



Forecast load traces for NEM and Queensland small load

Forecast load traces for input to
determination of BRCI for 2007/08,
2008/09 and 2009/10

Prepared for Queensland Competition Authority

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ACIL Tasman

Economics Policy Strategy

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Contents

1	Background	1
1.1	The Supreme Court decision	2
2	Comments on the CRA methodology	3
2.1	The 2008-09 addendum report methodology	3
2.1.1	Comment on 2008/09 methodology	3
2.2	The 2009-10 final second report methodology	3
2.2.1	Comments on 2009/10 methodology	4
3	ACIL Tasman load trace forecast methodology	5
3.1	Forecast load traces for the NEM regions	6
3.1.1	Load traces for years to March 2007, 2008 and 2009	6
3.1.2	Adjusting load traces to financial year configuration	7
3.1.3	Load forecasts from the NEMMCO SOOs	8
3.1.4	Forecast of minimum demand	9
3.1.5	Forecast load trace NEM Regions	10
3.1.6	10% and 90% POE load traces for NEM regions	11
3.1.7	Use of the NEM regional load trace forecasts	11
3.2	Forecast load traces for the Queensland total NEM load and small load in	13
3.2.1	Half hour load trace data for Queensland	13
3.2.2	Adjusting load traces to financial year configuration	15
3.2.3	Load forecasts for Queensland	17
3.2.4	Forecast of minimum demand for Queensland	18
3.2.5	Forecast load trace for total NEM load for Queensland	19
3.2.6	10% and 90% POE load traces for Queensland	22
3.2.7	Forecast load traces for directly connected customers for Queensland	22
3.2.8	Forecast load traces for small load for Queensland	22
3.2.9	Use of the Queensland load traces	24

List of figures

Figure 1	Load duration curves for actual loads in year to March 2007, 2008 and 2009 (as delivered from transmission network)	15
Figure 2	Load duration curves for loads adjusted to a financial year configuration for 2007/08, 2008/09 and 2009/10 (as delivered from transmission network)	17
Figure 3	Load duration curves for financial year 50% POE forecast load traces (50%POE as delivered from transmission network)	20

Forecast load traces for NEM and Queensland small load

Figure 4	Adjusted data and forecasts for peak month in 2007/08, 2008/09 and 2009/10 for the total NEM load for Queensland (50%POE as delivered from transmission network)	21
Figure 5	Adjusted data and forecasts for peak month in 2007/08, 2008/09 and 2009/10 for the small load for Queensland (50%POE as delivered from transmission network)	23

List of tables

Table 1	Power station auxiliary usage	6
Table 2	Key characteristics of actual load NEM regional traces for the years to March 2007, 2008 and 2009 (as sent-out from power stations)	6
Table 3	Key characteristics of NEM regional traces for the years to March 2007, 2008 and 2009 adjusted to day/date structure for 2007/08, 2008/09 and 2009/10 respectively (as sent-out from power stations)	8
Table 4	NEMMCO SOO demand and energy forecasts (as sent-out from power stations)	9
Table 5	Key characteristics of medium growth 50% POE forecast load traces for the NEM regions (as sent-out from power stations)	11
Table 6	List of TNIs included in the NEM Load trace for Queensland in the year to March 2009	14
Table 7	Key characteristics of actual base load traces to March 2007, 2008 and 2009 (as delivered from transmission network)	14
Table 8	Key characteristics of base traces adjusted to financial year's day structure and dates (as delivered from transmission network)	16
Table 9	Powerlink forecasts of scheduled demand and energy as delivered from the transmission network	18
Table 10	Key characteristics of forecast load traces (50%POE as delivered from transmission network)	20

1 Background

The Queensland Competition Authority (the Authority) engaged ACIL Tasman to provide a critique on the methodology used by CRA to calculate the energy purchase costs (EPC) for use in recalculation of the 2008/09 BRCI and the determination of the 2009/10 BRCI.

In addition, the Authority requested advice on improving the methodology forecasting half hour load traces to be used by CRA in the calculation of the EPC used in determining the BRCI for 2008/09 and 2009/10. The following forecast load traces were specified by QCA as being required:

- 2007/08 for the small load for Queensland at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2007 and the medium growth forecast summer and winter maximum demands and annual energy for 2008/09 as published in the 2006 Powerlink Annual Planning Statement (APR)
- 2008/09 for the small load for Queensland at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2008 and the medium growth forecast summer and winter maximum demands and annual energy for 2008/09 as published in the 2007 Powerlink Annual Planning Statement (APR)
- 2009/10 for the small load for Queensland at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2009 and the medium growth forecast summer and winter maximum demands and annual energy for 2009/10 as published in the 2008 APR

The Authority also requested ACIL Tasman to provide consistent load trace forecasts for each of the NEM regions for the years 2007/08, 2008/09 and 2009/10 for use by CRA in calculating the NEM spot prices as input to its calculation of the EPC. The NEM regional load trace forecasts use a similar approach as used for the load trace forecast for NEM load in Queensland. The approach ensures that the forecast half hour Queensland spot prices modelled by CRA and used in the calculation of the EPC, are consistent with the load trace forecasts for the small load in Queensland which are also used in the calculation of the EPC. The following load trace forecasts for each NEM region are required:

- 2007/08 for the NEM regions at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2007 and the medium growth forecast summer and winter maximum demands and annual energy for 2008/09 as published in the 2006 NEMMCO SOO
- 2008/09 for the NEM regions at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2008 and the medium growth forecast summer and winter maximum demands and annual energy for 2008/09 as published in the 2007 NEMMCO SOO

Forecast load traces for NEM and Queensland small load

- 2009/10 for the NEM regions at 10%, 50% and 90% POE based on the actual load trace for the year to 31 March 2009 and the medium growth forecast summer and winter maximum demands and annual energy for 2009/10 as published in the 2008 NEMMCO SOO

The process adopted by ACIL Tasman in load trace forecasting involves two basic steps:

- Step 1. adjusting the actual load shapes for the year to March to the day/date structure of the financial year being forecast
- Step 2. applying the ACIL Tasman load trace model which produces forecast load traces by transforming a base load trace to fit the forecasts of summer and winter maximum demands, minimum demand and annual energy.

1.1 The Supreme Court decision

The load trace forecasts are required by the Authority so that it can meet its obligations under the recent Supreme Court orders which require it to:

- recalculate the 2007-2008 benchmark retail cost index, and decide the benchmark retail cost index for 2008-2009
- calculate notified prices for the 2008- 09 tariff year by reference to the Remade Decision
- calculate notified prices for the 2009- 2010 tariff year by reference to the Remade Decision and the 2008-2009 Notified Prices

This means that recalculated BRCIs will be required for each of the years 2007/08, 2008/09 and 2009/10. In order that these are calculated in a consistent way, the load traces have been based on the latest information that would have been available at the time for each of the respective financial years being forecast. This includes the recorded load traces for the year to March prior to the financial year being forecast and the Powerlink APR forecast and the NEMMCO SOO forecast for the previous year.

2 Comments on the CRA methodology

This section of the report reviews the two methods for estimating the EPC component used by CRA and makes some comments on them in relation to a preferred methodology to be used in the 2009/10 BRCI determination.

The comments are largely confined to the alternative methodologies proposed as well as the treatment of data rather than the results.

2.1 The 2008-09 addendum report methodology

CRA based the energy growth rate for the small load on growth rates between corresponding 6 month periods to provide a growth in energy consumption for the small load bringing together actual (July to December 08) and projected (January to June 09) and using the energy growth rate between 2007/08 and 2008/09 (as calculated) to provide a forecast of energy consumed in the 2009/10 year.

Peak demand for 2009/10 for the small load was forecast by assuming that the forecast growth in peak demand was caused entirely by the small load.

The load trace for the small load in 2009/10 was developed on the basis of the actual load trace for 2007/08.

Energy purchase costs were estimated using a market model to provide an estimate of half hourly prices over the period and applying these prices to the half hourly load trace of the small load. When combined with assumed levels of hedge cover and hedge prices a half hourly energy purchase cost can be derived and aggregated into an annual energy purchase cost.

2.1.1 Comment on 2008/09 methodology

ACIL Tasman agrees with these steps except for the derivation of peak demand for the small load by assuming the growth in peak demand for the large load is all attributable to growth in the small load. We believe that the increase in large load demand should not be assumed to be the increase in the maximum demand for the small load.

Assuming the spot price modelling approach is well founded, the methodology used to estimate the EPC would appear sound.

2.2 The 2009-10 final second report methodology

The approach adopted by CRA in this instance avoided the problems of applying different growth rates to energy and maximum demand and then

attempting to derive the small load from the derived results. Instead, CRA firstly derived the half hourly load trace for the large load by taking the previous year's half hourly load trace, applying the 50% POE maximum demand from the SOO and then combining the maximum demand and energy growth to produce a new set of half hourly demands. The 10% POE maximum demand and 90% POE maximum demand were then applied to the top 200 half hours of the load trace for 09-10 to provide two additional load traces. The small load was derived from this by using the ratios derived from historical data between the large and small load for corresponding half hours. The ratios were then applied to the large load in the 3 cases (50%, 90% and 10% POE) to derive the small load.

The 3 cases are used and then combined to produce a weighted average because the use of the 50% POE case alone may bias the results towards the low side. Average annual wholesale electricity prices are not distributed in a normal pattern - the distribution is skewed towards the higher end – resulting in the median being less than the mean. As a result a POE50 (the median forecast) demand projection alone is likely to underestimate the energy purchase price. The weightings are not published but we believe they were 30% for 90POE, 40% for 50POE and 30% for 10POE. These seem reasonable enough, if somewhat arbitrary.

2.2.1 Comments on 2009/10 methodology

ACIL Tasman considers the 2009/10 methodology appears a better way to proceed than the previous method used for 2008/09 even though it involves a change in methodology. It provides a consistent method for developing the large and small load based on historical and accessible data. It will require that the small load and large load data is checked each year for consistency (no large directly connected customers either commencing or terminating their consumption) and may need to be adjusted for any material year on year changes that would alter the small load/large load ratio.

That said, the load trace methodology is still not ideal with the small load derived by using the ratios between the large and small load for corresponding half hours derived from historical data. ACIL Tasman has developed an alternative methodology to overcome these problems which is discussed in Section 3 of the report. Furthermore, it is critical that all of the load traces used in modelling of half hour spot prices and in calculating the EPC are consistent with each other.

3 ACIL Tasman load trace forecast methodology

This section deals with a methodology developed by ACIL Tasman to produce the load trace forecasts which is designed to overcome the identified shortcomings of the previous methods.

For the load trace forecasts for the total NEM load for Queensland, the ACIL Tasman methodology is based on the transformation of the load trace for latest year of available data (year to March) to match the Powerlink forecast of summer and winter maximum demand and annual energy for Queensland as published in its latest APR. The analysis is based on actual load trace data and forecasts load at the delivery point on the transmission network. This is because it more closely matched the load purchased by retailers than generated load or load sent out from generators as used by NEMMCO in its SOO.

For the load trace forecasts for the NEM regions, the ACIL Tasman methodology is based on the transformation of the load traces for latest year of available data (year to March) to match the NEMMCO forecast of summer and winter maximum demand and annual energy for each region of the NEM in as published in its latest SOO. The analysis is based on actual load trace data and forecasts load as sent-out from the power stations.

The process adopted by ACIL Tasman in forecasting load traces involves two basic steps:

- Step 1. adjusting the actual load shapes for the year to March to the day/date structure of the financial year being forecast
- Step 2. applying the ACIL Tasman load trace model which produces load trace forecasts by transforming a base load trace to fit the forecasts of summer and winter maximum demands, minimum demand and annual energy.

3.1 Forecast load traces for the NEM regions

As part of its evaluation of the EPC, CRA models the NEM (including Qld) spot prices by modelling the whole NEM. The Queensland spot price is then used as input to its EPC evaluation.

The methodology used by ACIL Tasman in developing these load traces is the same as that used to produce the half hour load trace for the total NEM load for Queensland as described in detail in Sections 3.1.1 to 3.1.5.

3.1.1 Load traces for years to March 2007, 2008 and 2009

The half hour load traces, as generated, for each of the five NEM regions for the year to March 2007, 2008 and 2009 downloaded by ACIL Tasman from the <erisk.net.au> website where NEMMCO data is available for sale. This, as generated, data is reduced to a sent-out from power station basis by deducting the estimated power station auxiliary usage. The power station auxiliaries estimated by ACIL Tasman are shown in Table 1.

Table 1 **Power station auxiliary usage**

NEM Region	NSW	Qld	SA	Tas	Vic
Estimated powerstation auxiliaries	6.0%	6.5%	2.0%	1.5%	9.0%

Data source: Estimated by ACIL Tasman

The adjustment to a sent-out basis is required because the CRA spot price model for the NEM is based on sent-out data. Key characteristics of the actual load traces for the NEM regions after allowance for power station auxiliaries are shown in Table 2.

Table 2 **Key characteristics of actual load NEM regional traces for the years to March 2007, 2008 and 2009 (as sent-out from power stations)**

Description	Year to March 2007					Year to March 2008					Year to March 2009				
	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic
Maximum summer demand (MW)	11,884	8,030	2,797	1,462	8,087	12,177	7,556	3,018	1,425	8,828	13,260	8,113	3,264	1,463	9,478
Maximum winter demand (MW)	12,175	7,175	2,320	1,683	7,183	12,984	7,328	2,339	1,727	7,598	13,418	7,665	2,396	1,734	7,281
Minimum demand (MW)	5,168	3,684	752	800	3,609	5,282	3,775	768	681	3,622	5,294	3,834	830	739	3,644
Annual Energy (GWh)	73,578	47,753	13,052	10,067	46,974	73,392	47,985	13,069	10,086	47,253	74,289	49,095	13,133	10,192	47,402
Load factor	69.0%	67.9%	53.3%	68.3%	66.3%	64.4%	72.3%	49.3%	66.5%	60.9%	63.2%	69.1%	45.9%	67.1%	57.1%

Data source: ACIL Tasman analysis of NEMMCO load data from <erisk.net.au>

3.1.2 Adjusting load traces to financial year configuration

Financial year load trace configurations for each NEM region were then produced by:

- moving the June Quarter from the beginning to the end of the year to 31 March load traces
- adjusting the date and day type structure to match the financial year being forecast.

The load traces for each NEM region were adjusted in precisely the same manner so that they remain exactly comparable with each other.

The moving of the June quarter from the beginning to the end to give a financial year day structure does not affect the daily, monthly or annual load factors. Furthermore, annual energy and summer and winter peaks and minimum demand are not affected by this move. The primary information captured by this move is the shape of the most recent actual June quarter load trace.

The adjustment of the dates to give the correct dates and day types for the financial year being forecasts does not affect the annual summer and winter peaks or the minimum load. However it has a very minor impact on energy and load factor in the year to March 2008. This is because the original data contains 366 days while the adjusted data contains only 365 days to be consistent with the 2008/09 financial year being forecast. Furthermore the number of weekdays and weekends may not be the same in the raw data and the financial year adjusted load traces. The characteristics of the adjusted load traces and the changes from the year to March data are shown in Table 3.

Table 3 **Key characteristics of NEM regional traces for the years to March 2007, 2008 and 2009 adjusted to day/date structure for 2007/08, 2008/09 and 2009/10 respectively (as sent-out from power stations)**

Description	2007/08 forecast					2008/09 forecast					2009/10 forecast				
	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic
With financial year day structure and dates															
Maximum summer demand (MW)	11,884	8,030	2,797	1,462	8,087	12,177	7,556	3,018	1,425	8,828	13,260	8,113	3,264	1,463	9,478
Maximum winter demand (MW)	12,175	7,175	2,320	1,683	7,183	12,984	7,328	2,339	1,727	7,598	13,418	7,665	2,396	1,734	7,281
Minimum demand (MW)	5,168	3,684	752	800	3,609	5,282	3,775	768	681	3,622	5,294	3,834	830	739	3,644
Annual Energy (GWh)	73,616	47,753	13,057	10,070	46,986	73,360	47,932	13,063	10,065	47,237	74,294	49,110	13,146	10,187	47,405
Load factor	69.0%	67.9%	53.3%	68.3%	66.3%	64.5%	72.4%	49.4%	66.5%	61.1%	64.0%	69.1%	46.0%	67.1%	57.1%
Differences with the adjusted financial year data															
Maximum summer demand (MW)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maximum winter demand (MW)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum demand (MW)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual Energy (GWh)	37	0	6	3	12	31	53	6	21	17	5	14	13	5	3
Load factor	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.1%	0.8%	0.0%	0.0%	0.0%	0.0%

Data source: ACIL Tasman adjustment of NEMMCO load traces of the regional NEM load

3.1.3 Load forecasts from the NEMMCO SOOs

The medium growth 50% POE forecasts of generated summer and winter maximum demands and sent-out annual energy were taken from the NEMMCO SOO for 2006, 2007 and 2008. The generated demand forecast was adjusted to a sent-out from power station basis by applying estimated power station auxiliaries (see Table 1) for each region so that the forecasts are consistent with the adjusted sent-out load traces. Note that the NEMMCO energy forecasts are already on a sent-out basis.

The NEMMCO forecasts for the NEM regions in 2007/08, 2008/09 and 2009/10 taken from the 2006, 2007 and 2008 NEMMCO SOOs respectively are shown in Table 4.

Table 4 **NEMMCO SOO demand and energy forecasts (as sent-out from power stations)**

NEM region	Summer peak demand (MW sent-out)			Winter peak demand (MW sent-out)			Minimum demand (MW sent-out)	Annual energy (GWh sent-out)	Load factors based on peak		
	10%POE	50%POE	90%POE	10%POE	50%POE	90%POE			10%POE	50%POE	90%POE
2007/08 load forecast from 2006 NEMMCO SOO											
NSW	14,213	13,301	12,624	13,292	12,981	12,681	5,291	75,600	60.7%	64.9%	68.4%
Qld	9,479	8,973	8,624	7,698	7,557	7,415	3,985	51,785	62.4%	65.9%	68.6%
SA	3,436	3,207	2,903	2,400	2,355	2,306	752	12,070	40.1%	43.0%	47.5%
Tas	1,464	1,445	1,428	1,816	1,797	1,742	829	10,463	68.5%	66.5%	65.8%
Vic	9,530	8,761	8,345	7,287	7,202	7,098	3,625	47,336	56.7%	61.7%	64.8%
2008/09 load forecast from 2007 NEMMCO SOO											
NSW	14,570	13,404	12,229	13,508	13,226	12,953	5,536	76,900	60.3%	65.5%	71.8%
Qld	9,757	9,241	8,929	7,825	7,676	7,570	4,184	53,129	62.2%	65.6%	67.9%
SA	3,353	3,027	2,777	2,496	2,449	2,398	769	13,064	44.5%	49.3%	53.7%
Tas	1,410	1,385	1,370	1,778	1,754	1,736	705	10,418	68.5%	67.8%	66.9%
Vic	9,213	8,429	7,964	7,309	7,180	7,068	3,622	46,468	57.6%	62.9%	66.6%
2009/10 load forecast from 2008 NEMMCO SOO											
NSW	14,269	13,433	12,605	13,555	13,198	12,840	5,424	76,120	60.9%	64.7%	68.9%
Qld	9,832	9,285	8,897	8,005	7,888	7,738	4,211	53,943	62.6%	66.3%	69.2%
SA	3,401	3,080	2,796	2,588	2,487	2,388	837	13,255	44.5%	49.1%	54.1%
Tas	1,461	1,436	1,420	1,826	1,803	1,783	761	10,483	67.1%	66.4%	65.5%
Vic	9,639	9,065	8,562	7,740	7,545	7,400	3,644	44,393	52.6%	55.9%	59.2%

Note: Minimum demand is as forecast by ACIL Tasman and is the minimum demand as recorded in the relevant year to March and grown to the relevant financial year using the SOO forecast growth in annual energy.

Data source: ACIL Tasman analysis based on NEMMCO SOO forecast for 2006, 2007 and 2008

3.1.4 Forecast of minimum demand

A forecast minimum demand was produced by ACIL Tasman by projecting the observed minimum half hourly load from the actual load traces at the forecast growth in annual energy. The resultant forecasts for minimum load are shown in Table 4 above.

The minimum load is an important input to the transformation process as it controls the lower end of the load trace. Without this control the transformation process may produce lower minimums as the transformation attempts to match the energy forecast. This would incorrectly result in a decline in the minimum load. This is likely to occur where the load forecast is expected to have declining load factors as is generally the case for the NEM regions.

ACIL Tasman is of the view that the growth in the winter and/or summer peak demand is unlikely to be a good growth rate to use for the minimum load. This is because, in addition to underlying load growth, peak load growth is heavily influenced by the increasing temperature sensitivity of the load as a

consequence of the growth in the penetration of domestic air conditioners. We have therefore chosen the generally lower forecast energy growth rate to apply to the minimum load in this case after considering that there is very limited increase in the high load factor block loads over the forecast period. If a major high load factor block load was included in the forecast then its MW contribution would be added separately to the minimum.

3.1.5 Forecast load trace NEM Regions

ACIL Tasman's load trace model was then applied to manipulate the half-hourly sent-out load traces for the NEM regions to match the forecasts of summer and winter peak demands, minimum demand and annual energy from the respective NEMMCO SOO as shown in Table 4.

The model uses a non linear transformation to adjust the recorded load trace to fit the forecast elements using a goal seek method akin to a linear programming solution.

Forecast half hourly NEM regional load traces on a sent-out basis were produced for:

- 2007/08 based on the year to 31 March 2007 NEM regional load traces with the June Quarter moved and the date and day structure adjusted to match 2007/08 and the medium growth 10%, 50% and 90% POE forecasts from 2006 NEMMCO SOO.
- 2008/09 based on the year to 31 March 2008 NEM regional load traces with the June Quarter moved and the date and day structure adjusted to match 2008/09 and the medium growth 10%, 50% and 90% POE forecasts from the 2007 NEMMCO SOO.
- 2009/10 based on the year to 31 March 2009 NEM regional load traces with the June Quarter moved and the date and day structure adjusted to match 2009/10 and the medium growth 10%, 50% and 90% POE forecasts from the 2008 NEMMCO SOO.

The characteristics of the forecast load traces are shown in Table 5. It can be seen that the characteristics of the forecast load traces for the total NEM load match the APR 50% POE forecasts summarised in Table 4.



Table 5 **Key characteristics of medium growth 50% POE forecast load traces for the NEM regions (as sent-out from power stations)**

Description	2007/08 forecast					2008/09 forecast					2009/10 forecast				
	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic	NSW	Qld	SA	Tas	Vic
With financial year day structure and dates															
Maximum summer demand	13,301	8,973	3,207	1,449	8,761	13,404	9,240	3,027	1,380	8,429	13,433	9,285	3,080	1,436	9,065
Maximum winter demand (MW)	12,981	7,557	2,355	1,797	7,202	13,226	7,676	2,449	1,754	7,180	13,198	7,888	2,487	1,803	7,545
Minimum demand (MW)	5,291	3,985	752	829	3,625	5,536	4,184	769	705	3,622	5,424	4,211	837	761	3,644
Annual Energy (GWh)	75,600	51,785	12,070	10,463	47,336	76,900	53,129	13,064	10,418	46,468	76,120	53,943	13,255	10,483	44,393
Load factor	64.7%	65.7%	42.9%	66.3%	61.5%	65.5%	65.6%	49.3%	67.8%	62.9%	64.7%	66.3%	49.1%	66.4%	55.9%

Data source: ACIL Tasman's load trace model

3.1.6 10% and 90% POE load traces for NEM regions

Load trace forecasts for the total NEM regions based on the 10% and 90% POE forecasts for summer and winter peak demands from the successive NEMMCO SOOs were developed using the same adjusted load traces and methodology as the 50% POE forecast described above.

10% and 90% POE load traces were then constructed by replacing the top 400 half hours from the 50% POE load trace in each region with the values from the same half hours in the load traces based on the 10% and 90% POE load forecasts for the respective regions. The top 400 half hour demands in each NEM region were replaced in this way.

The 10% and 90% POE load traces for each region are the same as the 50% POE load trace except for the top 400 half hour demands. This, in turn, means that the annual energy under the 10% POE load trace will be slightly higher than the annual energy under the 50% POE load trace and the annual energy under the 90% POE load trace will be slightly lower than the 50% POE load trace.

3.1.7 Use of the NEM regional load trace forecasts

The forecast NEM regional load traces are to be used by CRA in its modelling of the half hourly NEM spot prices which are in turn used in the calculation by CRA of the EPC for the Queensland small load. The day/date structure used in the NEM regional load trace forecasts for 2007/08, 2008/09 2009/10 have been kept entirely consistent with the day/date structure for the load trace for Queensland small load, which means that each half hour in the load traces for



ACIL Tasman

Economics Policy Strategy

Forecast load traces for NEM and Queensland small load

the NEM regional loads and the small load for Queensland are entirely coincident. This ensures that the Queensland half hour pool prices are entirely coincident with the half hour in the load trace for the small load which will ensure consistency in the calculation of the EPC.

3.2 Forecast load traces for the Queensland total NEM load and small load in

The NEM load for Queensland is defined as the load delivered from the transmission network to customers on distribution networks and does not include customers which are directly connected to the transmission network. Hence the forecast load trace for the NEM load for Queensland is for load as delivered from the transmission network.

3.2.1 Half hour load trace data for Queensland

The first step was to aggregate the half-hourly load data as supplied by NEMMCO for each Queensland TNI for:

- year to 31 March 2007 (for use in the 2007/08 load trace forecast)
- year to 31 March 2008 (for use in the 2008/09 load trace forecast)
- year to 31 March 2009 (for use in the 2009/10 load trace forecast)

into:

- total NEM load for Queensland
- directly connected customer load in Queensland

To ensure consistency with past assessments, ACIL Tasman was supplied a list of the TNI to include in the total NEM load for Queensland and those which were to be regarded as directly connected customers. The Authority also supplied the proportion of the Bulli load which was supplied to NSW. The list of TNI which had load traces supplied the Authority is shown in Table 6.

Table 6 **List of TNIs included in the NEM Load trace for Queensland in the year to March 2009**

Directly connected customer TNIs	Small customer TNIs	
BOYNE ISLAND (BSL)	ABERMAIN	MOLENDINAR
BURTON DOWNS (Coal Mine)	ASHGROVE WEST	MUDGEERABA
BLACKWATER (Rail)	ALLIGATOR CREEK	MACKAY
CALLEMONDAH (Rail)	ALGESTER	MOURA
COPPABELLA (Rail)	ALAN SHERRIFF	MURARRIE
DINGO (Rail)	BELMONT, WECKER ROAD	MIDDLE RIDGE
GREGORY (Rail)	BUNDAMBA	MORANBAH
GRANTLEIGH (Rail)	BILOELA	NEBO
MORANBAH SOUTH (Rail)	BULLI CREEK	NORTH GOONYELLA
MINDI (Rail)	BELMONT	NEWLANDS
MT MCLAREN (Rail)	BRAEMAR	OAKEY
NORWICH PARK (Rail)	BLACKWATER	PIONEER VALLEY
OONOOIE (Rail)	BRISBANE CBD	PROSERPINE
PEAK DOWNS (Rail)	CARDWELL	PALMWOODS
GLADSTONE SOUTH (QAL)	CLARE	QLD Nickel (Yabulu)
Note: QAL Included in Small load prior to 2009/10	CAIRNS	RUNCORN
ROCKLANDS (Rail)	COLLINSVILLE	RICHLANDS
TOWNSVILLE SOUTH (Sun Metals)	CAIRNS	ROCKLEA
WANDOO (Rail)	DAN GLEESON	ROCKHAMPTON
	DYSART	ROSS
	EGANS HILL	REDBANK PLAINS
	KEMMIS	SWANBANK
	EDMONTON	SOUTH PINE
	GARBUTT	SUMNER
	GOODNA	STONY CREEK
	GLADSTONE	TEEBAR CREEK
	GIN GIN	TANGKAM (DALBY)
	GLADSTONE SOUTH	AT DAANDINE POWER STATION
	INNISFAIL	TULLY
	INGHAM	TENNYSON
	INVICTA MILL	TARONG LOAD
	KAMERUNGA	TURKINJE
	KING CREEK	TOWNSVILLE EAST
	LILYVALE	TOWNSVILLE SOUTH
	LOGANLEA	WOOLOOGA
	LILYVALE	WOOREE

Note: One of the directly connected customer TNIs shown in Table 6 is included in the small customers for the years to March 2007 and March 2008 base load traces used in calculating the forecast load traces for 2007/08 and 2008/09.

Data source: The Authority

The characteristics of the summed load traces are shown in Table 7.

Table 7 **Key characteristics of actual base load traces to March 2007, 2008 and 2009 (as delivered from transmission network)**

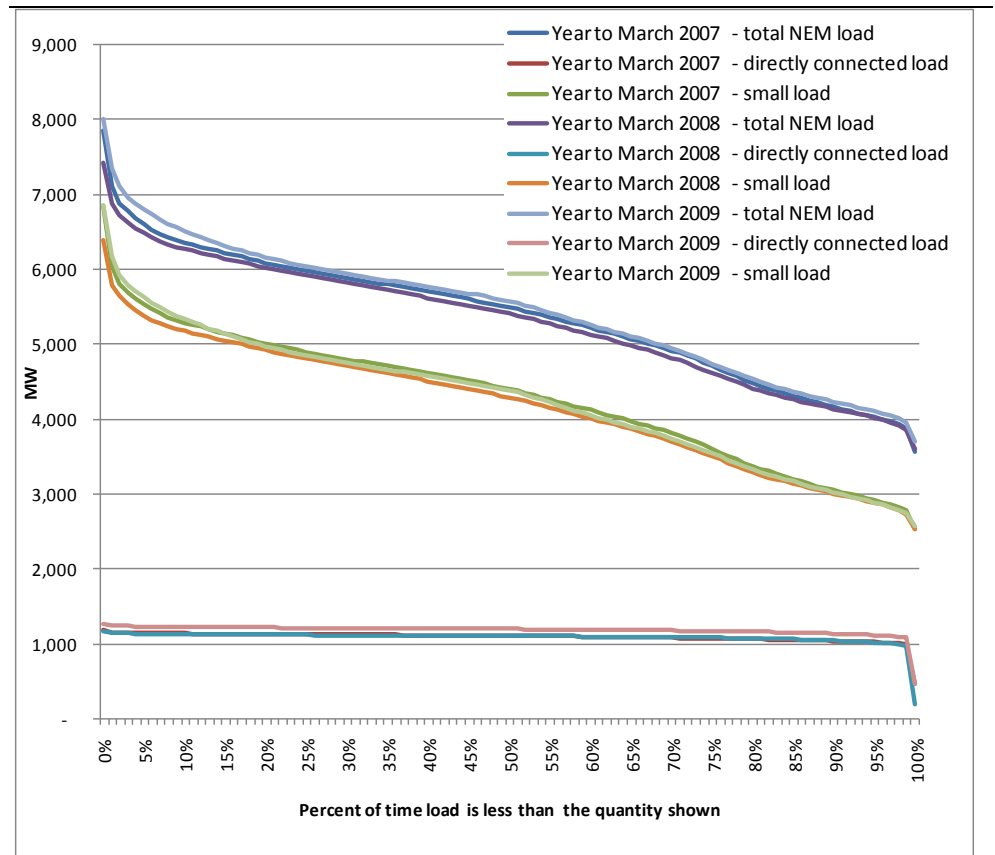
Description	Year to March 2007			Year to March 2008			Year to March 2009		
	Total	Directly connected	Small	Total	Directly connected	Small	Total	Directly connected	Small
Maximum summer demand (MW)	7,858	1,192	6,836	7,424	1,179	6,396	8,016	1,271	6,861
Maximum winter demand (MW)	7,228	1,172	6,153	7,219	1,171	6,202	7,569	1,266	6,410
Minimum demand (MW)	3,575	462	2,531	3,603	199	2,539	3,700	480	2,572
Annual Energy (GWh)	47,150	9,647	37,503	46,548	9,719	36,830	47,763	10,471	37,292
Load factor	68.5%	92.4%	62.6%	71.4%	93.8%	65.6%	68.0%	94.0%	62.1%

Note: One of the directly connected TNIs is not included in directly connected customers in year to March 2007 and year to March 2008.

Data source: Based on total of TNI load traces

The load duration curves for the actual load traces for the year to March 2007, 2008 and 2009 for the total, directly connected and small loads are shown in Figure 1.

Figure 1 **Load duration curves for actual loads in year to March 2007, 2008 and 2009 (as delivered from transmission network)**



Note: The small load in the year to March 2007 and 2008 includes one of the directly connected TNIs.

Data source: Sum of TNI load traces supplied by NEMMCO

3.2.2 Adjusting load traces to financial year configuration

Financial year load trace configurations for both total NEM load for Queensland and the directly connected customers are then produced by:

- moving the June Quarter from the beginning to the end of the year to 31 March load traces
- adjusting the date and day type structure to match the financial year being forecast.

The load traces for both total NEM load for Queensland and the directly connected customers are adjusted in precisely the same manner so that they remain exactly comparable with each other.

Forecast load traces for NEM and Queensland small load

The moving of the June quarter from the beginning to the end to give a financial year day structure does not affect the daily, monthly or annual load factors. Furthermore, annual energy and summer and winter peaks and minimum demand are not affected by this move.

The adjustment of the dates to give the correct dates and day types for the financial year being forecasts does not affect the annual summer and winter peaks or the minimum load but has a very minor impact on energy and load factor in the year to March 2008. This is because the base data contains 366 days while the adjusted data contains only 365 days of data to be consistent with the 2008/09 financial year being forecast. Furthermore the number of weekdays and weekends may not be the same in the raw data and the financial year adjusted load traces. The characteristics of the adjusted load shapes and the changes from the year to March data are shown in Table 8.

Table 8 **Key characteristics of base traces adjusted to financial year's day structure and dates (as delivered from transmission network)**

Description	Adjusted data for 2007/08			Adjusted data for 2008/09			Adjusted data for 2009/10		
	Total	Directly connected	Small	Total	Directly connected	Small	Total	Directly connected	Small
With financial year day structure and dates									
Maximum summer demand (MW)	7,858	1,192	6,836	7,424	1,179	6,396	8,016	1,271	6,861
Maximum winter demand (MW)	7,228	1,172	6,153	7,219	1,171	6,202	7,569	1,266	6,410
Minimum demand (MW)	3,575	462	2,531	3,603	199	2,539	3,700	480	2,572
Annual Energy (GWh)	47,332	9,675	37,657	46,488	9,690	36,797	47,780	10,467	37,312
Load factor	68.6%	92.4%	62.7%	71.5%	93.8%	65.7%	68.0%	94.0%	62.1%
Differences with the original raw data for year to March									
Maximum summer demand (MW)	0	0	0	0	0	0	0	0	0
Maximum winter demand (MW)	0	0	0	0	0	0	0	0	0
Minimum demand (MW)	0	0	0	0	0	0	0	0	0
Annual Energy (GWh)	182	28	154	-60	-28	-32	16	-4	20
Load factor	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%

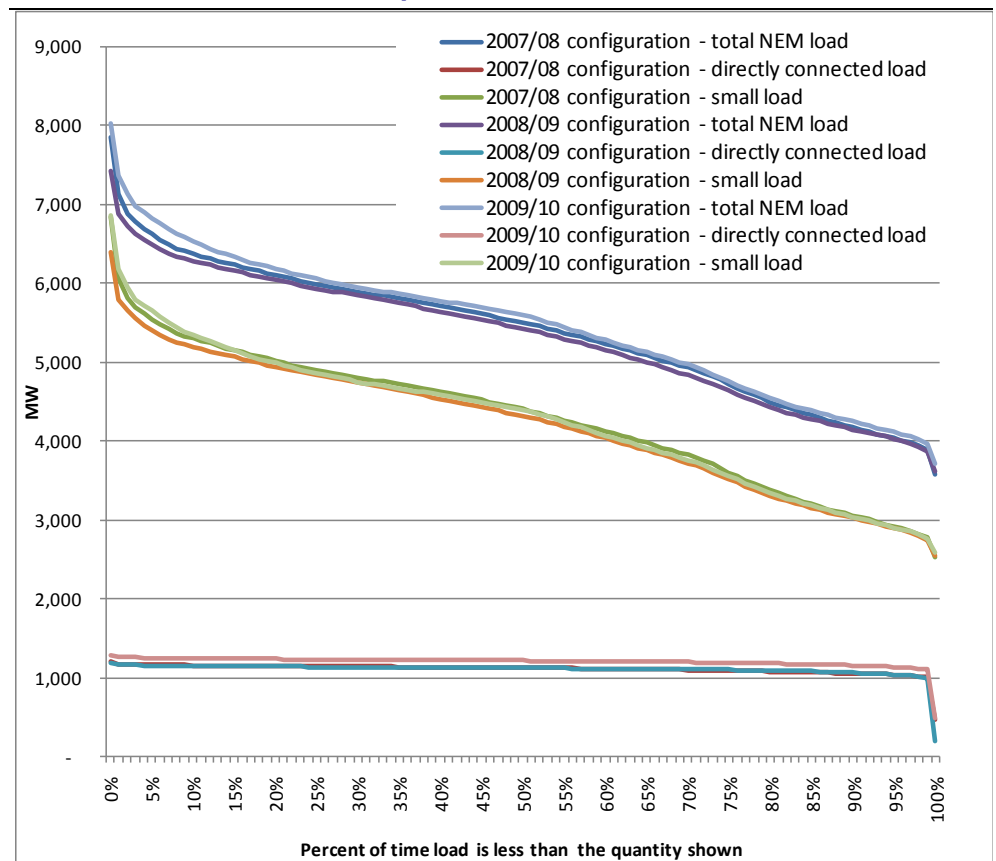
Data source: ACIL Tasman adjustments to aggregated load traces by TNI supplied by the Authority from NEMMCO

Table 8 shows that there is no change in the peak and minimum demands and that there is very minor changes to the annual energy and load factor. These

changes will have negligible impact on the forecast load traces when transformed to fit the respective APR forecasts.

The load duration for the adjusted to a financial year configuration is shown in

Figure 2 **Load duration curves for loads adjusted to a financial year configuration for 2007/08, 2008/09 and 2009/10 (as delivered from transmission network)**



Note: The small load in the year to March 2007 and 2008 includes one of the directly connected TNIs

Data source: Sum of TNI load traces supplied by NEMMCO

3.2.3 Load forecasts for Queensland

The forecasts of the following items for 2008/09 and 2009/10 were then extracted from the 2007 and 2008 APRs respectively:

- **Annual scheduled energy delivered** from the transmission system based on the medium economic forecast. (i.e. Native Energy minus the Delivered Energy Adjustment to account for embedded non-scheduled generation)
- **Scheduled summer maximum demand** delivered from the transmission system under the medium economic forecast at 10%, 50% and 90% POE. (i.e. Summer Native Demand minus the Delivered Demand Adjustment)

- **Scheduled winter maximum demand** delivered from the transmission system under the medium economic forecast at 10%, 50% and 90% POE. (This is the Winter Native Demand minus the Delivered Demand Adjustment)
- **Coincident demand of directly connected customers in summer and winter** taken from the table showing Connection Point Native Demands Coincident with State.

The forecasts for the respective years are summarised in Table 9.

Table 9 **Powerlink forecasts of scheduled demand and energy as delivered from the transmission network**

Summer peak demand (MW)			Winter peak demand (MW)	Minimum demand (MW) (See note)	Annual energy (GWh)	Load factors		
10%POE	50%POE	90%POE	50%POE			10%POE	50%POE	90%POE
2007/08 load forecast from Powerlink's 2006 APR								
9084	8615	8290	7270	3754	49697	62.3%	65.7%	68.2%
2008/09 load forecast from Powerlink's 2007 APR								
9338	8862	8573	7407	3992	51513	63.0%	66.4%	68.6%
2009/10 load forecast from Powerlink's 2008 APR								
9461	8925	8516	7581	4019	51899	62.6%	66.4%	69.6%

Note: Minimum demand is as forecast by ACIL Tasman and is the minimum demand as recorded in the relevant year to March and grown to the relevant financial year using the APR forecast growth in annual energy.

Data source: Powerlink's 2007 and 2008 APRs

3.2.4 Forecast of minimum demand for Queensland

A forecast minimum demand was produced by ACIL Tasman by projecting the observed minimum half hourly load from the actual load traces at the forecast growth in annual energy given that there is very limited growth in high load factor block loads. The resultant forecasts for minimum load are shown in Table 9 above.

As noted in 3.1.4, the minimum load is an important input to the transformation process as it correctly controls the lower end of the load trace. Without this control the process may produce lower minimums as the transformation attempts to match the energy forecast. This would incorrectly result in a decline in the minimum load

ACIL Tasman is of the view that the growth in the winter and/or summer peak demand is unlikely to be a good growth rate to use for the minimum load.

This is because, in addition to underlying load growth, peak load growth is heavily influenced by the increasing temperature sensitivity of the load as a consequence of growth in the penetration of domestic air conditioners. We have therefore chosen the generally lower forecast energy growth rate to apply to the minimum load in this case after considering that there is very limited increase in the high load factor block loads over the forecast period. If a major high load factor block load was included in the forecast then its MW contribution would be added separately to the minimum.

3.2.5 Forecast load trace for total NEM load for Queensland

The ACIL Tasman load trace model was then applied to manipulate the half-hourly load trace for the total NEM load for Queensland to match the forecasts of summer and winter peak demands, minimum demand and annual energy.

It uses a non linear transformation to adjust the recorded load trace to fit the forecast elements using a goal seek method akin to a linear programming solution.

Forecast half hourly load traces were produced for:

- 2007/08 based on the year to 31 March 2007 load trace with the June Quarter moved and the date and day structure adjusted to match 2007/08 and the medium growth 10%, 50% and 90% POE forecasts from the Powerlink 2006 APR.
- 2008/09 based on the year to 31 March 2008 load trace with the June Quarter moved and the date and day structure adjusted to match 2008/09 and the medium growth 10%, 50% and 90% POE forecasts from the Powerlink 2007 APR.
- 2009/10 based the year to 31 March 2009 load trace with the June Quarter moved and the date and day structure adjusted to match 2009/10 and the medium growth 10%, 50% and 90% POE forecasts from the Powerlink 2008 APR.

The characteristics of the forecast load traces are shown in Table 10. It can be seen that the characteristics of the forecast load traces for the total NEM load match the APR 50% POE forecasts summarised in Table 9.

Table 10 **Key characteristics of forecast load traces (50%POE as delivered from transmission network)**

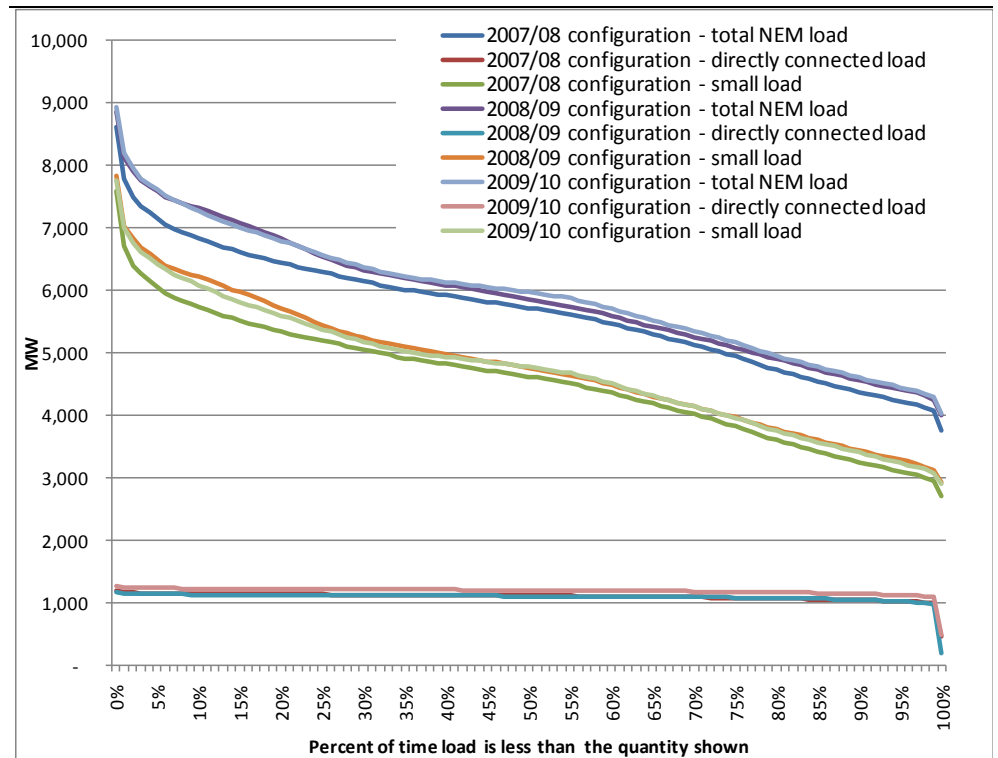
Description	2007/08 forecast			2008/09 forecast			2009/10 forecast		
	Total	Directly connected	Small	Total	Directly connected	Small	Total	Directly connected	Small
With financial year day structure and dates									
Maximum summer demand (MW)	8,615	1,192	7,592	8,862	1,179	7,833	8,925	1,271	7,770
Maximum winter demand (MW)	7,270	1,172	6,195	7,407	1,163	6,389	7,581	1,266	6,423
Minimum demand (MW)	3,754	462	2,710	3,992	199	2,929	4,019	480	2,892
Annual Energy (GWh)	49,697	9,675	40,022	51,513	9,690	41,823	51,899	10,467	41,432
Load factor	65.7%	92.4%	60.0%	66.4%	93.8%	60.9%	66.4%	94.0%	60.9%

Note: One of the directly connected TNIs is not included in directly connected customers in year to March 2007 and year to March 2008.

Data source: ACIL Tasman's load trace model

The load duration curves for the actual load traces for the year to March 2007, 2008 and 2009 for the total, directly connected and small loads are shown in Figure 3.

Figure 3 **Load duration curves for financial year 50% POE forecast load traces (50%POE as delivered from transmission network)**



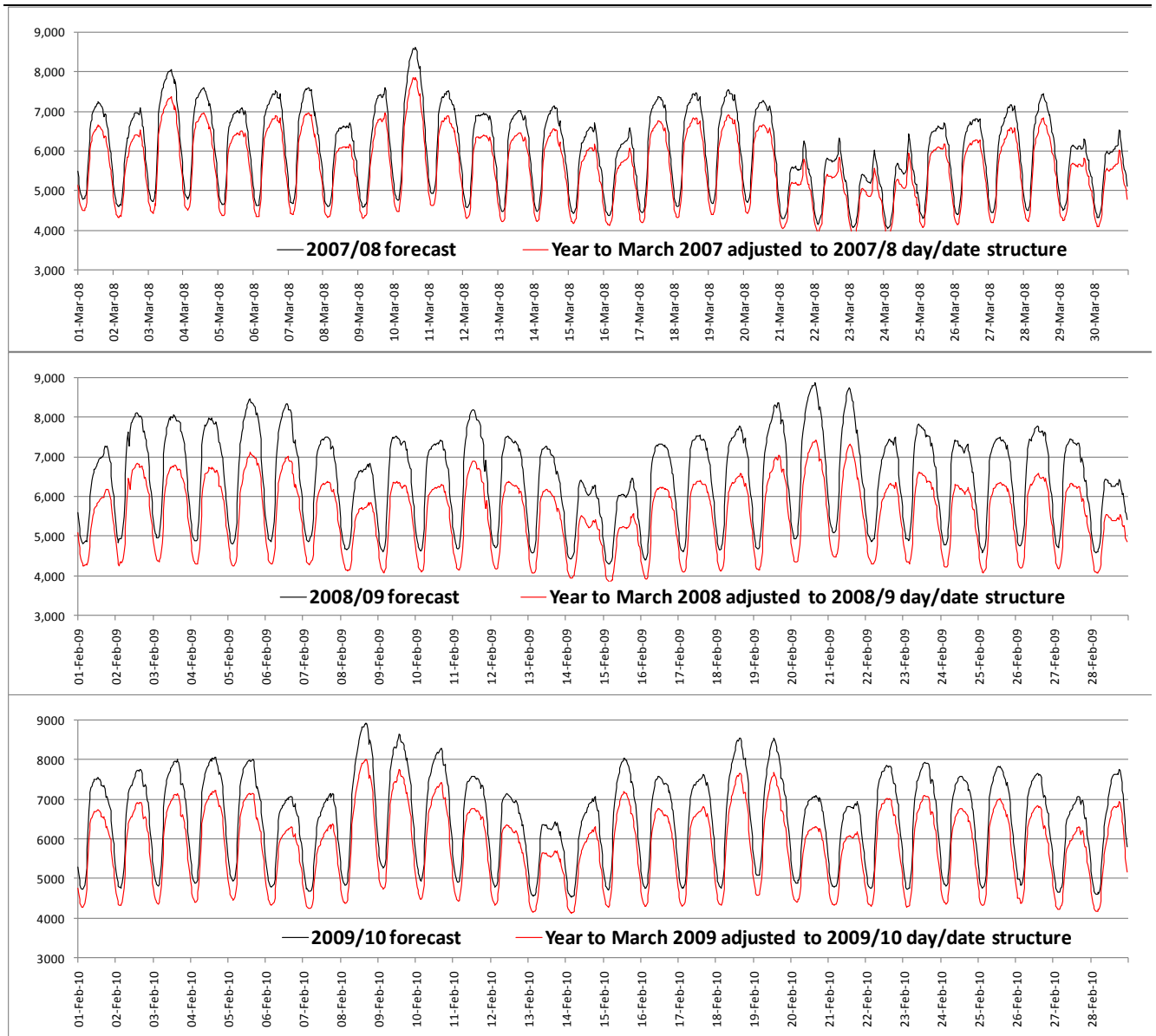
Note: The small load in the year to March 2007 and 2008 includes one of the directly connected TNIs

Data source: ACIL Tasman load trace transformation model



A sample of the transformation for the month of summer peak for the total NEM load for Queensland is shown in Figure 4.

Figure 4 **Adjusted data and forecasts for peak month in 2007/08, 2008/09 and 2009/10 for the total NEM load for Queensland (50%POE as delivered from transmission network)**



Source: ACIL Tasman load trace modelling

3.2.6 10% and 90% POE load traces for Queensland

Load trace forecasts for the total NEM load for Queensland based on the 10% and 90% POE forecasts for summer and winter peak demands from the successive APRs were developed using the same adjusted load traces and methodology as the 50% POE forecast described above.

10% and 90% POE load traces were then constructed by replacing the top 400 half hours from the 50% POE load trace with the values from the load traces based on the 10% and 90% POE load forecasts.

This means that the 10% and 90% POE load traces are the same as the 50% POE load trace except for the top 400 half hour demands. This, in turn, means that the annual energy under the 10% POE load trace will be slightly higher than the annual energy under the 50% POE load trace and the annual energy under the 90% POE load trace will be slightly lower than the 50% POE load trace.

3.2.7 Forecast load traces for directly connected customers for Queensland

The half-hourly load trace for directly connected customers was then adjusted by the MW change in the contribution to summer and winter system demand of the directly connected customers as reported by Powerlink in the relevant APR.

Comparing Table 10 with Table 8 it can be seen that no growth is forecast between the adjusted base load traces and the load trace forecast for each of the three financial years. This is in accordance with the forecast for the contribution that these customers make to the Queensland system peak as published in the respective APR.

Again ACIL Tasman took care to ensure that the half hour demands of the directly connected customers were entirely coincident with the half hour demands of the total NEM load for Queensland. This ensures that half hourly load trace for the small load for Queensland, which is found by subtracting the directly connected customer load from the total NEM load for Queensland, is also coincident with all other half hour load traces including the NEM regional load traces.

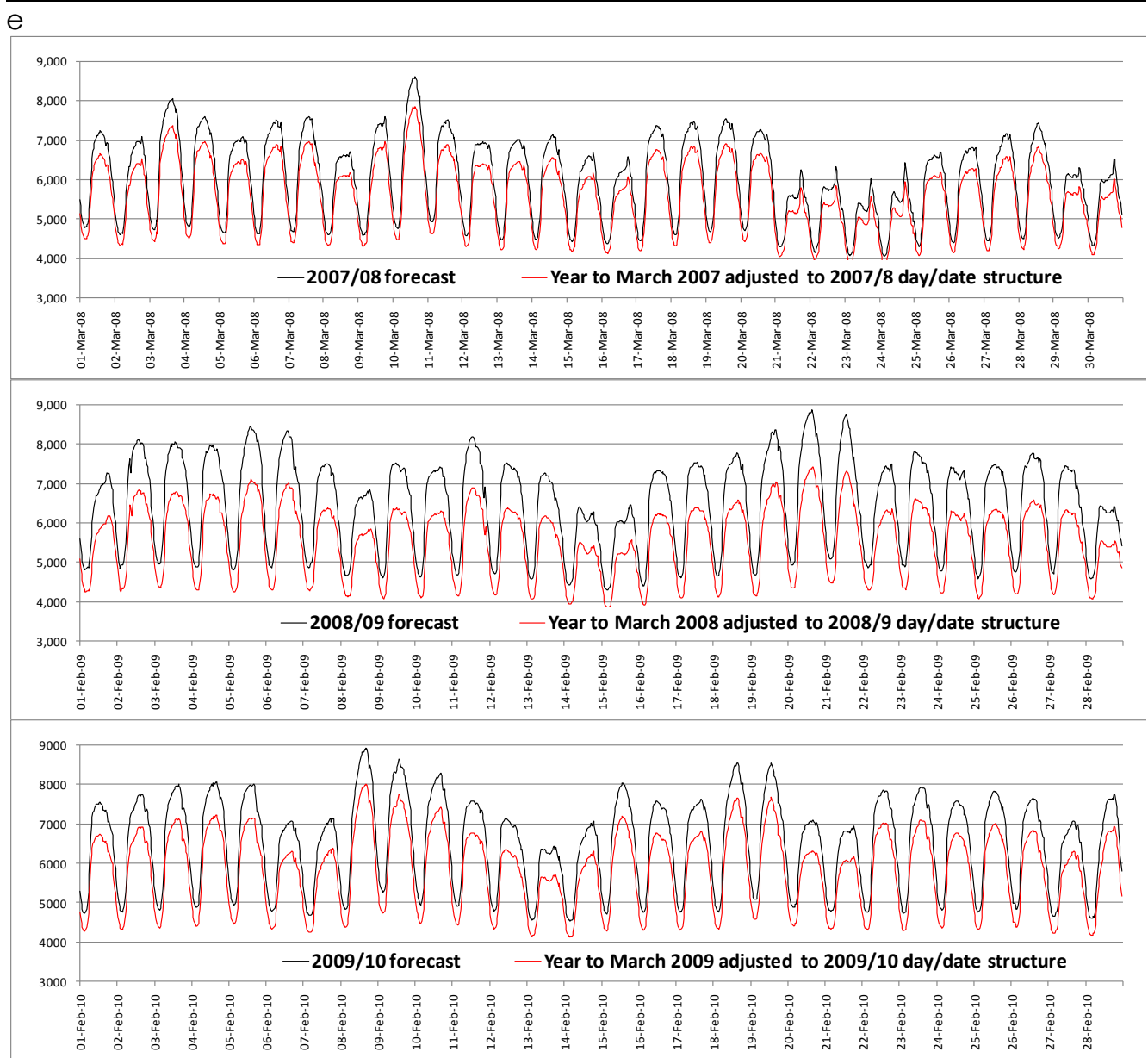
3.2.8 Forecast load traces for small load for Queensland

The forecast half-hourly demand trace for retail customers in Queensland, (i.e. the NEM load or small load), was then calculated by subtracting the forecast half-hourly load trace for directly connected customers from the forecast half-hourly demand trace for the total NEM load for Queensland. The key

characteristics of the small load are shown in Table 8 for the adjusted base load traces and Table 10 for the load trace forecasts. Load duration showing the small loads for the three years are shown in Figure 2 for the adjusted base loads and in Figure 3 for the load trace forecasts.

A set of one month samples of the transformation for summer peak for the small load for Queensland is shown in Figure 5.

Figure 5 **Adjusted data and forecasts for peak month in 2007/08, 2008/09 and 2009/10 for the small load for Queensland (50%POE as delivered from transmission network)**



Source: ACIL Tasman load trace modelling

Forecast load traces for NEM and Queensland small load

Load traces were produced for the small load for 10% 50% and 90% POE for:

- 2007/08 based on the year to 31 March 2008 load trace and 2006 APR
- 2008/09 based on the year to 31 March 2008 load trace and 2007 APR
- 2009/10 based on the year to 31 March 2009 load trace and 2008 APR.

3.2.9 Use of the Queensland load traces

The Queensland small load load traces are to be used by CRA to calculate the EPC for 2007/08, 2008/09 and 2009/10. They are totally coincident with the load traces for the NEM regions used in the modelling of the half hour NEM spot prices used by CRA in its EPC calculation.