15 November 2023

# Energy Queensland - Connections volume and Connex forecasts for 2025-30

FTI Consulting Methodology Report

EXPERTS WITH IMPACT™

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## Glossary

| Acronym | Description |
|---|---|
| ABS | Australian Bureau of Statistics |
| ACIF | Australian Construction Industry Forum |
| AER | Australian Energy Regulator |
| AUD | Australian Dollars |
| AUS-M | Australian Macroeconomic Model |
| CAC | Connection Asset Customers |
| DNSP | Distribution Network Service Provider |
| EQL | Energy Queensland |
| FTI | FTI Consulting |
| GDP | Gross Domestic Product |
| GSP | Gross State Product |
| ICC | Individually Calculated Customers |
| NER | National Electricity Rules |
| NIM | Net Interstate Migrants |
| NOM | Net Overseas Migrants |
| p.a. | Per Annum |
| QGSO | Queensland Government Statistician's Office |
| RBA | Reserve Bank of Australia |
| SA2 | Statistical Area 2 Level |
| SA4 | Statistical Area 4 Level |
| SCCA | Shopping Centre Council of Australia |

## Executive Summary

FTI Consulting has been contracted by Energy Queensland Limited (EQL) to estimate Queensland connections volumes forecasts and projected connection expenditure (Connex) for 2025-2030. This involves the development of proposed forecasting methodology and model design utilising data provided by EQL and FTI Consulting, along with data sourced from the ABS, Cordell Connect and ACIF.

FTI Consulting has the capability to develop short-term, medium-term and long-term forecasts extending to 2030. The economic and demographic forecasts cover these timeframes. The building activity/construction forecasts that we currently prepare also cover this timeframe.

## Introduction

EQL requested FTI Consulting to model and forecast the number of connections for the next regulatory period. FTI has developed a model to forecast these connections. Our forecasting model considers:

- Population growth – we have built a population forecast that considers:
  - Fertility rates by SA4
  - Mortality rates by SA4
  - Net overseas migration to each SA4
  - Net internal migration to each SA4
  - We supplemented this with new forecasts of population by SA4 provided by the QGSO on 12 June 2023.
- Household growth – as population grows the number of households should also grow. FTI have built a household growth module to translate population growth to household growth. Noting that:
  - Over time, household size has been slowly declining – the population is aging, resulting in a larger number of single or two person households.
  - Economic conditions change household formation rates – for example, when property prices or interest rates are high, we see lower rates of household formation.
  - Different SA4s have different demographic characteristics – for example the Wide Bay SA4 has a median age of 49, well above the national average. This SA4 is already seeing a decline in household size, and this decline should continue.
  - Construction is important – household growth in an area is largely based on demographic factors, but households require a place to live. Our model accounts for supply side factors, namely a growth in residential dwellings.
- The econometric relationship between households and connections – EQL have provided FTI data on the number of residential connections over the past decade. In each SA4, we have compared these residential connections to the number of new households. We have observed a stable relationship (where there are slightly more connections than new households), and we use this relationship to forecast connections at the residential level.

  - EQL provide customer number forecasts which we use as a sense check on our household forecasting module.
- Commercial connections per new residential connection – EQL have provided data on historical commercial connections. We assess the relationship between these and residential connections econometrically, supplement this with desktop review on retail/commercial floorspace ratios per person and forecast commercial connections on this basis.

EQL has also requested that FTI estimate the expenditure on connections over the same period.

Our forecasting model considers, in addition to the factors above:

- The relationship between connections and expenditure. We have been provided with a data set that outlines the expenditure on in-scope connections. We have not been able to build an econometric model, as this data set is short (4 years). As such, our connection expenditure ("connex") model considers the short-term relationship between volumes and expenditure.
- The "backlog" of connections to be served.
- We have scanned our existing data (e.g. construction forecasts, population forecasts and major projects) for evidence that we are adequately considering the impact of two significant drivers of activity in the QLD economy, namely:
  - The Queensland Jobs and Energy Plan, a multi-billion dollar investment that targets 70% renewable generation by 2032; and
  - The 2032 Brisbane Olympic games.
- Our model accounts for these major drivers of activity – our population forecasts from the QGSO take these into account, and the major projects database (construction forecasts) already demonstrate evidence of large scale infrastructure spending in renewable energy, sporting infrastructure and transport.

Our model is:

- **Comprehensive –** the breadth of the data in our model and analytical frameworks means that we track everything that matters.
- **Flexible –** we will build the models in a way that makes it easy see and change the reliance of key data points if necessary.
- **Evidence based –** models change when the evidence changes. The later steps and milestones can be adjusted, if necessary, when parameters need to be "locked down" will be subject to the needs of EQL, and we will agree this at the inception meeting.
- **Consultative –** we have reflected inputs from experts at EQL as a sense check on our forecasts.

## Background

Ergon Energy and Energex are subject to economic regulation by the Australian Energy Regulator (AER) in accordance with the National Electricity Law and Chapter 6 of the National Electricity Rules (NER).

Under this framework, a Distribution Network Service Provider (DNSP) must submit a regulatory proposal to the AER setting out, amongst other things, its expenditure proposals and proposed revenue allowance for the relevant regulatory control period. The AER assesses the proposal and ultimately decides on the revenues or prices a DNSP can earn or charge during the period.

The next regulatory control period will commence on 1 July 2025 and will apply for a period of five years (2025-30).

One of the early-stage activities under consideration as part of the development of the Ergon Energy and Energex 2025-30 regulatory proposals includes the adoption of a new methodology to estimate the businesses' proposed connection capital expenditure (Connex).

Connex refers to the capital costs associated with a range of connection services provided to residential customers, commercial and industrial customers, real estate developments, unmetered supplies and embedded generators. The costs associated with connecting new customers to the shared network are either customer funded or recovered from all customers through their network charges.

For the development of their proposed 2025-30 connex forecasts, Ergon Energy and Energex propose to use the following approach:

- Adoption of unit rates multiplied by forecast connection numbers for the 'high volume' connection categories. The unit rates would be derived using historical revenue figures and connection numbers. The forecast connection numbers used to calculate forecast expenditure levels would be informed by sound economic outlooks.
- For medium size connections , it would be appropriate to consider the unit rates approach based on several years of data to remove year-to-year volatility.
- For large, low volume connections (also known as major customer connections), the businesses will adopt a bottom-up approach for the first year of the regulatory control period, then escalated for the remainder of the period.

## Definitions

The forecasts are categorised by the below tariff class and umbrella customer types, as per the table below:

*Table 1: 2022-2023 Network Tariffs by tariff class*

| Tariff Class | Customer Type | Primary Tariff | Secondary Tariff |
|---|---|---|---|
| Standard Asset Customers (SAC) | Residential | ■ Residential Flat<br>■ Residential Transitional Demand<br>■ Residential Demand<br>■ Residential Time of Use Energy<br>■ Residential Time of Use[a] | ■ Super Economy<br>■ Economy |
| | Small business | ■ Business Flat<br>■ Small Business Wide Inclining Fixed<br>■ Tariff (WIFT)<br>■ Small Business Transitional Demand<br>■ Small Business Demand<br>■ Small Business Time of Use Energy<br>■ Small Business Primary Load Control<br>■ Business Time of Use[a]<br>■ Business Demand[a] | ■ Super Economy<br>■ Economy |
| | Large customer | ■ Large Demand<br>■ Small Demand<br>■ LV Demand Time of Use<br>■ Large Business Primary Load Control<br>■ Large Residential Energy (Residential<br>■ customer basic >100 MWh per year)<br>■ Large Business Energy (Business<br>■ customer basic >100 MWh per year) | ■ Large Business Secondary Load Control |
| *Notes:*<br>*a. Grandfathered tariff (closed to new customers)* | | | |

*Source: Cordell Connect*

This study applies the following alignment of data to the above Customer Types:

*Table 22: Alignment of Customer Types and Data Descriptors*

| Category | Customer Type | Descriptor | Subcategories |
|---|---|---|---|
| Residential | Residential - Small | ■ Residential Simple LV Connection | ■ Simple connection LV |
| | Residential – Large | ■ Residential Complex HV and LV Connection | ■ Complex connection HV<br>■ Complex connection LV |
| Commercial | Small business | ■ Commercial/ Industrial – Simple LV Connection | ■ Simple connection LV |
| | Large customer | ■ Commercial/ Industrial – Complex connection HV and LV | ■ Complex connection HV (customer connected at HV)<br>■ Complex connection HV (customer connected at LV, minor HV works)<br>■ Complex connection HV (customer connected at LV, upstream asset works) |

*Source: Energex Pricing Proposal Distribution services for 1 July 2022 to 30 June 2023 - 31 March 2022*

We have not provided forecasts of:

- Connection Asset Customers (CAC): Customers with a network coupling point at 66 kV, 33 kV, 22 kV, 11 kV and installed capacity above 1,000 kVA who are not assigned to the ICC tariff class are allocated to the CAC tariff class.
- Individually Calculated Customers (ICC): Customers are assigned to the ICC tariff class if they are coupled to the network at 132 kV, 110 kV, 66 kV or 33 kV and with installed capacity above 10 MVA. Customers may also be assigned to the ICC tariff class if they are coupled to the network at 132 kV, 110 kV, 66 kV or 33 kV and with installed capacity below 10 MVA.

CAC tariffs are based on:

- the actual dedicated connection assets utilised by the customer; plus
- average charges for use of the shared distribution network, including common and non-system assets.
- A customer has a dedicated distribution system which is quite different and separate from the remainder of our distribution system
- A customer is connected at or close to a Transmission Connection Point, or
- At the determination of the DNSP, the nature of the customer's connection to the network, and/or usage of the network, make average prices inappropriate

- Inequitable treatment of other customers would arise from the application of the 10MVA threshold

ICC tariffs are based on:

- the actual dedicated connection assets utilised by the customer; plus
- the customer's specifically identified portion of the shared distribution network utilised for the electricity supply, including common and non-system assets.

# Data

This analysis combines a breadth of the data in our model and analytical frameworks to ensure that key matters are recorded across the life of the project. Data was sourced from various sources including EQL, FTI Consulting, the Australian Bureau of Statistics (ABS), the Reserve Bank of Australia (RBA), the Queensland Government Statistician's Office (QGSO), the Australian Construction Industry Forum (ACIF), the AUS-M model and Cordell Connect.

The model links multiple sets of data on the demand and supply side of the market and historical connection to construct a robust forecast of Queensland energy connection volumes across a 5-year period.

FTI Consulting have developed the connection volume forecasts using historical connection volume data provided by EQL.

## EQL Data

The EQL team provided the historical connections volumes and customer number forecasts for the Energex and Ergon regions across various time series. The following files were provided:

- "Energex and Ergon Energy Connection Volume Timeseries":
  - Geography: Energex and Ergon
  - Time series: July 2017 – October 2022
  - Data Variables: Residential, C&I and Embedded Generation
- "Customer forecasts for reset RIN":
  - Geography: Energex and Ergon
  - Time series: June 2016 – June 2023
  - Data Variables: Major Customers, Mid-sized business customers, Non-residential, Residential Total, Growth Rate
  - Scenarios: Forecast base, Forecast high, Forecast low
- "Ergon and Energex CA RIN - Connection volumes (table 2.5.2)":
  - Geography: Energex and Ergon
  - Time series: 2008-09 – 2021-22
  - Data Variable Categories: Commercial/ Industrial, Embedded Generation, Residential, Subdivision
  - Data Variable Sub-Categories: Complex connection HV (customer connected at HV), Complex connection HV (customer connected at LV, minor HV works), Complex connection HV customer connected at LV, upstream asset works), Complex connection sub-transmission, Simple connection LV, Complex connection HV (large capacity), Complex connection HV (small capacity), Complex connection HV, Complex connection LV, Complex connection HV (no upstream asset works), Complex connection HV (with upstream asset works)
- "RIN_ENERGEX_2017_2022 v01":
  - Geography: Energex
  - Time series: July 2017 – October 2022

- Customer Type: Domestic, Commercial, Lighting, Rural, Industrial, Unknown

  Data Variable: Service Order No, Premise Depot, Customer Service Order Type, Service Order Class, "Service Order Subclass", Service Order Subclass Description, NMI, Customer Type, Completed Date/Time, Market Outcome Status, Obligation Start Date, Obligation End, Date/Time.

- "RIN_ERGON_2017_2022":
  - Geography: Energex
  - Time series: July 2017 – October 2022
  - Customer Type: Domestic, Commercial, Lighting, Rural, Industrial, Unknown
  - Data Variables: PTJ#, "Depot Description", "Service Order Type", "Service Order Class", "S/O Sub Class Code", "Service Order Sub Class Description", NMI, Customer Type, "Completed Transaction Date", Market Outcome Status, Obligation Start Date, "Obligation End Date/Time", "Actual Completion Date/Time", month
- "2022-12-13 EMC2011 Extract - Energy Consumption v2":
  - Geography: Energex and Ergon
  - Time Series: November 2021 – October 2022
  - Data Variables: #, Data Source, Premise ID, NMI, GNTC, NTC, NTC Description, Primary Tariff, NMI Class, Cust Class, Tariff Type, Meter Config, Load, Month End Date, Financial Year, Quantity as Consumed
- "2022-12-13 EMC2017 Extract - Customer Details - Copy for FTI"
  - Description: Customer details by NMI Number
  - Data Variables: Data Source, Premise Id, NMI Without Checksum, NMI, NMI Status, Region Id, Region Description, Post Code, NMI Class, Local Government Area, Market Publish Status, Market Publish Status Description, Retailer Code, Retailer Description, Retailer Tier, Customer Threshold, Unmetered Type, Unmetered Indicator, Type Consumer, Type Consumer Description, Customer Class, Customer Class Description, Jurisdiction, Jurisdiction Description, Depot Code, Depot Description, Field Service Area, Field Service Region, Voltage
- "EGX and ERG CA RINs – Historical Connex"
  - Description: Four years of Connex for Ergon and Energex, split by residential and commercial customers and their sub types.

The data provided by EQL has been integrated into the modelling in a number of ways.

- Historical volumes and Connex expenditure were econometrically modelled against historical population and other economic variables. FTI found:
  - significant relationships between volumes and population.
  - Significant relationships between historical connection volumes and historical Connex, albeit that the Connex dataset is short.
- Customer number forecasts were regressed against population and household numbers.

- There was a significant relationship between these variables. FTI determined that household growth was more stable than customer numbers, however we continue to undertake this modelling in response to changes in the customer number forecasts.

## ABS Data

The ABS is the independent statutory agency of the Australian Government responsible for statistical collection and analysis and for giving evidence-based advice to federal, state and territory governments. FTI sourced the following public and accessible data:

- Statistics about the population and components of change for Queensland
  - Census data 2001 to 2021 for Queensland
  - Census SA4 population charts (historical) for Queensland
  - Fertility rates
  - Mortality rates
  - Net overseas migration
  - Net internal migration
- Gross State Product
- Employment
- National Accounts
- Buildings Approval data

## QGSO Data

The QGSO is part of Queensland Treasury and provides a broad range of expert services to support national, whole-of-government and agency policies, programs, and service delivery decisions. FTI Consulting sourced the following public and accessible data:

- Statistics about the population and components of change (births, deaths, migration) for Queensland that consider
  - Fertility rates by SA4
  - Mortality rates by SA4
  - Net overseas migration to each SA4
  - Net internal migration to each SA4

On 12 June 2023, the QGSO published regional population forecasts – these meant that FTI's population modelling that was required for the first release was no longer required. The FTI Consulting team adjusted the SA4 population forecasts in September 2023 (and these changes were only marginal).

## Construction Forecasts

FIT Consulting combine data from ACIF, Cordell Connect and the AUS-M model into our construction forecasts. We have access to an off-the-shelf Building activity model that spatially forecasts construction activity. Our model forecasts all of the different construction classes tracked by the ABS and the Construction industry, namely:

- residential (new houses, new apartments/other, and alterations/renovations, real estate developments)
- non-residential (e.g., retail, offices, hospitals, education, other commercial)

Our model forecasts these at geographically disaggregated levels. We examine trends across Queensland, in Brisbane and the rest of the state. Our model uses input from CoreLogic, who have a detailed database of major projects around the State. We also draw upon development approvals data that indicates where the major development fronts are for the next 12-18 months. This data, along with our macroeconomic forecasting tools allow us to spatially disaggregate building activity.

### ACIF

The ACIF Construction Market Forecasts provide a rolling ten-year forecast of building and construction activity at the Australian, Queensland, Brisbane and the rest of the state levels. The Forecast Sectors and Asset Types that are analysed in this study include the following Construction categories:

- Residential
- Non-Residential - Small businesses
- Non-Residential - Medium sized businesses

FTI Consulting have a detailed construction activity model that forecasts what is going to be built, where and when across Queensland and in its various regions. In the Building Activity model that we own and operate and use to prepare the ACIF forecasts we forecast and track the following:

- Residential – Every type of dwelling including Houses as well as other dwelling types.
- Non-Residential Building – Offices, Retail, Industrial, Other commercial.
- Small, medium and large – stratified by size of development and by project description.
- Real estate developments – urban infill and greenfield developments >$20 million.

### Major Projects Database

Cordell Connect (operated by CoreLogic) provides an extensive, Australia wide compilation of residential, commercial, industrial, community, engineering and mining projects. The Major Projects Database is a repository for the building and construction project pipeline.

Cordell Connect is an online leads generation and business development tool, providing you with timely details on construction, infrastructure and other building projects across Australia. The Major Projects Database records what projects are being planned or what stage of development the project is in.

A Major Project is an active project which is valued at $20 million or more. Some are in preliminary stages of consideration. Some are subject to development approval and others are already under construction and may even be approaching completion. Projects which have been completed, have been abandoned or deferred are not counted as being active.

*Table 3: Queensland Major Projects Database List – Sample for illustration only*

| Project Name | Category | Geography | Start Date | Value (Million) |
|---|---|---|---|---|
| Former Keating Bread Factory Apartments | Residential | Brisbane City | 30/10/23 | $90 |
| James Cook University Townsville Campus Technology Innovation Complex | Education | Townsville City | 31/03/21 | $93.5 |
| West & James Streets Commercial Development - Officeworks | Retail And Wholesale Trade | Toowoomba Regional | 26/07/23 | $30 |
| 4-8 Bailey Street & 10 Kurilpa Street Apartments | Residential | Brisbane City | 11/08/23 | $23.4 |
| Kensington Gardens Lifestyle Estates | Residential | Bundaberg Regional | 6/11/2023 | $65 |
| Isle Of Newport Waterfront Master Plan Community | Residential | Moreton Bay Regional | 27/11/2018 | $59 |

*Source: Cordell Connect*

## AUS-M

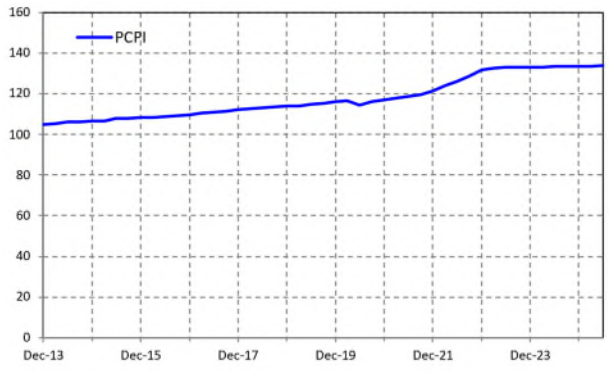
The AUS-M is a macro econometric model of the Australian economy with a reduced form general equilibrium framework. It has been used for identifying drivers of structural change in the Australian economy (including demographic and labour force changes) and analysing the national competition policy access regime.

Operated by Outlook Economics, it is based on the TRYM model, originally developed by the Australian Treasury. AUS-M builds on TRYM by incorporating input-output based demand systems and more industry and commodity detail. In terms of common labels, AUS-M is a modern Keynes-Klein style model, to which Computable General Equilibrium features have been added.

AUS-M also involves considerable information about demographic change in Australia. Information is tracked about natural growth, net immigration and net internal migration.

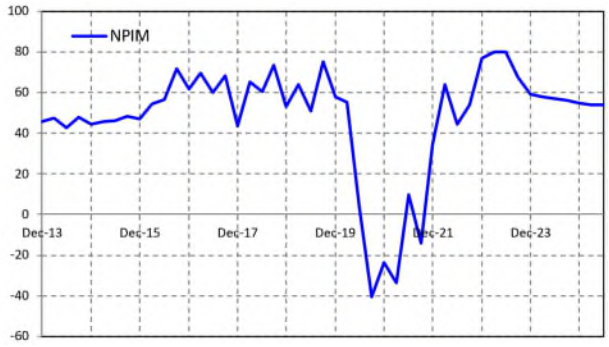
FTI Consulting utilise the AUS-M to operate a fully integrated macroeconomic model that forecasts Gross Domestic Product (GDP), Investment, Consumption, Interest Rates and Industry Dynamics. This model has a state module that allows us to forecast QLD economic activity, including GSP. This model at a high level provides insight into household formation and connections.

*Figure 1: Levels - Consumer Price Index: 16th Series*



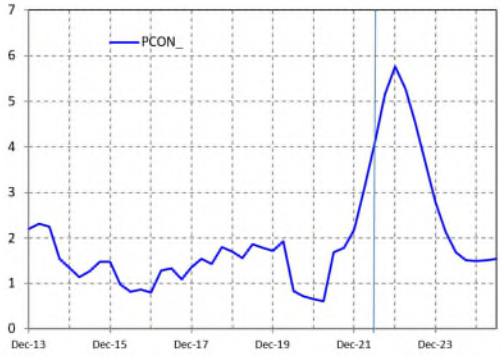

*Source: AUS-M*

*Figure 2: Net Migration (smoothed and spliced)*



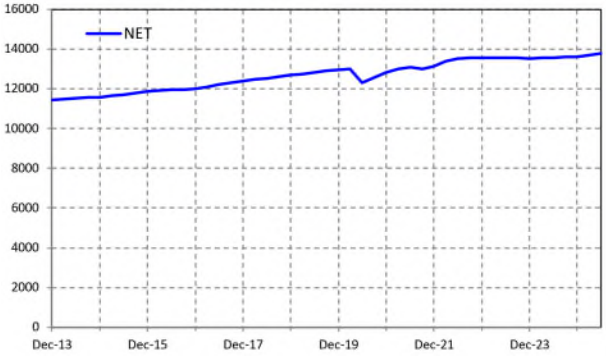

*Source: AUS-M*

*Figure 3: Growth Rate - Household Consumption - deflator*




*Source: AUS-M*

*Figure 4: Levels – Total employment*




*Source: AUS-M*

### QLD Energy and Jobs Plan

The QLD energy and Jobs Plan is a key initiative of the QLD Government that invests an additional $4 billion to projects including renewable energy, and the QLD Supergrid across all key QLD regions with the goal to increase the share of renewable energy in QLD by 2030 to 60%, and by 2035 to 80%.[1] This investment is captured by our model through our construction data (which has rapid escalation in construction in the energy sector in QLD), and through our macroeconomic modelling.

### Brisbane Olympics

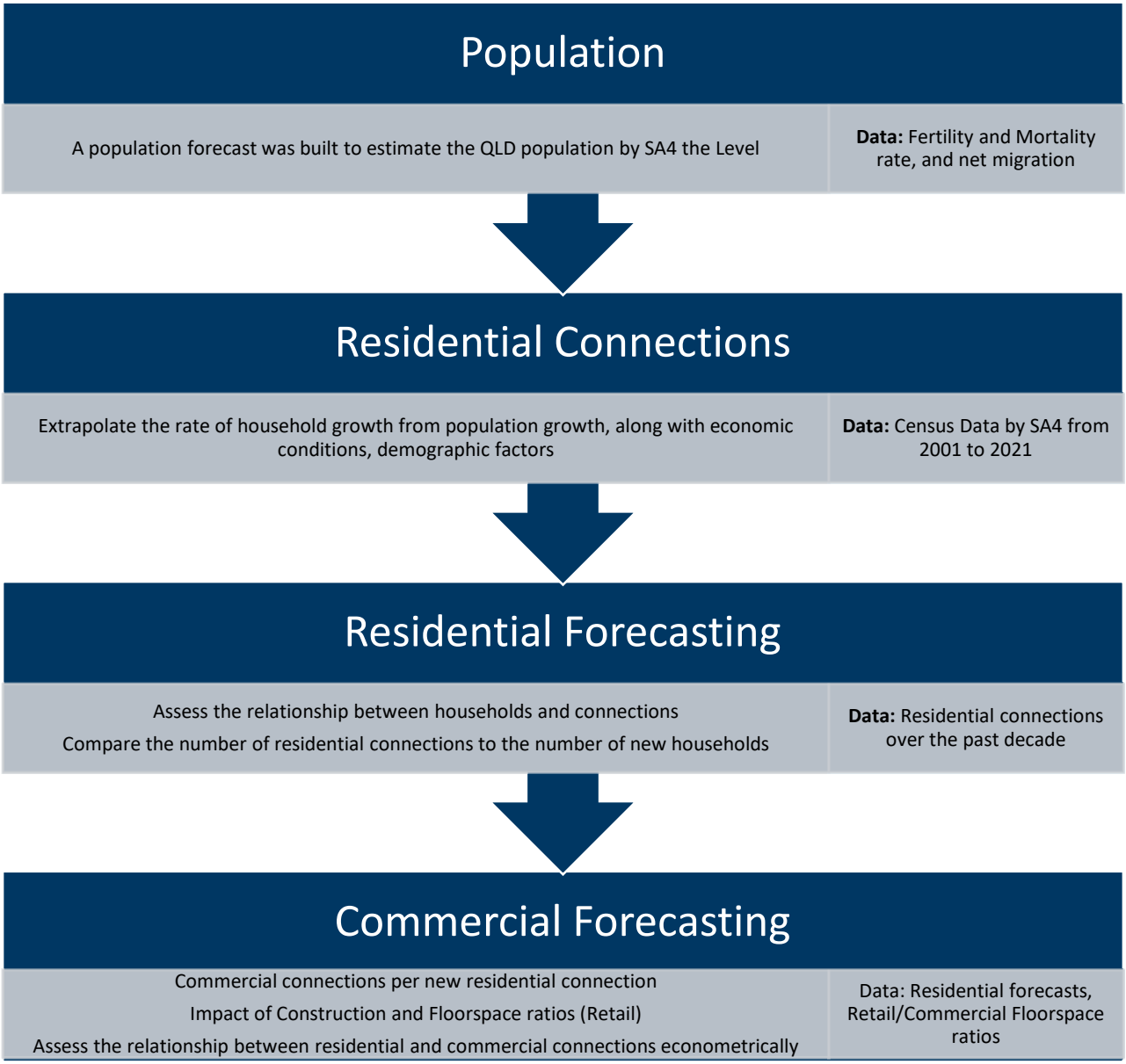
The Olympic Games, to be held in Brisbane in 2032 will generate significant additional construction (residential, commercial and infrastructure). This has been captured through our macroeconomic forecasts, and our construction forecasts.

[1] https://www.epw.qld.gov.au/__data/assets/pdf_file/0031/32989/queensland-energy-and-jobs-plan-overview.pdf

# Our approach

## High level approach - volumes

*Figure 5: Model Diagram - volumes*



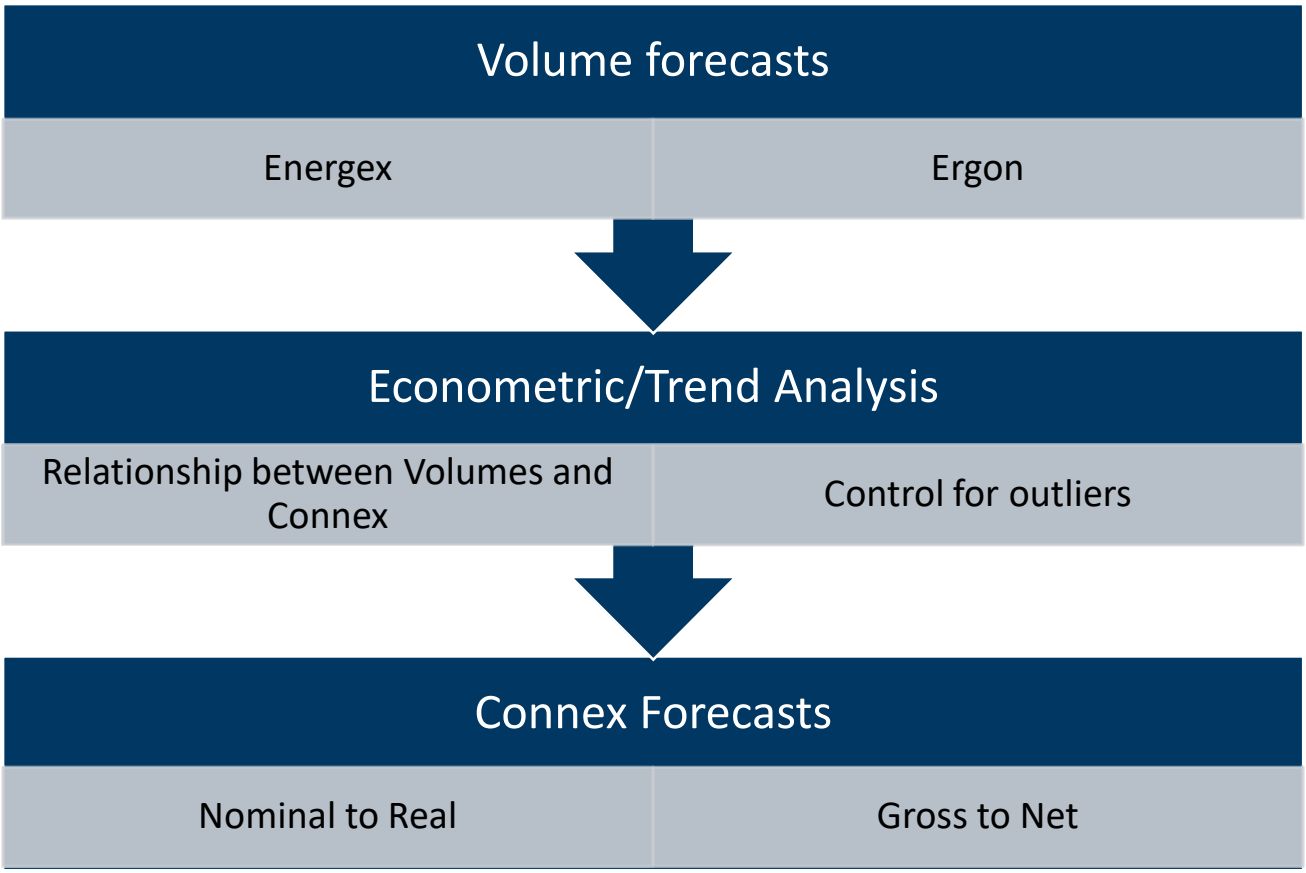

Our model works as per Figure 5, above. To build our residential forecasts, we start from understanding population growth, then forecast the number of households and econometrically relate these to the number of connections.

We check our household forecasts by regressing these against customer numbers, and update these regressions as new customer number data is provided.

To get commercial forecasts, we rely on the relationship between population growth, and the demand for services.

## High level approach – Connex

*Figure 6: Model Diagram – Connex*




Our Connex model takes the volume forecasts, and combines these with data from EQL on the Connection Expenditure from 2019-2022. We have an insufficient data set to econometrically estimate any relationships, so the approach is to:

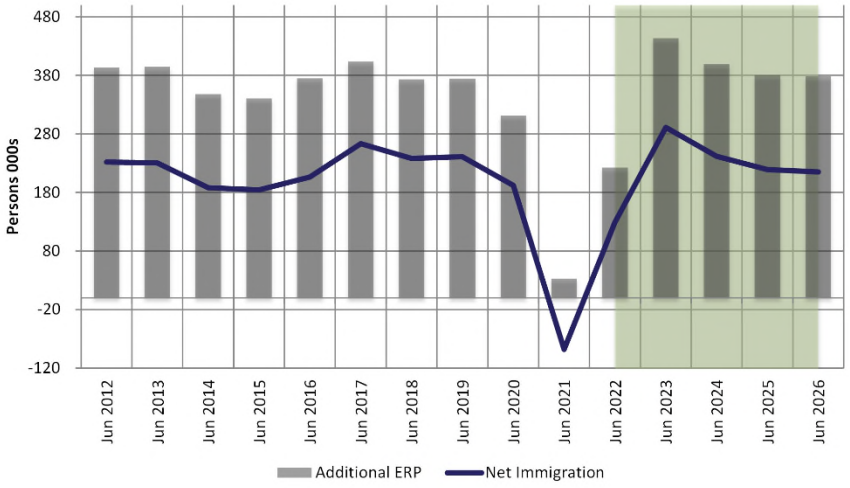
- Consult with EQL to establish the data which is most reflective of actual expenditure, given that the four year data sets are very volatile.
- Control for outliers based on these consultations and our judgment
- Establish the relationship between Volumes and Connex for Energex and Ergon for Residential, Commercial and their subcategories.
- Undertake a Nominal to Real conversion using our forecasts of growth in costs, and CPI.
- Use trend analysis to convert Gross to Net Costs.

## Population forecasting

There are a number of sources of population forecasting, that we would typically rely on to build these economic forecasts. The Queensland Government Statistics Office (QGSO) produces population forecasts that are robust and publicly available. However, prior to our draft forecast release these forecasts had not been produced since 2018, and in the intervening period, population growth has deviated from its long-term trend (see Figure 7). 2020 saw the first negative net overseas migration since 1946. Between 2020 and 2021, Australia lost around 400,000 migrants relative to projections which makes projections from 2018 completely out of date. Further, QLD saw Net Internal Migration (NIM) at rates well above projections. As such, this exercise requires a fresh population forecast.

Between the draft and final forecasts, the QGSO provided updated population projections and these were used for the final.

*Figure 7: Population Growth (Australia)*




Population is forecast using:

- ABS Census data that outlines population by age and gender for 2021 and 2016 by SA4.
- Mortality rates (by age and gender) for 2016 to 2021.
- Fertility rates (live births per 100 women) by 5-year age group from 2016 to 2021.
- Net Overseas Migrants (NOM) over the last 5 years from the 2021 Census of Population and Housing.

The high-level approach to forecasting population is to:

1. Obtain the 2016 Census data by age and gender
2. Apply birth rates to estimate the number of births over the period from 2016 to 2021
3. Apply mortality rates to obtain the number of deaths in the period from 2016 to 2021
4. Use the 2021 Census to obtain the number of arrivals since the last Census, which is an estimate of the Net Overseas Migrants

5. Combine these estimates to obtain an estimate of what the population for an SA4 would be in 2021 if there was no internal migration. This stage is necessary, as the ABS do not publish net internal migration data.
6. The difference between the data from the actual 2021 Census, and the "estimated" 2021 population is equal to 5 years of net internal migration, this number is then divided by 5 to obtain an annual NIM rate.
7. Then starting with the actual 2021 Census data, apply the birth rates, mortality rates, NOM per annum and NIM per annum for each year to obtain annual population forecasts.
8. In the final model, we replace this step with forecasts from the QGSO. We present population data from the draft (which is very similar, due to our forecasts being more complete.

*Figure 8: Greater Brisbane – Population Forecast*

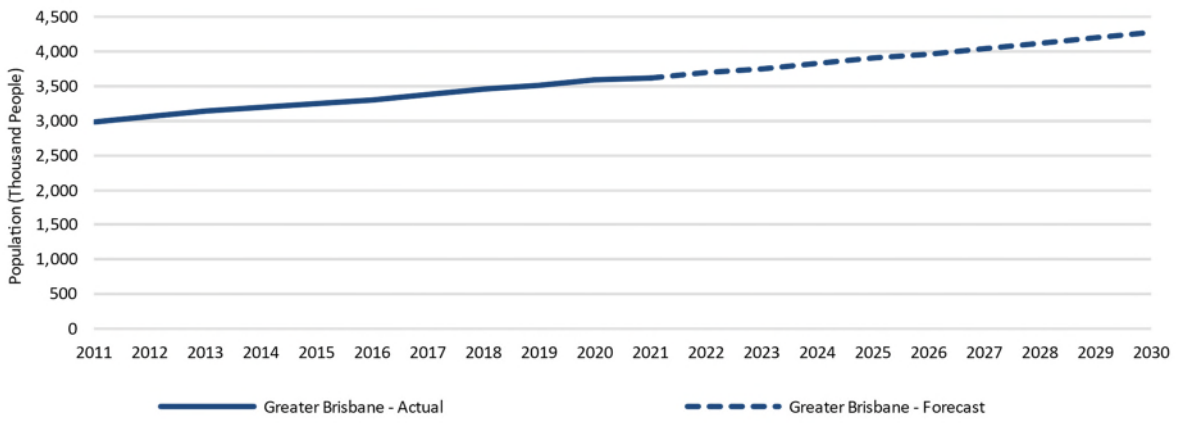



*Figure 9: Cairns - Population Forecast*

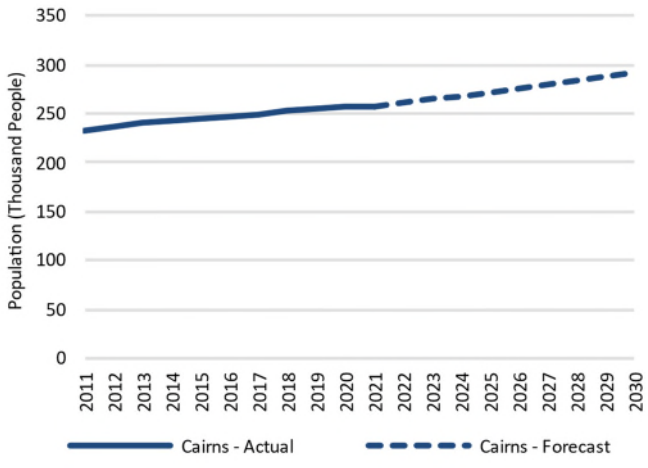
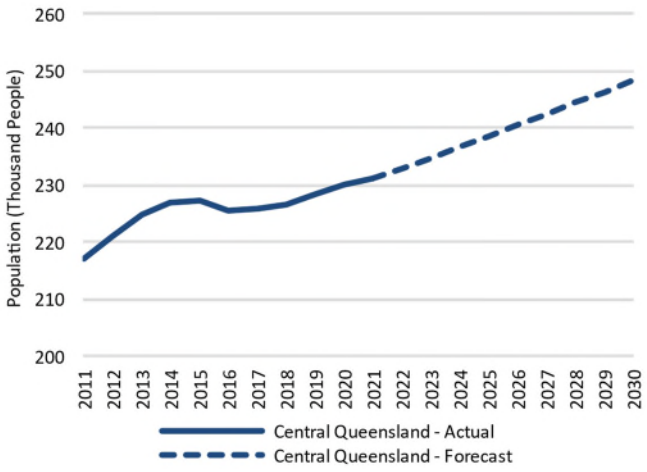



*Figure 10: Central Queensland - Population Forecast*




*Source: ABS*

*Figure 11: Darling Downs - Population Forecast*

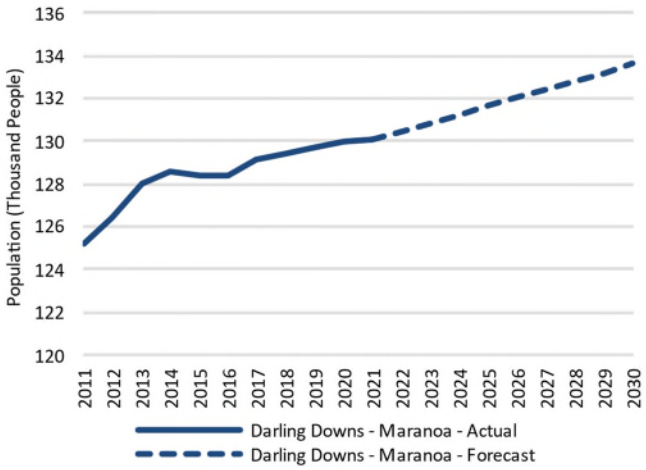



*Figure 12: Mackay - Population Forecast*

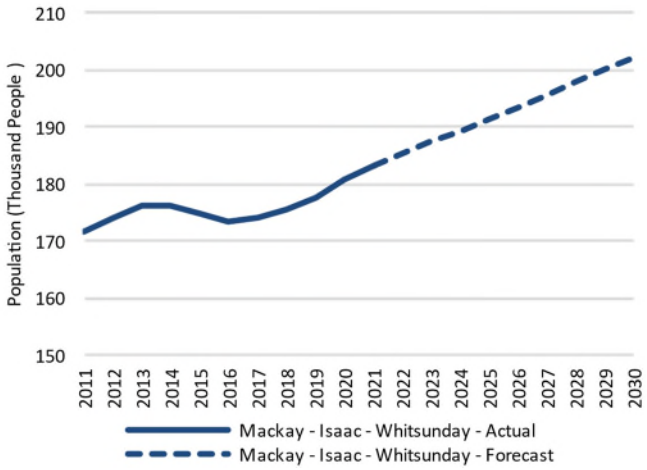



*Figure 13: QLD Outback - Population Forecast*

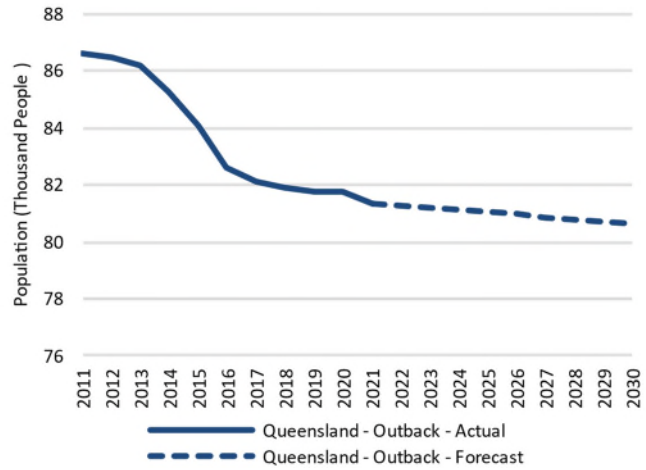



*Figure 14: Toowoomba - Population Forecast*

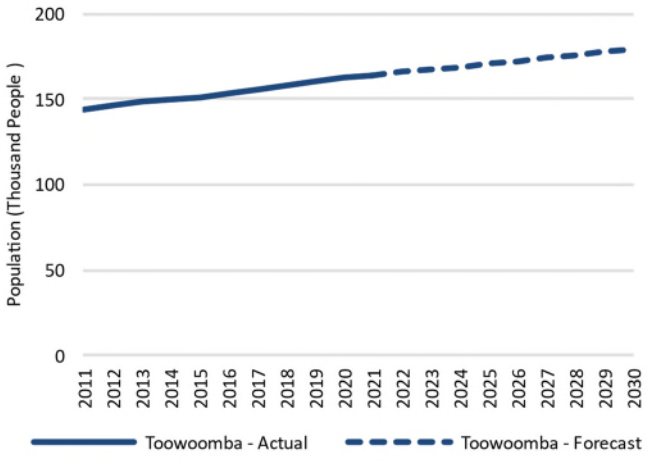



*Figure 15:Townsville - Population Forecast*

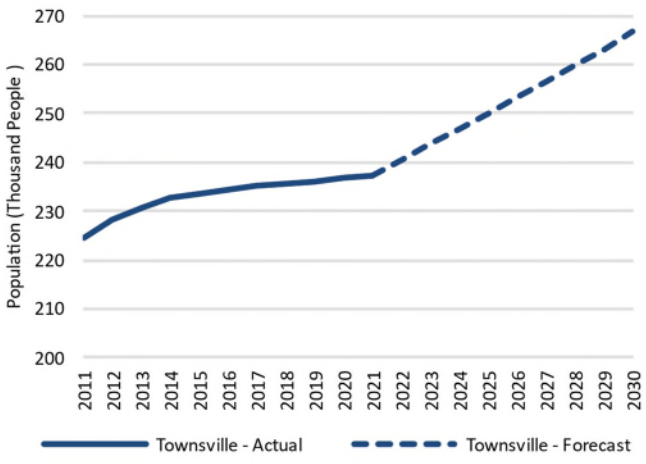
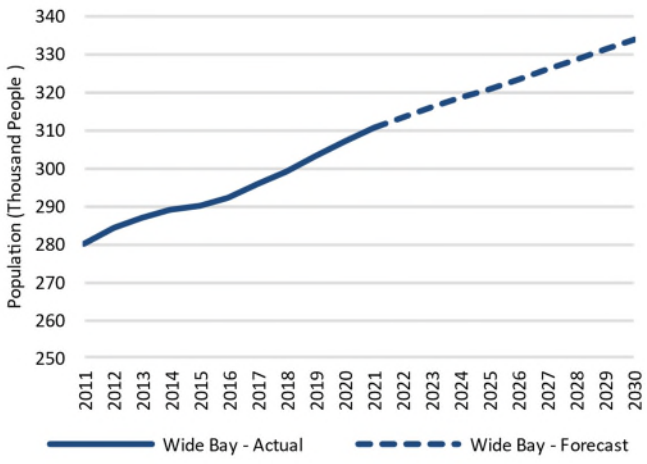



*Figure 16: Wide Bay - Population Forecast*




*Source: ABS*

In the figures above, we present our population forecasts. Generally, the forecasts are for growth in most SA4s, with the exception of QLD Outback, which is continuing its trend of modest decline.

## Household formation

Household formation is given in the chart below. The national average household size is 2.5 persons. The SA4s of interest are around this value, some (e.g. Wide Bay) are considerably lower than this, and some (e.g. Logan-Beaudesert) are considerably higher than this. Household formation has been slowly declining over time. Many factors drive household formation. For example:

- Demographics – the aging population, in particular drives lower household sizes, due to the higher number of single person households
- Economic conditions – factors including high interest rates, high rental and house prices slow down household formation
- Migration – the average migrant is younger than national average, increasing household size.

Our approach to modelling household formation is to use multiple censuses to infer a trend. We then adjust that based on migration level and economic conditions.

*Figure 17: Greater Brisbane – Average Household Size Forecast*

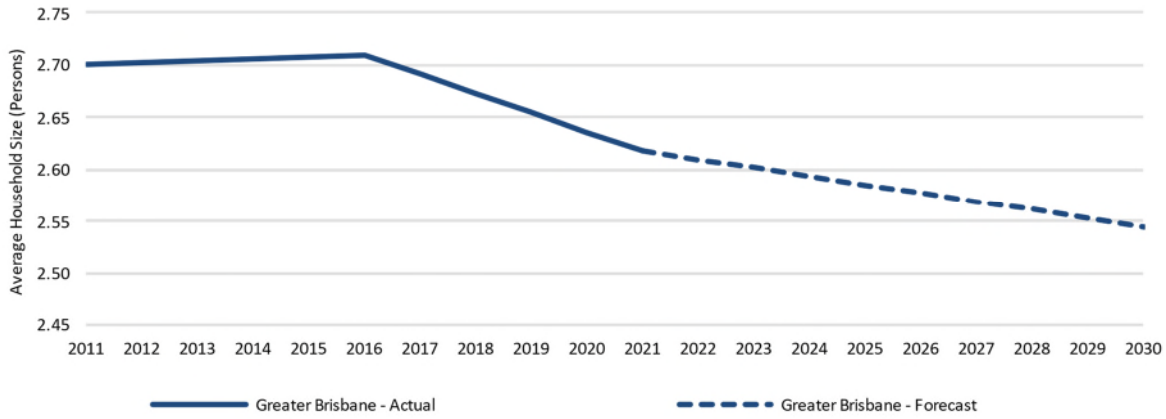



*Figure 18: Cairns - Average Household Size Forecast*

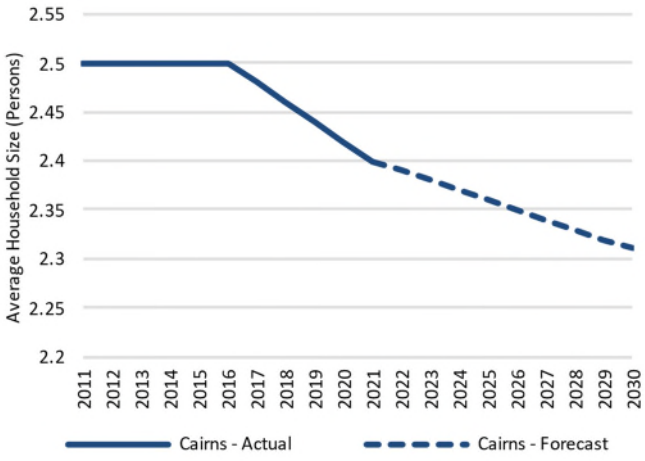
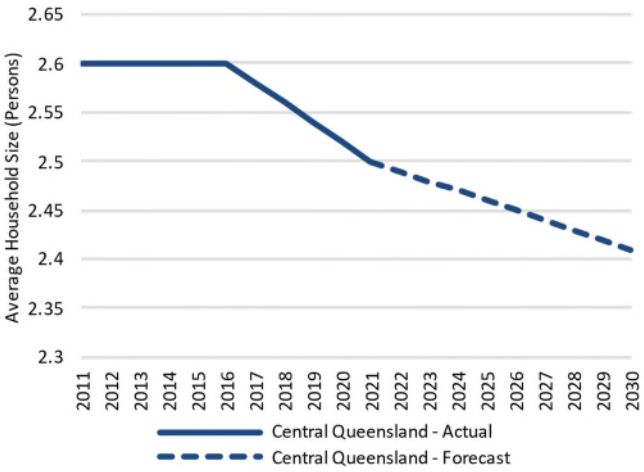



*Figure 19: Central Queensland - Average Household Size Forecast*




*Source: ABS*

*Figure 20: Darling Downs - Average Household Size Forecast*

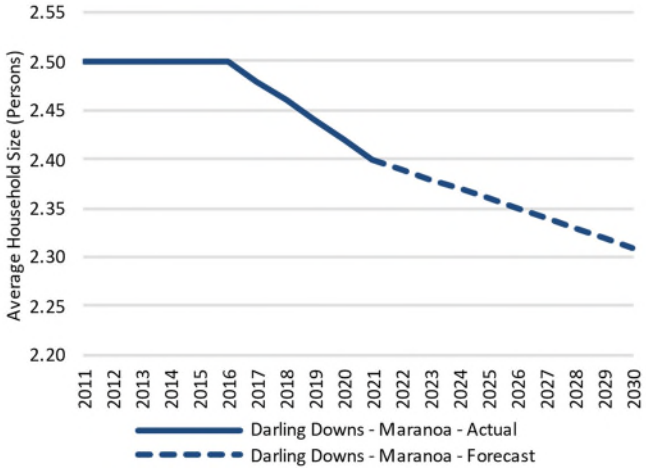



*Figure 21: Mackay - Average Household Size Forecast*

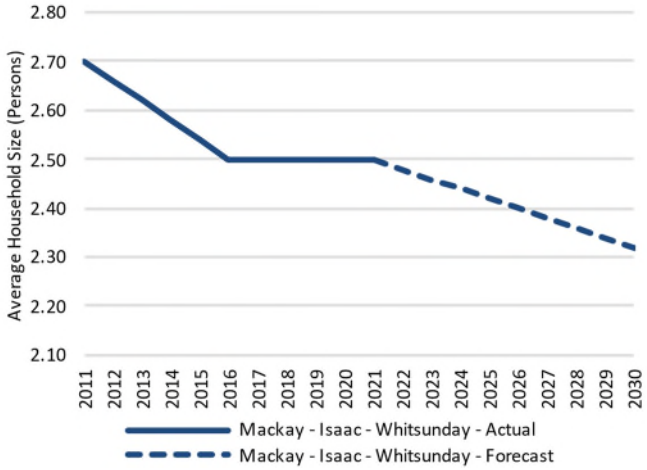



*Figure 22: QLD Outback - Average Household Size Forecast*

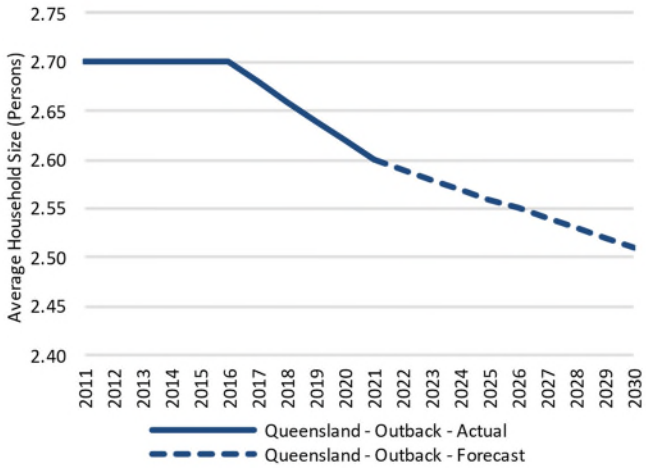



*Figure 23: Toowoomba - Average Household Size Forecast*

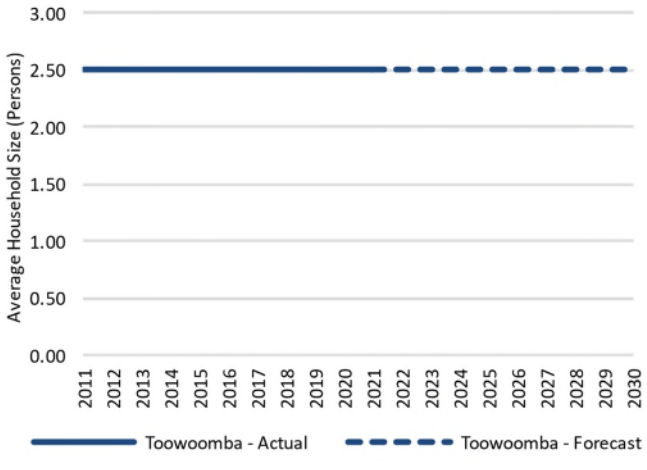



*Figure 24: Townsville - Average Household Size Forecast*

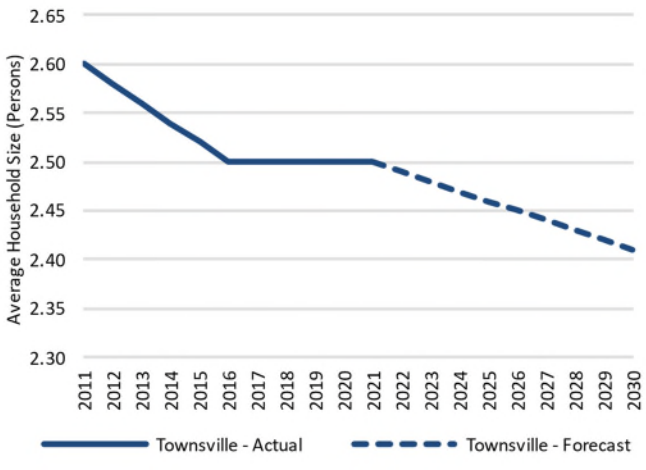
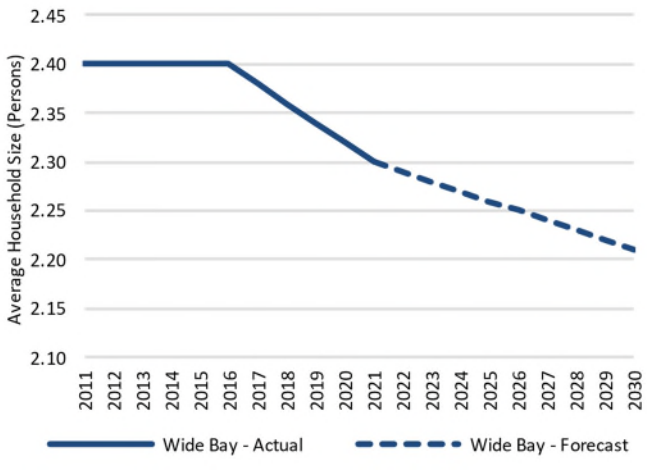



*Figure 25: Wide Bay - Average Household Size Forecast*




*Source: ABS*

The forecasts above reflect gradual decline in household size in all SA4s with the exception of Toowoomba.

## Household formation and residential connections

FTI Consulting conducted the modelling using the R program and undertook a range of statistical tests to determine the robustness of our estimates, and to assess the importance and statistical significance of our variables, and the significance of our estimates in general.

Our approach to econometric modelling will combine the relevant information about:

- Economic trends
- Key social parameters – especially population
- Building activity
- Historical trends in connection volumes

There is a limitation to this, namely that the data received on connections is a very short series, accordingly our confidence levels are reduced to an extent.

Figure 26 and Figure 27 show the relationship between household formation and connections for Energex, and for each SA in the Ergon region. As is evident, there is a very strong and consistent relationship between connections and household formation in the Energex region. The relationship in the Ergon SA4s is much less apparent.

*Figure 26: Energex - Household formations and connections*

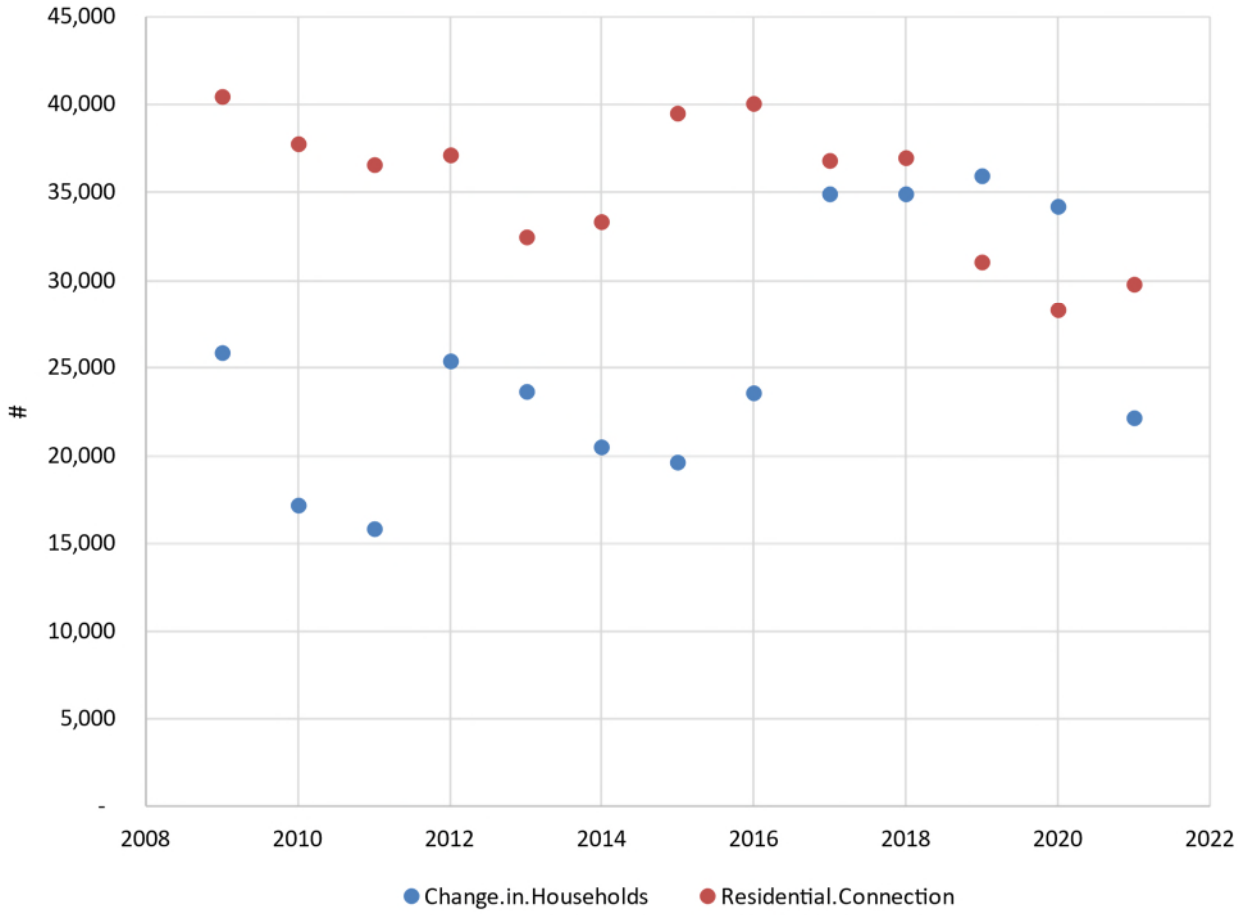
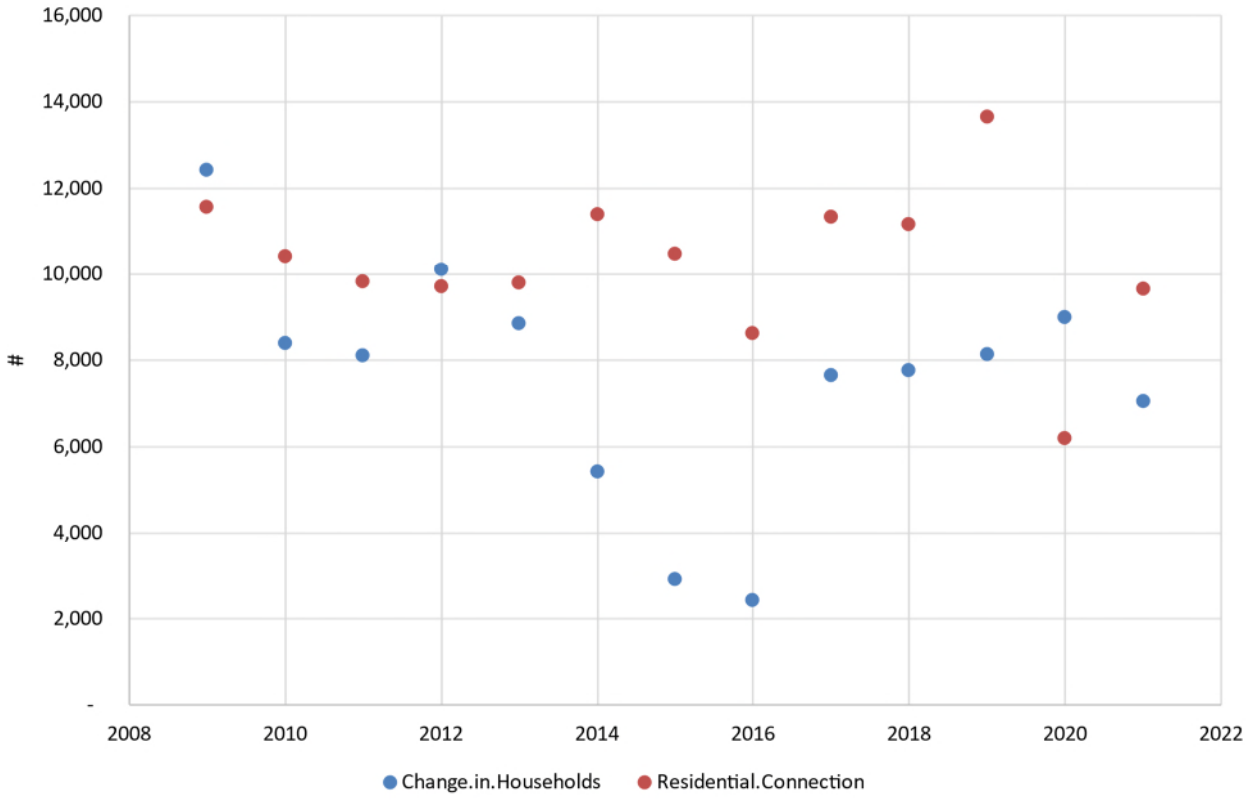


*Figure 27: Ergon - Household formations and connections*




Appendix A details the econometric relationships. Note that the short data series on connections limited the econometric approaches, and number of variables that could be used to forecast connections. Further, the Ergon data did match up with Household formation. As such, we have used Energex data and South East QLD household formation to infer QLD averages.

The analysis will produce customer number forecasts in a way that will be transparent, easy to understand, easy to change if needed, and easy to update each year by EQL's forecasting team.

## Connex Modelling

Our Connex model uses data from EQL – namely historical volumes and historical connex to build a relationship between these two series.

### Trend analysis

The trend between connections and connex is difficult to establish. The Connex series provided by EQL is short, and very volatile. As such, it was necessary to build the trend analysis through an iterative process of consultation and modelling – econometric analysis was unable to be undertaken in a meaningful way.

While Volumes were volatile to an extent, the longer series enabled us to identify a smooth longer term trend, the shorter and more volatile connex series did not allow for this. We determined that the appropriate values for connex per connection were:

*Table 4: Connex per Connection*

| | Energex | Ergon |
|---|---|---|
| Simple Residential | $1,200.00 | $491.77 |
| Complex Residential | $19,000.00 | $8,170.18 |
| Simple Commercial | $2,628.70 | $6,567.21 |
| Complex Commercial | $46,265.71 | $39,607.51 |

### Gross to Net Connex

We use the historical relationships (four years of data) for each class of connection for both Energex and Ergon and apply these over the entire period.

### Nominal to Real Connex

The parameters for Connex per connection are not fixed in nominal terms, we escalate these using an appropriate industry inflator. To do this:

- We assess the shares of labour and other using the ABS input output tables.
- For the labour share, we gross up costs using the WPI forecast for the construction industry from the AUS-M model.
- For the other share, we gross up costs using the PPI forecast for the construction industry from the AUS-M model.

To get to real values, we then deflate costs using the forecast of CPI from the AUS-M model.

### Residential Connection forecasts

Table 4 below presents the connections by SA4 (With the Energex region bundling multiple SA4s. South East QLD returns to pre-COVID growth in connections. Significant annual growth is also forecast in Wide Bay, Cairns, Mackay, Townsville and Toowoomba. Despite reducing population over the period, QLD Outback is forecast to see growth in residential connections.

*Table 4: Residential Connection Forecast by SA4*

| SA4 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| South East QLD | 33,580 | 34,350 | 35,802 | 35,947 | 36,774 | 37,621 | 38,488 | 39,376 | 40,286 |
| Cairns | 1,996 | 2,032 | 2,109 | 2,108 | 2,146 | 2,186 | 2,226 | 2,267 | 2,309 |
| Central QLD | 1,266 | 1,284 | 1,327 | 1,320 | 1,339 | 1,358 | 1,377 | 1,397 | 1,417 |
| Darling Downs | 359 | 363 | 373 | 369 | 373 | 376 | 380 | 383 | 387 |
| Mackay | 1,474 | 1,507 | 1,570 | 1,576 | 1,611 | 1,648 | 1,686 | 1,724 | 1,764 |
| QLD Outback | 62 | 63 | 65 | 64 | 65 | 65 | 66 | 67 | 67 |
| Townsville | 989 | 999 | 1,028 | 1,018 | 1,028 | 1,038 | 1,048 | 1,058 | 1,069 |
| Toowoomba | 682 | 688 | 708 | 702 | 709 | 716 | 723 | 730 | 737 |
| Wide Bay | 1,801 | 1,826 | 1,887 | 1,878 | 1,904 | 1,931 | 1,958 | 1,986 | 2,015 |

*Source: EQL Data, ABS, AUS-M, Construction Model*

Table 5 presents the SA4 data bundled by Energex and Ergon.

*Table 5: Residential Connection Forecast by Energex or Ergon*

| Geography | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Energex | 33,580 | 34,350 | 35,802 | 35,947 | 36,774 | 37,621 | 38,488 | 39,376 | 40,286 |
| Ergon | 7,640 | 7,763 | 8,037 | 8,016 | 8,147 | 8,280 | 8,416 | 8,554 | 8,696 |

*Source: EQL Data, ABS, AUS-M, Construction Model*

## Estimating commercial connections

FTI Consulting use a multifaceted approach to estimate commercial connections.

- We econometrically estimate the relationship between residential and commercial connections.
- We use our construction forecasts and data to understand the amount of additional commercial and retail space by region
- We use floorspace ratios for retail connections to estimate the number of new retail connections per person.

### Econometric estimates

The Econometric results are summarised in Appendix A. Note that while a number of econometric approaches were considered and applied, including a number of different variables the very short nature of the connections series meant that we ended up using a simple Ordinary Least Squares approximation.

The approximation suggests that over time, that around 5.4 residential connections drives an extra commercial connection. We then use our construction data, floorspace ratio data, and macroeconomic data to adjust and apportion this higher-level estimate.

### Construction Data

### Floorspace ratios

Floorspace ratios are an important factor in relating the number of new people to a number of new retail premises. We use data from the Shopping Centre Council of Australia (SCCA)[2] which suggests that:

- The average Australian demands 2.3 square metres of retail space; and
- The average retailer requires 100 square metres
- There is on average one “shop” per 43 Australians.

These assumptions give the results for retail space as per Table 6.

[2] http://www.scca.org.au/wp-content/uploads/2020/01/AUSTR1.pdf

*Table 6: Additional Retail Connections*

| SA4 (Or region) | Additional Retail Connections (2021-2030) |
|---|---|
| Greater Brisbane | 14,943 |
| Cairns | 788 |
| Central QLD | 395 |
| Darling Downs | 82 |
| Mackay | 436 |
| QLD Outback | -17 |
| Townsville | 673 |
| Toowoomba | 354 |
| Wide Bay | 531 |

*Source: ABS Census Data*

## Commercial results

Table 7 presents the commercial connections by SA4. Growth is concentrated in South East QLD. There is some growth in all regions, although very few connections are forecast annually in the QLD outback.

*Table 7: Commercial Connection Forecast by SA4*

| SA4 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| South East QLD | 2,101 | 2,149 | 2,494 | 2,249 | 2,301 | 2,354 | 2,408 | 2,463 | 2,520 |
| Cairns | 703 | 716 | 729 | 743 | 756 | 770 | 784 | 799 | 814 |
| Central QLD | 446 | 452 | 459 | 465 | 472 | 479 | 485 | 492 | 499 |
| Darling Downs | 127 | 128 | 129 | 130 | 131 | 133 | 134 | 135 | 136 |
| Mackay | 519 | 531 | 543 | 555 | 568 | 581 | 594 | 608 | 622 |
| QLD Outback | 22 | 22 | 22 | 23 | 23 | 23 | 23 | 23 | 24 |
| Townsville | 349 | 352 | 355 | 359 | 362 | 366 | 369 | 373 | 377 |
| Toowoomba | 240 | 243 | 245 | 247 | 250 | 252 | 255 | 257 | 260 |
| Wide Bay | 634 | 643 | 652 | 662 | 671 | 680 | 690 | 700 | 710 |

*Source: EQL Data, ABS, AUS-M, Construction Model*

Table 8 presents commercial connections by Energex and Ergon.

*Table 8: Commercial Connection Forecast by Energex or Ergon*

| Geography | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Energex | 2,120 | 2,169 | 2,518 | 2,271 | 2,324 | 2,378 | 2,433 | 2,490 | 2,548 |
| Ergon | 3,040 | 3,087 | 3,135 | 3,183 | 3,233 | 3,283 | 3,334 | 3,387 | 3,440 |

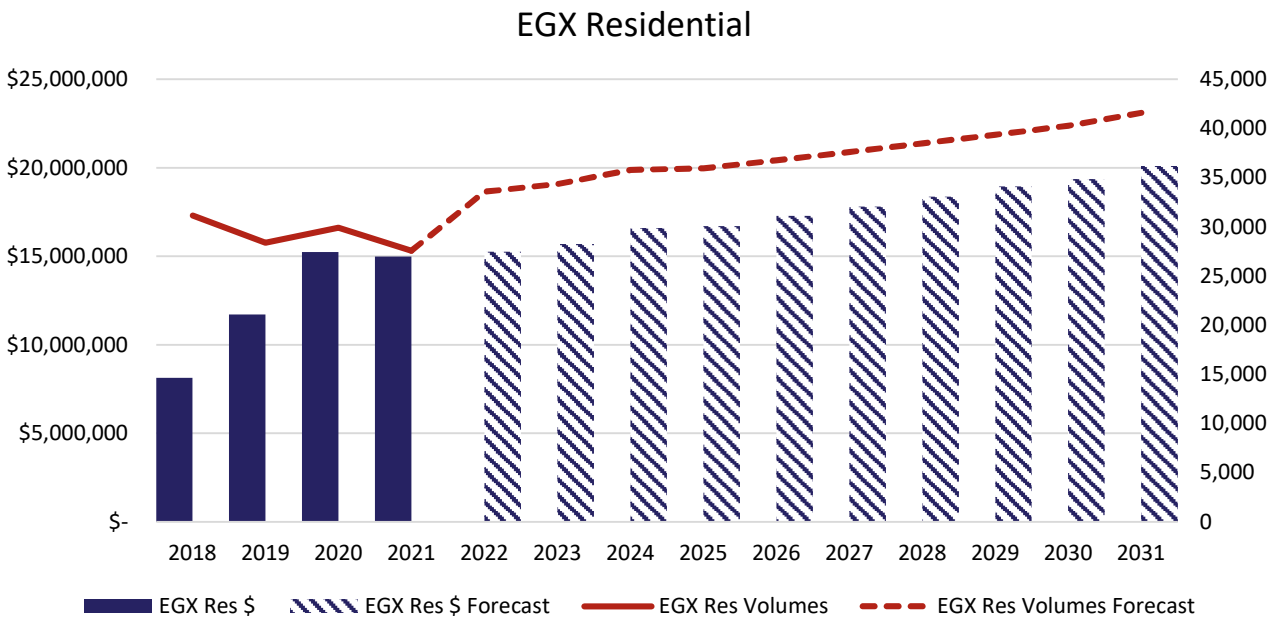
*Source: EQL Data, ABS, AUS-M, Construction Model*

## Connex Forecasts

The following charts present the estimation of connex for the April 2023 round. Real, net connex is presented, however in the model, we also provide forecasts of:

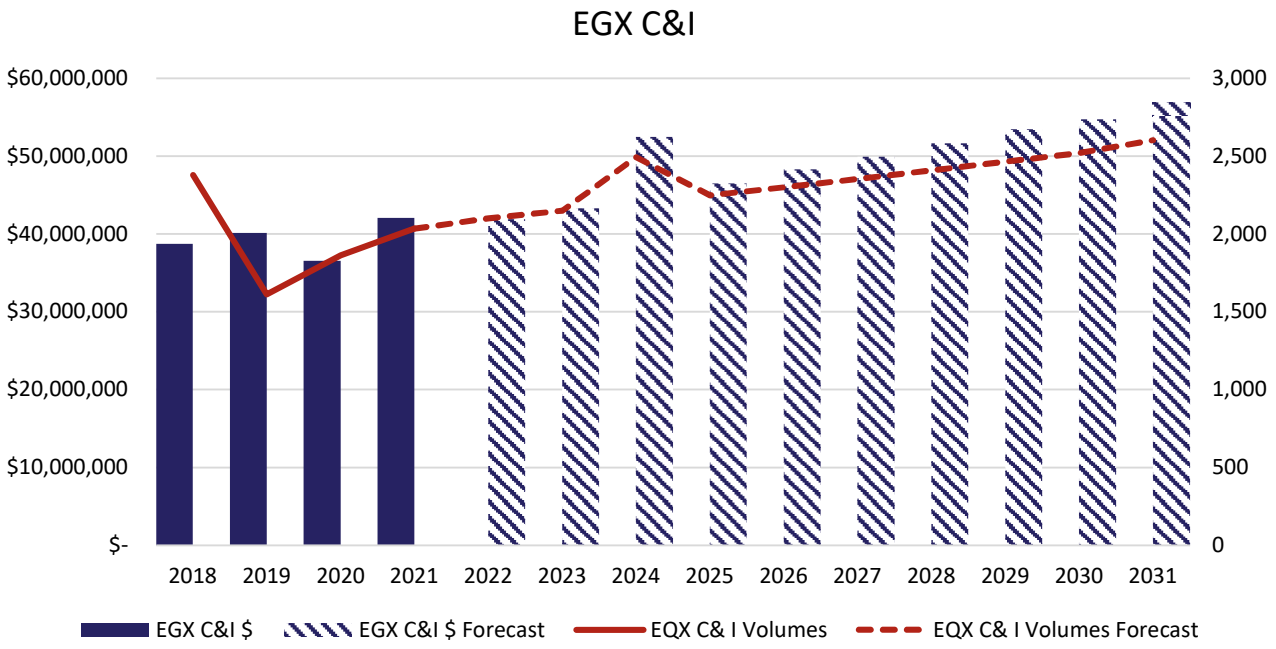
- Real, gross connex
- Nominal, net connex
- Nominal, gross connex.

*Figure 28: Energex, residential volumes and connex, net, real*



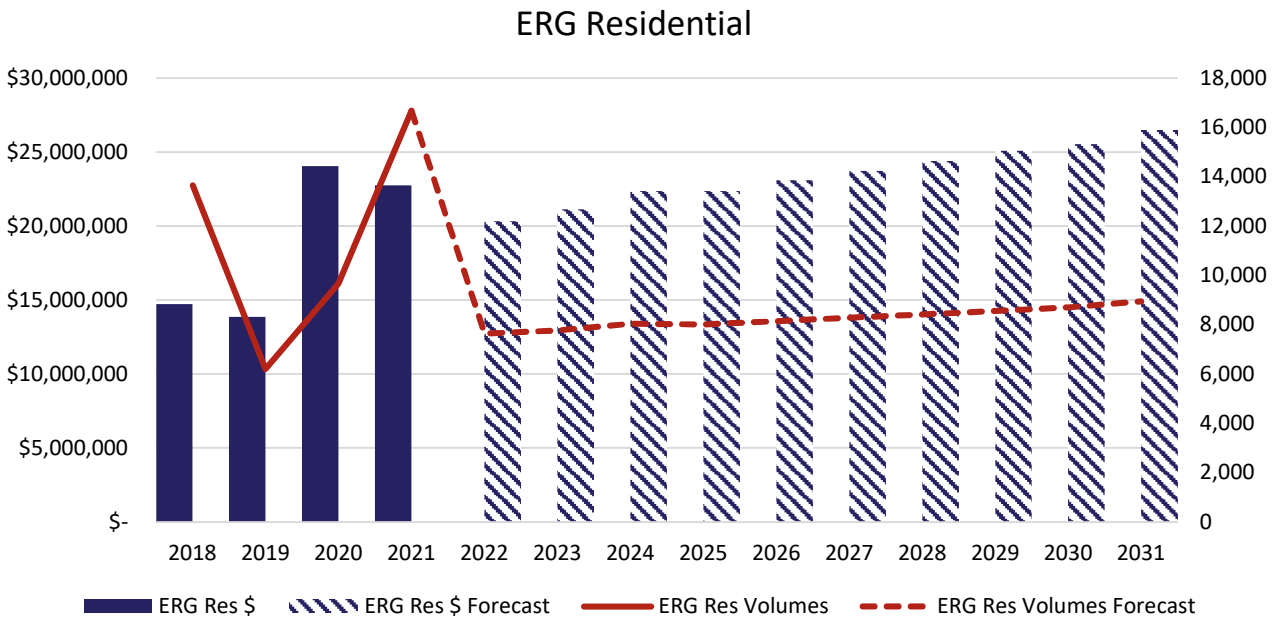

The figure above shows the Energex Residential forecasts for volumes and Connex. Note that the historical volumes and connex show some inconsistency in their relationship. Following our statistical analysis, , we undertook consultation with EQL to determine how the variable relationship between volumes and connex could be explained, and which years were the most indicative of "trend." Our forecasts for volumes and connex suggest modest growth in connex, with a spike in 2024 as the current backlog as processed (based on consultations with EQL).

*Figure 29: Energex, C&I volumes and connex, net, real*



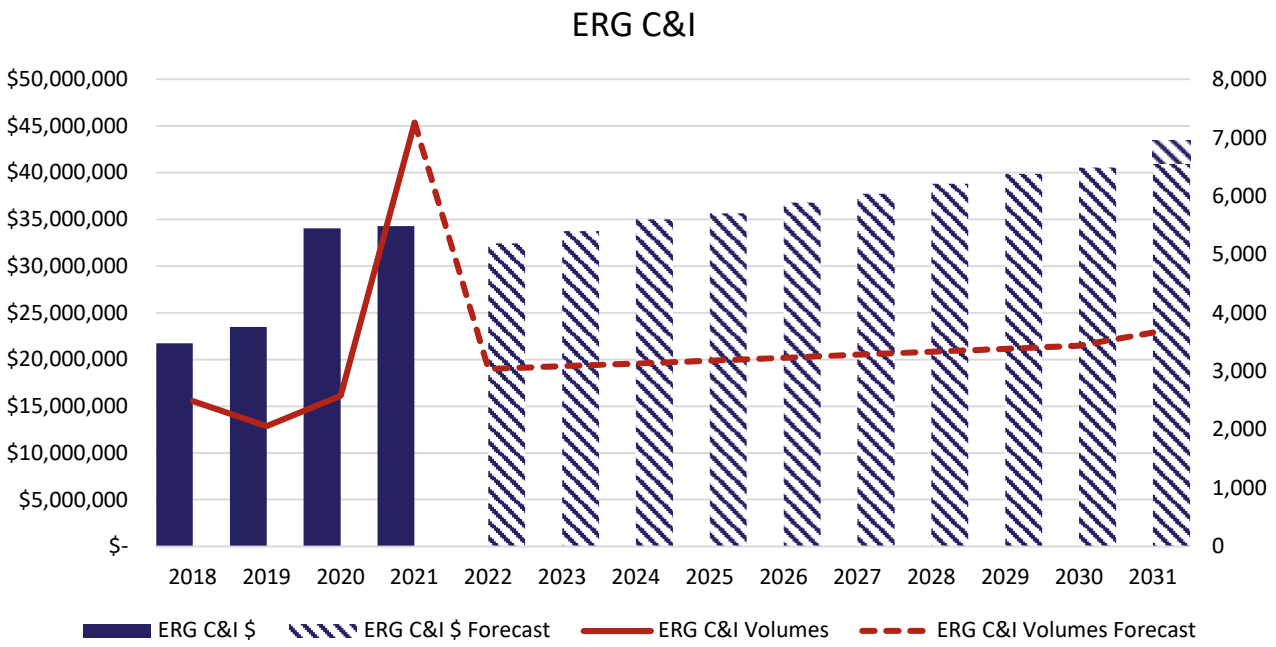
The figure above shows the volumes and connex for Energex C&I. There is a more stable historical relationship than for residential connex. Our forecast of connex is for steady growth from 2022, with a spike in 2024 as the backlog is processed (based on consultations with EQL).

*Figure 30: Ergon, residential volumes and connex, net, real*




The figure above gives the forecasts of Ergon Residential. The significant spike in connex in 2020 and 2021 and modest connex in 2018 and 2019 has required significant consultation with EQL. Consultation suggested that the issue was one of timing, and as such a weighted average of the four year period was seen as a reliable starting point. We forecast a modest reduction in connex from 2022, with steady growth thereafter.

*Figure 31: Ergon C&I connex, net, real*




Historical data on Ergon C&I was volatile, with a significant spike in connection volumes in 2021, with no real flow on impact on connex. Based on consultations with EQL, we use the relationship for the 2018-2020 to estimate the connex per connection. Using this, we forecast connex increasing moderately from 2021 levels.

## How to use the model

The model tab “Using the Model” explains how to use this model. The connection volumes can be found in the “Output Tab Summary” and these can be further filtered by networks, connection types and regions. The Connex outputs are found on four main tabs:

- Connex Real Net
- Connex Real Gross
- Connex Nominal Net
- Connex Nominal Gross

## Conclusion

FTI Consulting have built an integrated model to forecast connections in QLD in the period to 2030. The model leverages the relationships between population growth, household formation and connections to develop a residential connections forecast.

To develop commercial forecasts, the relationship between additional population, and the services this additional population require has been used.

The growth in population in QLD forecast to 2030 results in significant additions to connections, both residential and commercial, with growth concentrated in the South East QLD region.

# Appendices

## Appendix A: Econometric Analysis and Assumptions

*Table 9: Econometric Parameters*

| Category | Energex | Ergon |
|---|---|---|
| Residential | 1.03541 | 0.5501 |
| Commercial | 5.365 | 3.3720 |

*Source: EQL Data, ABS, AUS-M, Construction Model*

*Table 10: Tariff Classes – SAC, CAC, ICC*

| Tariff Class | Eligible Customer |
|---|---|
| Standard Asset Customers (SAC) | All customers connected at LV with installed capacity up to 1,000 kVA are classified as SACs. SAC tariffs are based on:<br>■ average charges for dedicated connection assets; plus<br>average charges for use of the shared distribution network, including common and nonsystem assets. |
| Connection Asset Customers (CAC) | Customers with a network coupling point at 66 kV, 33 kV, 22 kV, 11 kV and installed capacity above 1,000 kVA who are not assigned to the ICC tariff class are allocated to the CAC tariff class. CAC tariffs are based on:<br>■ the actual dedicated connection assets utilised by the customer; plus<br>average charges for use of the shared distribution network, including common and nonsystem assets. |
| Individually Calculated Customers (ICC) | Customers are assigned to the ICC tariff class if they are coupled to the network at 132 kV, 110 kV, 66 kV or 33 kV and with installed capacity above 10 MVA.<br>Customers may also be assigned to the ICC tariff class if they are coupled to the network at 132 kV, 110 kV, 66 kV or 33 kV and with installed capacity below 10 MVA where[a]:<br>■ A customer has a dedicated distribution system which is quite different and separate from the remainder of our distribution system<br>■ A customer is connected at or close to a Transmission Connection Point, or<br>■ At the determination of the DNSP, the nature of the customer's connection to the network, and/or usage of the network, make average prices inappropriate<br>■ Inequitable treatment of other customers would arise from the application of the 10MVA threshold<br>ICC tariffs are based on:<br>■ the actual dedicated connection assets utilised by the customer; plus<br>■ the customer's specifically identified portion of the shared distribution network utilised for<br>the electricity supply, including common and non-system assets. |
| *Note: a. Some existing customers coupled to the HV network at lower voltage levels will remain allocated to the ICC tariff class for legacy reasons* | |

*Source: Energex Pricing Proposal Distribution services for 1 July 2022 to 30 June 2023 - 31 March 2022*