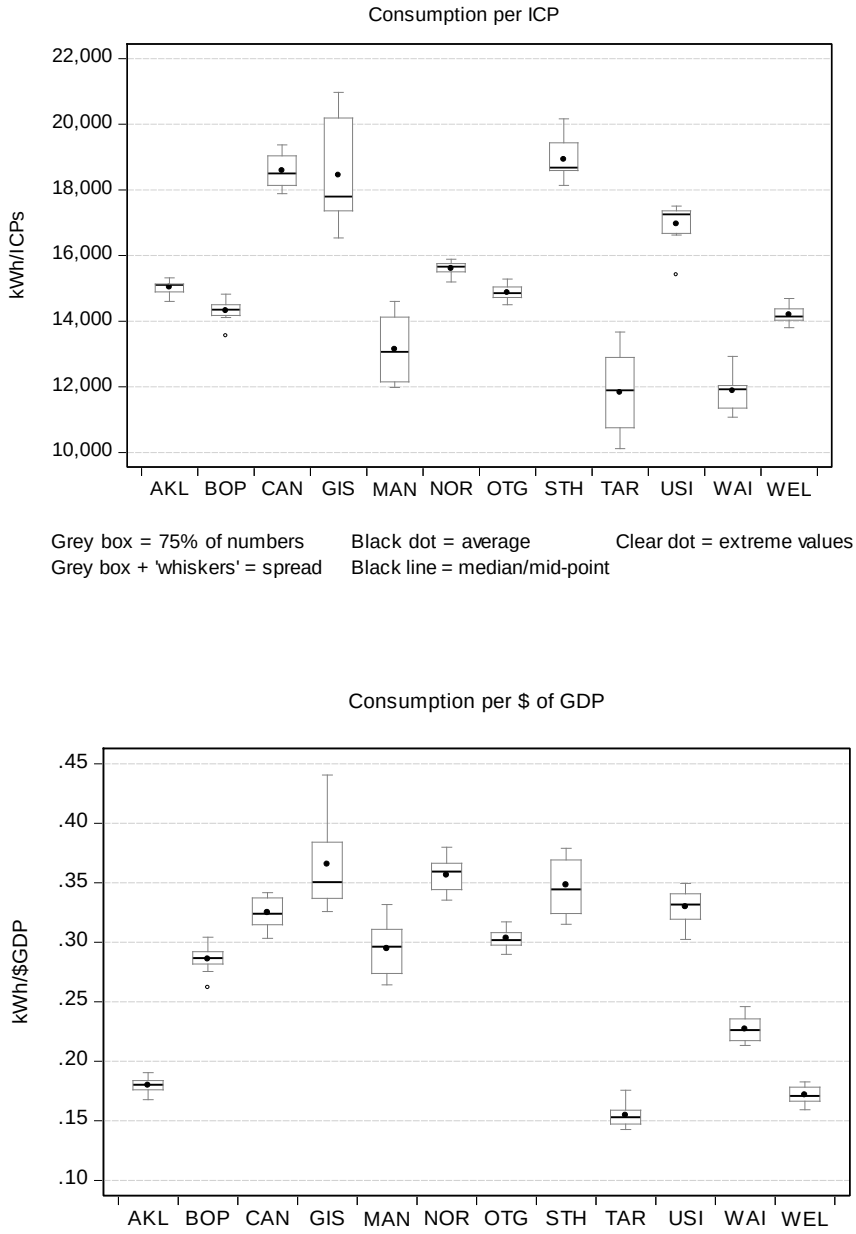
The implication of all this is that it is inappropriate, without further scrutiny, to assume a regional rate of growth is a reasonable indication of growth within a sub-set of a region.

The Commerce Commission's methods are deliberately simple and simplicity has benefits – particularly in the context of setting default price-quality paths. There comes a point, however, when a simple method is simply wrong.

[3] FTE estimates from employment counts in the 2001 and 2013 and Censuses. People in part time employment given a half weight.

Figure 4 Large variations in demand on EDB networks by region[4]

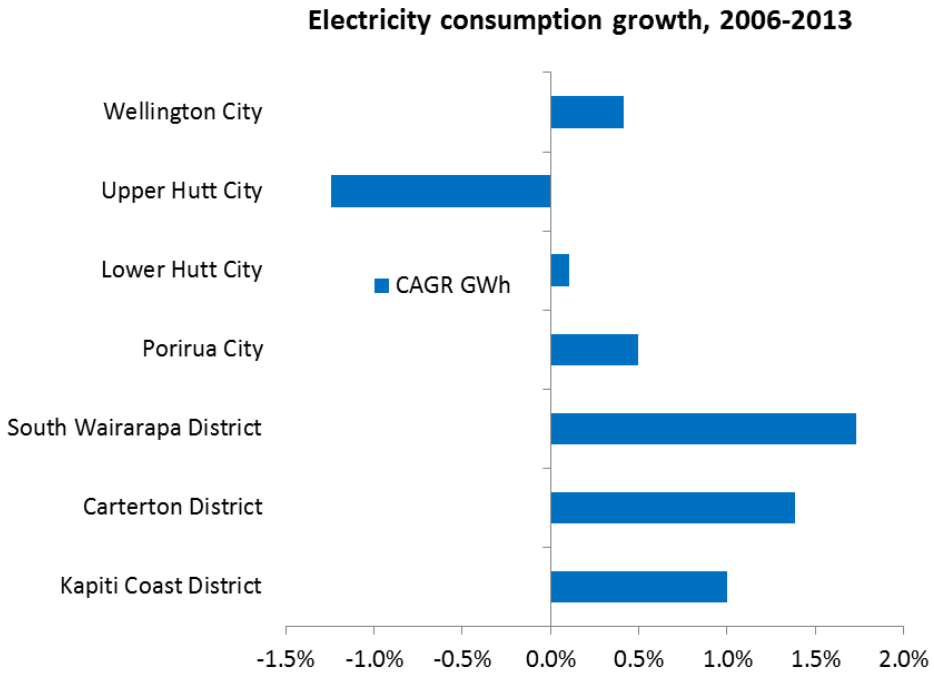
Consumption is net kWh excluding losses and embedded generation, 2001 - 2013



Source: NZIER, EDB information disclosures, EA CDS

[4] Regional abbreviations are: AKL = Auckland; BOP = Bay of Plenty; CAN = Canterbury; GIS = Gisborne-Hawke's Bay; MAN = Manawatu-Wanganui; NOR = Northland; OTG = Otago; STH = Southland; TAR = Taranaki; USI = Upper South Island, comprising Nelson, Tasman, Marlborough and the West Coast; WAI = Waikato; WEL = Wellington.

Figure 5 Demand growth has varied widely in the Wellington Region



Source: NZIER, EDB information disclosures, EA EMI