Electricity Authority

Pricing Manager

Functional Specification

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Revision History

Version	Release Date	Description
1.0	September 2006	Final Version released
2.0	May 2007	Rule change RC#51 applied. Effective 1/6/07 Pricing Manager required to publish demand half hour metering information. New process PP-030.
3.0	September 2010	Interim price period rule change Pricing Manager required to publish interim prices and to assess claims of error for validity.
4.0	February 2012	Updated with Code references.
4.1	June 2013	Updated due to scarcity and virtual reserve provider updates
4.2	February 2014	Functional Specification Review
4.3	February 2017	Pricing Application (Price Index and Pricing Error Claims)
4.4	June 2017	Metering Situation calculation and notices (PP-070, MR-020)

Pricing Manager

Functional specification

1. Introduction

The responsibilities of the Pricing Manager role are defined in the Electricity Industry Participation Code 2010 (the Code). The responsibilities must be performed by a service provider appointed by the Electricity Authority (Authority). The terms and conditions under which service providers are appointed and must act are set out in Part 3 of the Code.

The primary responsibility of the Pricing Manager, as defined in the Code, is the calculation and publication of provisional, interim and final prices for energy and reserves. The calculations are performed by modelling software designed for the Pricing Manager which is maintained by and leased from the system operator.

There are additional reporting tasks that the Pricing Manager role is required to perform. These functions use data from the core pricing system, but are processed and delivered using secondary applications and systems.

2. This document

This document describes the responsibilities and functions of the Pricing Manager service provider, as set out in part 13 of the Code. The document details data requirements and business processes but not any actual file formats. It is expected that the service provider responsible for fulfilling the Pricing Manager role will develop interfaces with participants and with other service providers for the delivery of information to and from the Pricing Manager, as required by the Code.

This document should be read in conjunction with the associated Pricing Manager Operational Requirements.

3. Code available

The Code can be downloaded from www.ea.govt.nz.

If there are any conflicts between this document and the Code, the Code takes precedence.

4. The current environment

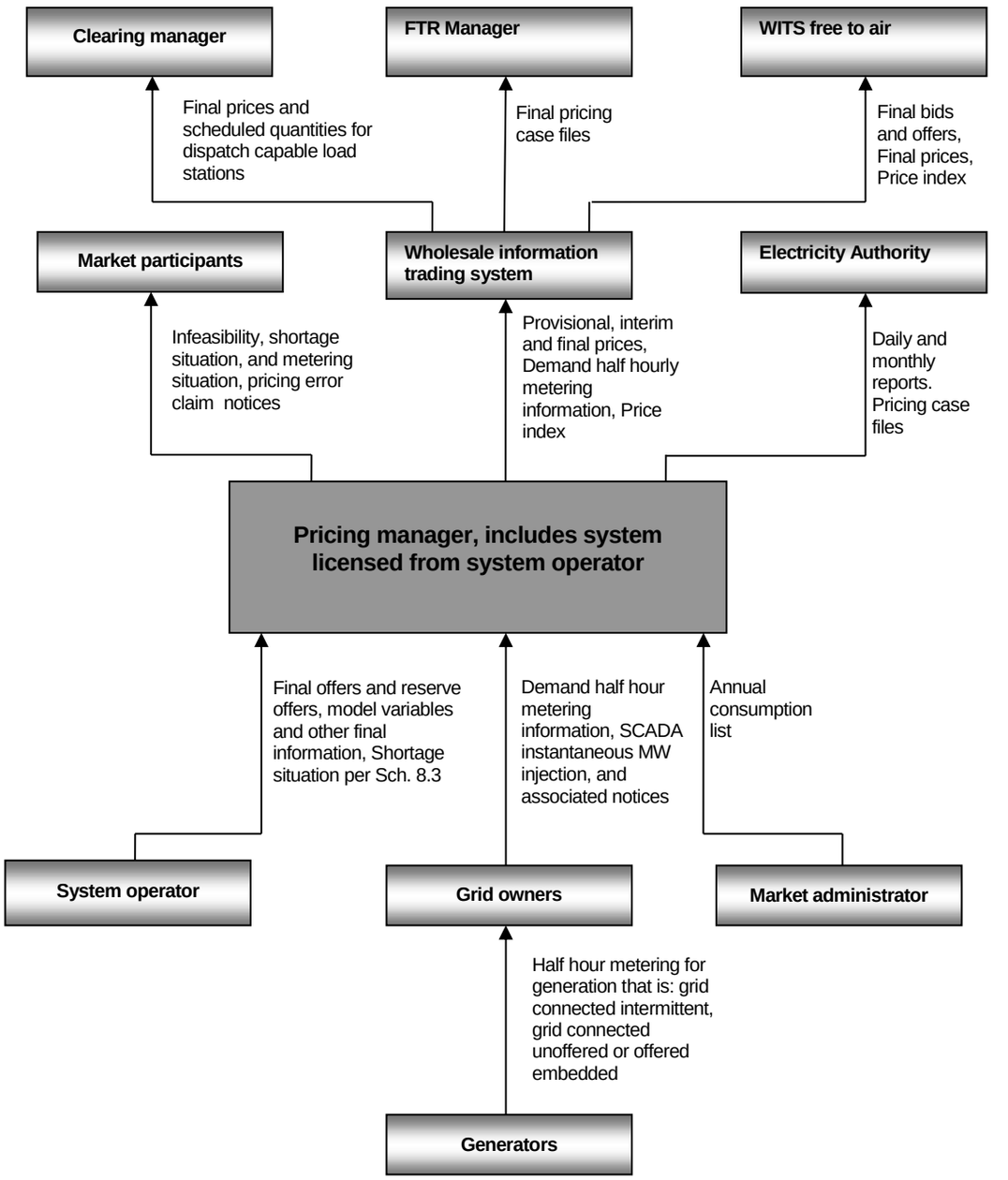
The Pricing Manager licenses a version of the pricing model software from the system operator. Under the terms of the license, the system operator warrants that the software will enable the Pricing Manager to meet its obligations under the Code and that it performs according to its published software specification.

There are two parts to the pricing model software: a database managed by the system operator; and a separate piece of software, which extracts the information from the system operator's database and performs the calculations. The outputs from the latter are stored in the system operator's database for subsequent publication via the Wholesale Information and Trading System.

There is an additional system – the Pricing Application - used to support the reporting aspects of the Pricing Manager role and is described in this document.

5. Information flows of the wholesale electricity market

The processes described in this document are concerned with the management of the information flows in and out of the areas in the diagram shown below:



As can be seen from the flow diagram, the Pricing Manager receives data from the system operator and grid owner. This information is fed into the database that is

accessed by the modelling software which calculates the provisional, interim and final prices. Once calculated, the prices are published to the market via the wholesale information and trading system.

The clearing manager uses final prices and the corresponding scheduled quantities for dispatch capable load stations in the settlement (invoicing) process.

The FTR Manager uses the information within pricing model case files (zip files, each containing a number of csv files detailing pricing model inputs and outputs) to calculate the retained loss and constraint excess following the methodology in Schedule 14.6 of the Code.

The information required by the Pricing Manager to calculate provisional, interim and final prices and its sources are shown in the table below.

Information required	Code reference (part 13)	Supplier
Local network embedded half-hour metering information (offered embedded generation subject to a dispatch instruction and un-offered/intermittent generation with a point of connection to the grid)	13.136-13.140	Generators and embedded generators (by 05:00), supplied via the system operator.
Existing generation configuration (instantaneous MW injection data or estimate at GIPs)	13.141(1)(a)	Grid owners, supplied via the system operator.
Actual demand – half-hour metering information at the GIP/GXPs	13.141(1)(b)	Grid owners, supplied via the system operator.
SCADA situation and/or metering situation information (per trading periods per GIP/GXP, if exists)	13.143 and 13.145	Grid owners, supplied via the system operator.
Expected supply – final offers excluding those for intermittent generators	13.141(1)(c) and 13.63	System operator
Reserve offers	13.141(1)(d)	System operator
System operator information	13.141(1)(e) and 13.63	System operator
Model parameters	13.189 and Schedule 13.2	System operator
Shortage situation information	Clause 5(1A) of Technical Code B of Schedule 8.3 13.144	System operator

Information required	Code reference (part 13)	Supplier
Generator's notice of initial offer	13.6(4)	Generators, supplied via the system operator.

6. The pricing process

Each trading day, the Pricing Manager is required to calculate interim or provisional prices for energy and reserves for the previous trading day. Prices are calculated using the input data identified above and the methodology defined within Schedule 13.3 of the Code. Prices are provisional if a 'provisional price situation exists' and where it is not possible to resolve this situation by 10:00 hours on the trading day that the situation was identified.

Prices for the previous trading day must be published as interim every day by 12:00 hours. Where there is a provisional price situation, prices for the previous trading day must be published as provisional by 12:00 hours on business days or by 10:00 hours on non-business days.

A provisional price situation exists whenever one of the following occurs:

- An infeasibility situation. This is where the solution from the pricing model for at least one trading period is infeasible.
- A SCADA situation. This is where the grid owner's SCADA data is incorrect or incomplete, and where the grid owner has not provided a reasonable estimate of such data.
- A metering situation. This is where the grid owner's metering information is incorrect, incomplete or remains an initial estimate to the extent as defined more fully in the Code
- A high spring washer price situation. This is where, for a given trading period, there is a transmission constraint and where a price at any GXP or GIP is greater than five times the highest unstrained cleared offer price. High spring washer price situations cannot be declared for trading periods where another provisional price situation already exists.

Notice of an infeasibility situation, metering situation and high spring washer situation must be provided by the Pricing Manager while notice of a SCADA situation is provided by the Grid Owner. In most instances these notices must be published by 09:00 hours on the day following the trading date in question.

It must be noted that:

- The resolution of a provisional price situation is dependent on the ability of the relevant parties to provide revised information. The grid owner and generators are operational every trading day, however the system operator only operates in business hours on business days. The Code makes allowances for this situation,

- A provisional price situation usually applies to specific trading periods but if there is at least one price for a single trading period then all prices are regarded as provisional, and
- A provisional price situation may arise as a result of revised data provided by the grid owner or system operator.

Notifications of provisional price situations

The Pricing Manager is required to publish notice of a provisional pricing situation if a provisional price situation cannot be resolved. A provisional price situation notice must be published on the day that the provisional price situation was identified by 12:00 hours if that day is a business day or 10:00 hours if that day is a non-business day.

Process in the event of a provisional price situation

The grid owners and the system operator have a number of opportunities to provide revised information to resolve a provisional price situation(s) in order for the Pricing Manager to successfully calculate an interim price:

1. The first opportunity is by 10:00 of the day the provisional price situation is identified if the day is a business day, otherwise by 12:00 of the 2nd business day after (clause 13.146(3)).

2. The second opportunity is by 12:00 of the 2nd business day following the publication of a provisional price situation (13.154(2)).

3. A third opportunity is provided for an infeasibility situation or high spring washer price situation that arises as a result of revised information provided in response to the second opportunity (or 13.154(2)). Revised information must be provided by 16:00 of the 2nd business day following the publication of a provisional pricing situation (rule 13.157).

4. A fourth opportunity is provided for a high spring washer price situation that arises as a result of revised information provided in response to the third opportunity (or 13.157)). Revised information must be provided by 10:00 of the 3rd business day following the publication of a provisional pricing situation (rule 13.157).

After the receipt of revised data, the Pricing Manager re-runs the modelling software to try to calculate the interim prices again.

If the result of running the modelling software is a success and there is a price calculated for each trading period for the day in question then the Pricing Manager publishes interim prices by the following times:

1. If success is achieved on the first opportunity above, then by 12:00 of the day the provisional pricing situation arose if the day is a business day, otherwise by 12:00 of the 2nd business day after.

2. If success is achieved on the second opportunity above, then by 14:00 of the 2nd business day following the publication of the provisional pricing situation.

3. If success is achieved on the third opportunity above, then by 18:00 on the 2nd business day following the publication of the provisional pricing situation.

4. If success is achieved on the third opportunity above, then by 12:00 on the 3rd business day following the publication of the provisional pricing situation.

If the attempt is unsuccessful, or revised information is not provided by the times specified, the Pricing Manager course of action is described in the following table:

Opportunity	**Attempt is unsuccessful: Provisional price situation arises from revised information**	**Revised information not provided by the time specified**
1	Provisional prices are published from the first run of the modeling software. Outputs using the revised information are discarded	Provisional prices are published.
2.	An infeasibility situation notice or high spring washer price situation notice is published by 14:00 on the 2nd business day following the publication of the provisional prices.	*For a high spring washer price situation:* Prices are published as interim as if the high spring washer price situation did not exist by 14:00 on the 2nd business day following the publication of the provisional prices. *For other provisional price situations*: Interim prices are published using the 'manual' method described below for those trading periods affected by the provisional price situation. This must be done by 18:00 on the 2nd business day following the publication of the provisional prices.
3	*If a high spring washer price situation arises:* A high spring washer price situation notice is published by 18:00 on the 2nd business day following the	*For a high spring washer price situation:* Prices are published as interim as if the high spring washer price situation did not exist by 18:00 on the 2nd business day following the

Opportunity	Attempt is unsuccessful: Provisional price situation arises from revised information	Revised information not provided by the time specified
	publication of the provisional prices. *If an infeasibility situation arises*: Interim prices are published using the 'manual' method described below for those trading periods affected by the provisional price situation. This must be done by 18:00 on the 2nd business day following the publication of the provisional pricing situation.	publication of the provisional prices. *For other provisional price situations*: Interim prices are published using the 'manual' method described below for those trading periods affected by the provisional price situation. This must be done by 18:00 on the 2nd business day following the publication of the provisional prices.
4	*Not applicable*	Prices are published as interim as if the high spring washer price situation did not exist by 18:00 on the 2nd business day following the publication of the provisional prices.

Calculation of interim prices

Virtual Reserve Provider

When an infeasibility has been resolved that was caused by a shortage of instantaneous reserve, the Pricing Manager must add a virtual reserve provider which offers at a reserve price which is the highest of

- three times the highest energy offer cleared; or
- the highest scheduled reserve offer in the relevant island.

Once the virtual reserve provider has been added, the Pricing Manager then recalculates and publishes interim prices.

Scarcity Pricing

When the Pricing Manager has issued a shortage situation notice in accordance with clause 13.144, for every trading period so affected, the Pricing Manager must

a) Determine whether a scarcity pricing situation exists in accordance with Clause 13.135A.

b) If a scarcity pricing situation exists for the affected trading period, determine if a scarcity pricing must be applied in accordance with Clause 13.135C.

c) If scarcity pricing must be applied then calculate the scarcity pricing factor in accordance in Schedule 13.3. This factor is then applied to interim prices for the affected trading period.

Where there is a situation that the virtual reserve provider and scarcity pricing both need to be applied, the virtual provider will be applied first.

Manual Price Calculation

For the circumstances described in the above table, the Pricing Manager is required to calculate interim prices as follows:

- The price will be zero at the disconnected nodes,
- For energy prices at net GIPs and net GXPs: For net GIPs the interim price is where that loss-adjusted demand intersects with the offer stack. For net GXPs, the interim price is 1.05 times the net GIPs interim price, and
- For reserves: The interim price is the mean of the relevant final prices of the corresponding day in each of the four previous weeks.

These prices are to be published by 18:00 on the 2nd business day following the publication of a provisional pricing situation.

Pricing errors

An interim price can be republished if a pricing error has been claimed which has been upheld by the Authority and if that error results in a direction from the Authority to republish interim prices.

Publication of final prices

The last published set of interim prices is republished as final prices if there is no error claim. This republication takes place before 14:00on the first business day following publication of those interim prices.

Publication of price index

The price index is a load-weighted average of the last seven day's published prices, for all New Zealand and three regions.

If the status of any day's published price changes, the index is re-calculated and republished.

The price index is published on WITS each day around the same time that the previous day's prices are published.

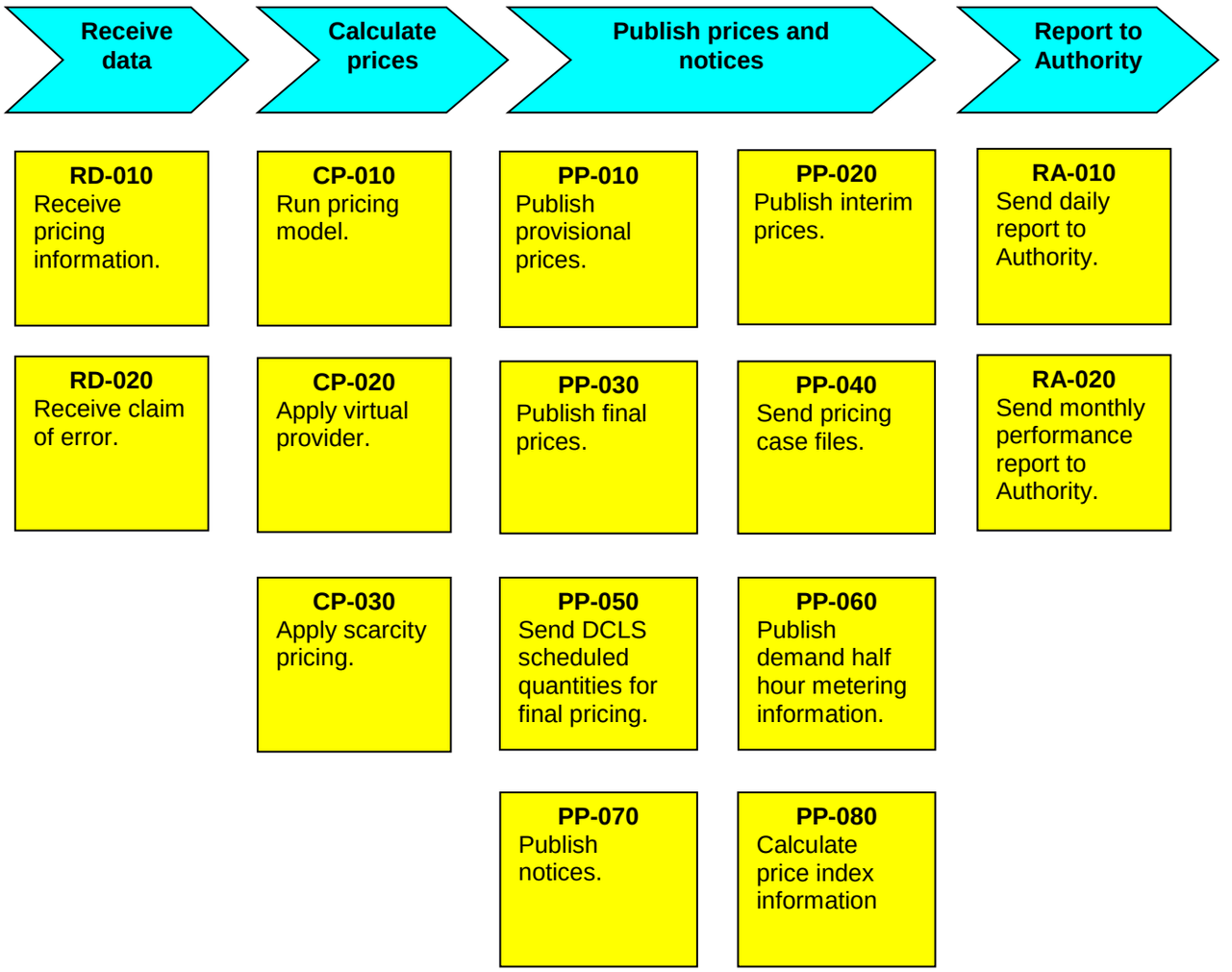
7. Publication of pricing information

The following table outlines the publication of pricing information by the Pricing Manager.

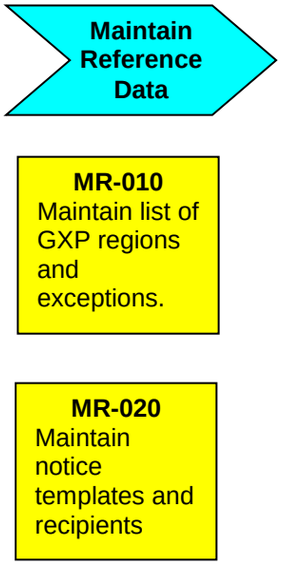
Information	Code reference (part 13)	Destination
Provisional prices for energy and reserves	13.149(b), 13.150(b), 13.132(d) (energy only)	Purchasers and generators Clearing manager
Interim prices for energy and reserves	13.135A-C,13.142, 13.152, 13.156, 13.159, 13.162 - 13.164, 13.166A	Purchasers and generators Clearing manager
Final prices for energy and reserves	13.171	Purchasers and generators Clearing manager
Pricing case files	N/A	Electricity Authority
Pricing case files for final prices	14.73(2B)	FTR Manager
Demand half-hour metering information	13.141(1)(b), (2)-(5)	Purchasers and generators

8. Process maps

Process map – Calculate and publish provisional, interim, and final prices



Process map – Maintain reference data



1. Sub-Processes

Sub-process:	**RD-010 Receive pricing information**
Process:	Receive data
Source:	System operator, grid owners, generators, market administrator
Destination:	Pricing Manager
Code references:	13.136 – 13.141, 13.143, 13.145 and Schedule 8.3 Technical Code B (5 (1C))
Dependencies:	

Description:

To run the pricing model, the Pricing Manager receives information daily from the system operator. The information required to be provided by grid owners and generators is also delivered via the system operator.

To determine whether there is a metering situation, the market administrator publishes the annual consumption list.

Business requirements:

1. The Pricing Manager must agree with the system operator on the format and method of transfer of the data required to run the pricing model.
2. The Pricing Manager must ensure that the mechanisms agreed for the transfer of data are secure.
3. Every trading day, the Pricing Manager must be able to receive all the required data for the previous trading day before 07:30.
4. The Pricing Manager must ensure final offers from intermittent generators are excluded from the offered embedded half-hour metering information.

Data input:

1. From generators and embedded generators (this information is incorporated into the grid owner's demand half hour metering information):

   - Offered embedded half-hour metering information adjusted for losses in relation to generating plant that injects electricity directly into a local network or where electricity flows into a local network without passing through a GIP/GXP; and
   - unoffered and/or intermittent generation half hour metering information adjusted for losses from generating stations connected to the grid.

2. From grid owners (via the system operator):

   - notification when a SCADA situation exists and which trading periods of the given trading day are affected;
   - data specifying the instantaneous MW injection at GIPs where offers were made during trading periods of the previous trading day or a reasonable estimate of such data;
   - GIP/GXP demand half hour metering information for each trading period of the previous trading day or an estimate of such data;
   - notification of which GIP/GXPs have estimated demand half hour metering information
   - revised data after a provisional price situation; and
   - revised half-hour metering information after an estimate.

3. From the system operator:

   - final offers for energy and reserves for each trading period of the previous trading day (excluding offers from intermittent generators);
   - other final information for each trading period received by the system operator during trading;
   - shortage situation notice where an island wide instruction to disconnect demand has been issued, amended, or revoked (to be provided to the Pricing Manager by 07:30 on the following trading day).

4. From the market administrator (via the market administrator's website):

   - Annual consumption list

Annual Consumption List

Field	Format	Mandatory /optional	Description
GXP	Char(4)	M	Point of connection
Organisation	Varchar(50)	M	Participant trading at the POC
Consumption	Number(10)	M	Annual Consumption in GWh
Year End	Date	M	Last day of year that was used for calculation

Processing:

The Pricing Manager:

1. Formats and stores the data input.

Data outputs:

Input data formatted for use in the modelling process.

Sub-process:	**RD-020 Receive claim of error**
Process:	Receive claim of error
Source:	Error claimant
Destination:	Pricing Manager
Code references:	13.168, 3.169, 13.170(c), 13.173 – 13.179
Dependencies:	

Description:
An error claimant may claim a pricing error. The Pricing Manager must process the error claim and provide the Authority with a copy of all information received together with an opinion as to whether it agrees that a pricing error has occurred. The system stores all the correspondence relating to all claims.

Business requirements:

1. The Pricing Manager must only accept an error claim after it has published the interim or interim reserve prices containing the indicated pricing error.

2. The Pricing Manager must only accept an error claim from a participant if it considers the claimant has been materially affected by the pricing error.

3. The Pricing Manager must notify participants of the email address used for claiming a pricing error.

4. The Pricing Manager must check that sufficient information is provided by the claimant.

5. The Pricing Manager must publish a notice that a pricing error has been claimed (see PP-050).

6. The Pricing Manager must request from the relevant party all additional information that it considers pertinent.

7. The Pricing Manager must provide the Authority with copies of all the information about the pricing error and ascertain from the Authority whether the Authority considers there to have been a pricing error.

8. If the Pricing Manager believes that an error has occurred, it must:

    - recommend the Authority upholds the claim,
    - provide it reasons for accepting the claim,
    - recommend actions to correct the error.

9. If the Pricing Manager believes that the is no error, it must:

    - recommend the Authority rejects the claim,

- provide it reasons for rejecting the claim.

10. In the event of a pricing error being claimed, the Pricing Manager must take appropriate action under clause 13.173 and delay publication of final prices until the Authority has made its determination in accordance with clause 13.175.

11. Once the Pricing Manager has received the Authority's decision is must publish it (see PP-050).

12. If the Authority accepts the error, the Pricing Manager must:

    - if required, take action to correct the error
    - if required, direct a participant to take action to correct the error,
    - once those actions have been completed, republish updated interim and interim reserve prices.

13. If the Authority rejects the error, the Pricing Manager must publish the interim and interim reserve prices as final and final reserve prices.

14. The Pricing Manager must make reasonable efforts to ensure that by 14:00 on the 2nd business day after the error was reported.

15. No more than 2 hours after it has published a notice relating to the error, the Pricing Manager must:

    - republish interim and interim reserve prices, or
    - publish final and final reserve prices.

16. The Pricing Manager must store a copy of all correspondence received and sent together with all assessments and decisions made, in the system, along with the current status of the claim.

Data input:

The error claim as notified by an error claimant and all subsequent correspondence, assessments and decisions.

Processing:

The Pricing Manager, via the system:

1. Logs the details of all new claims.
2. Sends an acknowledgement of the receipt of a claim to the claimant.
3. Notifies participants that a pricing error has been claimed.
4. Stores the result of any assessment and any recommendations.

5. Notifies the Authority that a pricing error has been claimed and provides the information provided by the claimant together with any assessments made and recommendations.
6. Stores any decisions received from the Authority about the claim.
7. Notifies participants of the Authority's decision, via email.
8. Closes the claim if the pricing manager considers that it does not meet the requirements of Clause 13.170, or once the directions of the Authority have been followed.
9. Stores the processing status of each claim.
10. Takes the actions required by the Authority to correct the pricing error.
11. Republishes interim and interim reserve prices, or publishes updated interim and interim reserve prices, and/or publishes final and final reserve prices.

Data outputs:
Recommendation to the Authority in the event of a pricing error claimed.
Acknowledgements and Notices to participants.
Interim and interim reserve prices and/or final and final reserve prices.
Record of all correspondence of each claim together with an audit trail.

Sub-process:	**CP-010 Run pricing model**
Process:	Calculate prices
Source:	Pricing Manager
Destination:	Pricing Manager
Code references:	13.141, 13.135A, 13.135B, 13.135C and 13.166
Dependencies:	RD-010, CP-020, CP-030

Description:
After receiving the necessary information, the Pricing Manager runs the pricing model to calculate prices for a given trading day (a 'solve'). If prices are obtained for every trading period and there is no provisional pricing situation, they are declared to be interim prices. If there is a provisional price situation, this must be resolved by the Pricing Manager. This includes issuing notices as required and when revised data is received, re-running the pricing model.

Business requirements:

1. The Pricing Manager must use a modeling system that calculates prices using the input information in clause 13.141 and the methodology in Schedule 13.3 of the Code.

2. A provisional price situation is where there is a metering situation, SCADA situation, infeasibility situation or a high spring washer situation. SCADA situations are identified by the grid owner, while the other types of provisional price situations are identified by the Pricing Manager.

3. A metering situation is where demand half hour metering information is incomplete or incorrect or remains an initial estimate for:

    - Any GIP or GXP with a historical annual consumption > 500 GWh
    - Any two or more GIPs or GXPs with a historical annual consumption > 300 GWh
    - Any ten or more GIPs or GXPs
    - Any intermittent generating station with a point of connection to the grid
    - Any GXP with a dispatch-capable load station at which a nominated dispatch bid has been submitted

4. An infeasibility situation is where the modeling system calculates a model variable with a value as set out in Schedule 13.2.

5. A high spring washer price situation occurs, for a given trading period where there is:

    - A binding transmission security constraint

- The energy price at any GXP or GIP, excluding those which are disconnected, is equal to or greater than 5 x highest unconstrained cleared offer price. Where the unconstrained cleared offer price is the highest offer at a given GXP or GIP that is less than or equal to the calculated price at that GXP or GIP.

Data inputs:

Data for the given trading day as stored from sub-process RD-010.

Processing:

The Pricing Manager:

1. Runs the pricing model using the data relevant for a given trading day.

2. Analyses the inputs and results of the run and determines whether prices are interim or if there is a provisional price situation.

3. If there is no provisional price situation the Pricing Manager determines whether to:

   - apply the virtual service provider (CP-020); and/or
   - issue a shortage situation notice (PP-050); and/or
   - apply scarcity pricing (CP-030) and/or
   - publish the results as interim (PP-020).

4. If there is a provisional price situation the Pricing Manager determines whether to:

   - issue a metering situation notice*, or infeasibility notice or high spring washer price situation notice (PP-050); and/or
   - publish the results as provisional (PP-020) and issue a provisional price situation notice (PP-050); and/or
   - calculate prices manually following clauses 13.163 and 13.164 of the code (PP-020)

   * *This is determined using inputs and processes outside of the modeling system.*

5. The Pricing Manager will re-run the model when revised information has been received in response to a SCADA situation notice, metering situation notice, infeasibility notice or high spring washer notice. Steps 3 or 4 will then be repeated.

Data outputs:

Interim prices and interim reserve prices.

Or:

Provisional prices and provisional reserve prices, and/or
Shortage situation , and/or
Metering situation, infeasibility situation or high spring washer price situation, and/or
Provisional price situation

Sub-process:	**CP-020 Apply virtual provider**
Process:	Calculate prices
Source:	Pricing Manager
Destination:	Pricing Manager
Code references:	13.166A
Dependencies:	RD-010, CP-010

Description:

If a previous solve contains an infeasibility caused by a shortage of instantaneous reserve, the Pricing Manager applies the virtual reserve provider to the affected trading periods before publishing interim prices.

Business requirements:

1. When an infeasibility situation caused by a shortage of instantaneous reserve has been resolved and there are no other provisional pricing situations, the Pricing Manager must apply the virtual reserve provider.

2. The Pricing Manager must apply the virtual reserve provider to the relevant island, with the relevant reserve type. When the Pricing Manager applies the virtual reserve provider, the offer price must be the highest of:

   (a) three times the highest scheduled offer price in the relevant island, and

   (b) the highest reserve offer scheduled in the relevant island for the relevant reserve type

3. When the Pricing Manager applies the virtual reserve provider, a sufficient quantity of reserve must be provided so that reserve prices do not exceed the offer price as specified above.

Data inputs:

Data for the given trading day as received in sub-process RD-010.

Infeasibility results and reasons of the latest run (if any).

Processing:

The Pricing Manager:

1. Applies the virtual reserve provider to the trading date, trading periods and Island(s) where there was an infeasibility caused by a shortage of instantaneous reserve shortfall in previous solves.

2. Re-runs the pricing model for the trading date.

Data outputs:
Interim prices and interim reserve prices.

Sub-process:	**CP-030 Apply scarcity pricing**
Process:	Calculate prices
Source:	Pricing Manager
Destination:	Pricing Manager
Code references:	13.135A, 13.135B, 13.135C
Dependencies:	RD-010, CP-010

Description:

If a shortage situation notice has been published by the Pricing Manager, the Pricing Manager applies scarcity and re-runs the pricing model. For all trading periods affected by the shortage situation the pricing model:

- determines whether a scarcity pricing situation exists;
- determines whether scarcity pricing should be applied;
- applies the scarcity pricing factor to interim prices where required.

Business requirements:

1. If the Pricing Manager has published a shortage situation notice, the Pricing Manager must apply scarcity pricing to the relevant trading periods.

2. The Pricing Manager must determine whether a scarcity pricing situation exists using to the following criteria:

    - there are no AC binding constraints in the relevant island, or in the whole country in the case of a national scarcity situation;
    - in the case of a national scarcity situation, there are no HDVC constraints and the HDVC is in service;
    - in the case of a North Island scarcity situation, the HVDC link is out of service or the HVDC link is in service, and the price at Haywards exceeds the price at Benmore;
    - in the case of a South Island scarcity situation, the HVDC link is out of service or the HVDC link is in service, and the price at Benmore exceeds the price at Haywards;
    - if one pole of the HVDC has zero flow and other flow is unconstrained then the HVDC is regarded as being unconstrained and in service.

3. The Pricing Manager must determine whether scarcity pricing should be applied using the following criteria:

    - in the case of an island scarcity pricing situation, if the average island GWAP (generation weighted average price) in the previous 336 trading

periods in the island affected by the scarcity pricing situation exceeds $1,000 per MWh;

- in the case of a national scarcity pricing situation, if the average island GWAP in the previous 336 trading periods in either island exceeds $1,000 per MWh;
- where the average island GWAP includes a previous trading period where a scarcity pricing factor must be applied, the GWAP for that trading period will based on interim prices after the scarcity pricing factor has been applied;
- if the average island GWAP includes provisional prices within the 336 trading periods the Authority will direct the Pricing Manager to delay the publication of interim prices in accordance with Clause 13.184 until such time as the relevant provisional price situation has been resolved;
- if the Authority does not delay the publication of interim prices then scarcity pricing cannot be applied in compliance with the Code.

4. When scarcity pricing is to be applied, the Pricing Manager must:

- calculate an island GWAP for an island scarcity situation or national GWAP for a national scarcity situation;
- for an island scarcity situations, the scarcity pricing factor is 1 when the GWAP is between $10,000 - $20,000, $10 000/ $GWAP_{ISL}$ when the GWAP is below $10 000, and $20,000/ $GWAP_{ISL}$ when the GWAP is above $20,000;
- for national scarcity situations, the scarcity pricing factor is 1 when the GWAP is between $10,000 and $20,000, $10 000/ $GWAP_{NAT}$ when the GWAP is below $10,000, and $20,000/ $GWAP_{NAT}$ when the GWAP is above $20,000.

5. In a situation where both the virtual reserve provider and scarcity pricing need to be applied, the Pricing Manager must first apply the virtual reserve provider.

Data inputs:

Data for the given trading day as received in sub-process RD-010.

Shortage situation notice of the latest run (if any).

Processing:

The Pricing Manager:

1. Applies scarcity to the trading date, trading period and islands identified in the Pricing Manager's shortage situation notice.

2. Re-runs the pricing model for the trading date. The model will indicate where there is a scarcity pricing situation and will apply the scarcity pricing factor where required.

Data outputs:
Interim prices and final reserve prices. Flag indicating if a scarcity pricing situation exists for a trading period.

Sub-process:	**PP-010 Publish provisional prices**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Participants
Publication medium:	Wholesale Information and Trading System
Code references:	13.146, 13.147, 13.149, 13.150, 13.151, 13.153, 13.154
Dependencies:	CP-010

Description:

The Pricing Manager sends provisional prices and provisional reserve prices to the Wholesale Information and Trading System for publication to market participants.

Provisional prices are only provided if there is an unresolved provisional price situation, i.e. where there is a metering, SCADA, high spring washer price or infeasibility situation and interim prices cannot be provided.

Business requirements:

1. If notice of a provisional price situation is given on a business day and no revised data is received by 10:00, the Pricing Manager must publish provisional and provisional reserve prices by 12:00 using the latest data given to it by 10:00.

2. If notice of a provisional price situation is given on a non-business day and no revised data or notice has been received, the Pricing Manager must publish provisional prices and provisional reserve prices by 10:00 using the data given to it by 07:30.

Data inputs:

Provisional prices, provisional reserve prices from the modelling software.

Processing:

The Pricing Manager:

1. Sends the provisional price information, determined from the pricing model using the appropriate data, to the Wholesale Information and Trading System for publication.

Data outputs:

Provisional prices and provisional reserve prices.

Provisional prices are provided per trading day, trading period and GIP/GXPs.

Provisional prices for reserves are provided for both fast and sustained reserves per trading day and trading period at the island reference points of Haywards (HAY2201) and Benmore (BEN2201).

Sub-process:	**PP-020 Publish interim prices**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Participants
Publication medium	Wholesale Information and Trading System
Code references:	13.135B, 13.142, 13.152, 13.156, 13.159, 13.162,13.163,13.164(b)(c), 13.166A, 13.167, 13.178, 13.184, 13.185
Dependencies:	CP-010, CP-020, CP-030

Description:

The Pricing Manager sends interim prices and interim reserve prices to the Wholesale Information and Trading System for publication to market participants.

Business requirements:

Publication times (other than where there is a scarcity pricing situation)

1. If no provisional price situation or shortage situation exists at 10:00 on a trading day, interim prices and interim reserve prices for the previous trading day must be published by 12:00 (13.142).

2. If a scarcity pricing situation does not exist and a provisional price situation is successfully resolved with revised information (i.e. no further provisional price situation arises) then:

   - Where the provisional price situation is resolved by 10:00 on the trading day following the trading day to be published, interim prices and interim reserve prices must be published by 12:00 (13.152);

   - Where the revised information must be provided by 12:00 on the 2nd business day after provisional prices have been published, interim prices and interim reserve prices must be published by 14:00 on the 2nd business day after provisional prices have been published (13.156);

   - Where the revised information must be provided by 16:00 on the 2nd business day after provisional prices have been published, interim prices and interim reserve prices must be published by 18:00 on the 2nd business day after provisional prices have been published (13.159);

   - Where the revised information, provided in relation to a high spring washer price situation only, must be provided by 10:00 on the 3rd business day after provisional prices have been published, interim prices and interim reserve prices must be published by 12:00 on the 3rd business day after provisional prices have been published (13.162).

3. Where either:

- No revised information is provided, other than for a high spring washer price situation (13.156(1)(a) and 13.159(b)(i)); or

- An infeasibility arises after the receipt of two sets of revised data (13.159(a)(ii)); then:

Interim prices and interim reserve prices must be published by 18:00 on the 2nd business day after provisional prices have been published. In this case prices must be published following the manual pricing method outlined below.

4. If no revised data is provided for a high spring washer price situation then:

   - Where revised information should have been provided by 12:00 on the 2nd business day after provisional prices have been published, interim prices and interim reserve prices must be published by 14:00 on the 2nd business day after provisional prices have been published, as if the high spring washer price situation did not exist (13.156(1)(b)).

   - Where revised information should have been provided by 16:00 on the 2nd business day after provisional prices have been published, interim prices and interim reserve prices must be published by 18:00 on the 2nd business day after provisional prices have been published, as if the high spring washer price situation did not exist (13.159(b)(ii)).

Virtual reserve provider and scarcity pricing

5. The virtual reserve provider must be applied (see CP-020) before interim prices and interim reserve prices can be published whenever there was a provisional price situation caused by a shortage of instantaneous reserves.

6. Scarcity pricing must be applied (see CP-030) before interim prices and interim reserve prices can be published whenever the Pricing Manager has published a shortage situation notice.

7. Where it has been determined that there is a scarcity pricing situation, then interim prices and interim reserve prices must be published by (13.135B):

   - 12:00 on the trading day following the trading day to be published, if there is no provisional price situation; or

   - if there is a provisional price situation, 2.5 hours after that provisional price situation is resolved.

Publication time exceptions

8. Publication of interim and/or interim reserve prices must be delayed if the Authority orders it (13.184).

9. If the Pricing Manager is required to publish 1 or more interim price and/or interim reserve prices for more than 1 trading day at a time, the publication deadline is extended by an extra 2 hours for each trading day (13.185).

Manual pricing method

10. Manual pricing is defined in clauses 13.163 and 13.164 of the Code and is as follows:

11. For those trading periods unaffected by the unresolved provisional price situation prices and reserve prices are published as interim, using the information provided under Clause 13.154.

12. For those trading periods affected by the unresolved provisional price situation calculate and publish interim prices as follows:
    - Determine whether each GIP or GXP is a net GIP or net GXP. A net GIP is where the demand half hour metering information is less than or equal to zero. A net GXP is where the demand half hour metering information is greater than zero; and
    - Determine loss adjusted demand. Loss adjusted demand is the sum of all demand half hour metering information multiplied by 1.05; and
    - Assign a price to all net GIPs equal to the highest price at the point where the loss adjusted demand intersects the offer stack. The offer stack means the stack generated from ranking in price order, from lowest to highest, all final offers (as provided by the system operator) to sell electricity, excluding those from intermittent generation; and
    - Assigning a price to all net GXPs to 1.05 times the price calculated for all net GIPs.

13. For those trading periods affected by the unresolved provisional price situation calculate and publish interim reserve prices by taking the mean of the relevant final reserve prices of the corresponding day in each of the four previous weeks.

14. Manual pricing is calculated using a process outside of the pricing manager's system.

Data inputs:

Interim prices and interim reserve prices from the modelling software.

Demand half hour metering information (RD-010)

Final offers from the system operator, excluding those from intermittent generation (RD-010)

Processing:

The Pricing Manager:

1. Sends the interim price information, determined from the pricing model using the appropriate data, to the Wholesale Information and Trading System for publication.

Data outputs:

Interim prices and interim reserve prices. Interim prices are provided per trading day, trading period and GIP/GXPs. Interim prices for reserves are provided for both fast and sustained reserves per trading day and trading period at the island reference points of Haywards (HAY2201) and Benmore (BEN2201).

Exceptions:

Sub-process:	**PP-030 Publish final prices**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Participants
Publication medium	Wholesale Information and Trading System
Code references:	13.171, 13.172, 13.177(2), 13.183, 13.184, 13.185
Dependencies:	CP-010, CP-020, CP-030

Description:

The Pricing Manager sends final prices to the Wholesale Information and Trading System for publication to market participants.

Final prices will be available for all trading periods in a trading day except when there is a pricing error claimed on which the Authority has yet to rule.

Business requirements:

1. If by 12:00on the 1st business day after the Pricing Manager published interim and interim reserve prices, there is no pricing error claimed against those prices then, by 14:00, the Pricing Manager must publish the same interim and interim reserve prices as final and final reserve prices.

2. Publication of final and/or final reserve prices must be delayed if the Authority orders it.

3. Unless directed by the Authority, final or final reserve prices must not be republished for any trading period even where they contain an error.

4. If the Pricing Manager is required to publish 1 or more final price and/or final reserve prices for more than 1 trading day at a time, the publication deadline is extended by an extra 2 hours for each trading day (13.185

Data inputs:

Final energy prices and final reserve prices from the modelling software.

Processing:

The Pricing Manager:

1. Sends the appropriate price information, that was previously published as interim and interim reserve prices, to the Wholesale Information and Trading System to be published as final and final reserve prices.

Data outputs:

Final prices for energy and reserves, where

- final prices for energy are provided per trading day, trading period and POC, and
- final prices for reserves are provided for both fast and sustained reserves per trading day and trading period at the island reference points of Haywards (HAY2201) and Benmore (BEN2201).

Exceptions:
If there is a pricing error claimed, final and final reserve prices are not published. Once the Authority has determined whether a pricing error has occurred, the Pricing Manager only publishes final and final reserve prices in the case where no error was found.

Sub-process:	**PP-040 Send pricing case files**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Electricity Authority and FTR Manager
Code references:	14.73(2B)
Dependencies:	CP-010, PP-030

Description:
The Pricing Manager sends pricing model 'case files' (zip files, each containing a number of csv files detailing pricing model inputs and outputs) to the Electricity Authority and FTR Manager.

Business requirements:
1. The Electricity Authority should receive a case file for all pricing model solves. 2. The FTR Manager should receive a case file for all pricing model solves which have been published as final (14.73(2B).

Data inputs:
Pricing model case files

Processing:
The Pricing Manager: 1. Sends pricing model case files to the Electricity Authority for all pricing model solves. 2. For each pricing model solve, the Pricing Manager determines whether the solve has been published as provisional, interim or final. This information is also sent to the Electricity Authority. 3. Sends the pricing model case files to the FTR Manager for all solves which have been published as final.

Data outputs:
Pricing model case files Information identifying whether a solve has been published as provisional, interim or final

Sub-process:	**PP-050 Send DCLS scheduled quantities for final pricing**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Clearing Manager
Publication medium	Wholesale Information and Trading System
Code references:	13.189A
Dependencies:	CP-010, PP-030

Description:

The Pricing Manager sends scheduled quantities for dispatch capable load stations where prices have been published final to the Clearing manager via the Wholesale Information and Trading System.

Business requirements:

1. Scheduled quantities for dispatch capable load stations where prices have been published final must be sent to the Clearing manager.

2. The Pricing Manager must provide the information by 1600 hours on the 7th business day for all trading dates in the previous billing period.

Data inputs:

Scheduled quantities for dispatch capable load stations from the pricing model

Processing:

The Pricing Manager:

1. Sends the scheduled quantities for dispatch capable load stations to the Clearing Manager via the Wholesale Information and Trading System.

Data outputs:

Scheduled quantities for dispatch capable load stations where prices have been published final.

Sub-process:	**PP-060 Publish demand half-hour metering information**
Process:	Publish prices and notices
Source:	Grid owner
Destination:	Participants
Publication medium	Wholesale Information and Trading System
Code references:	13.141(1)(b), (2)-(5)
Dependencies:	RD-010

Description:

The Pricing Manager receives demand half-hour metering information from the grid owner (via the system operator) and sends it to the Wholesale Information and Trading System for publication to market participants.

The information will be available each trading day for all trading periods in the previous trading day.

Business requirements:

1. Demand half-hour metering information must be published by 10:00 on a given trading day for the previous trading day.

2. Revised demand half-hour metering information that resolves a provision price situation must be published whenever it is received.

Data inputs:

Demand half-hour metering information and/or revised demand half-hour metering information received from the grid owner (via the system operator).

Processing:

The Pricing Manager:

1. Sends the demand half-hour metering information to the Wholesale Information and Trading System for publication.

Data outputs:

Demand half-hour metering information.

Sub-process:	**PP-070 Publish notices**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Grid owners, Generators, System Operator, The Market
Rule references:	13.144, 13.146, 13.149(a), 13.150(a), 13.156(1)(d)(e), 13.159(a)(iii),13.163(c), 13.164(a)(d), 13.173(c), 13.176
Dependencies:	CP-030

Description:
The Pricing Manager notifies grid owners, generators, the system operator and the market whenever there is a metering, infeasibility, high spring washer price, provisional price, shortage, or scarcity pricing situation. Notices are also provided whenever prices are calculated manually (following Clause 13.163 and 13.614) and as required to process a pricing error claim.

Business requirements:

1. The Pricing Manager must publish notice of an infeasibility, high spring washer price, and metering or shortage situation no later than 09:00 on the day the input information is received.

2. The Pricing Manager must not publish notice of a high spring washer price or shortage situation for a trading period if an unresolved infeasibility or metering or SCADA situation exists for the period.

3. On a business day the Pricing Manager must publish notice of the existence of a provisional price situation and each trading period affected by 12:00.

4. On a non-business day the Pricing Manager must publish notice of the existence of a provisional price situation and each trading period affected by 10:00.

5. After receipt of revised data in accordance with clauses 13.154 and 13.155 that gives rise to either an infeasibility situation or a high spring washer price situation, the Pricing Manager must publish notice of the situation by 14:00on the 2nd business day after the provisional or provisional reserve prices were published.

6. After receipt of revised data in accordance with clauses 13.157 and 13.158 that gives rise to a high spring washer price situation, the Pricing Manager must publish notice of the situation by 18:00 on the 2nd business day after the provisional or provisional reserve prices were published.

7. Where no revised information is provided, other than for a high spring washer price situation, or an infeasibility arises after the receipt of two sets of revised data, the Pricing Manager must publish notice by no later than the time when it is required to publish interim prices that it cannot calculate interim and interim reserve prices.

8. The Pricing Manager must publish notice of all interim and interim reserve prices by 18:00 on the 2nd business day after the relevant prices have been published where prices have been calculated manually following Clauses 13.163 and 13.164.

9. The Pricing Manager must publish notice that a pricing error has been claimed by 14:00 on the 1st business day following the trading day on which the Pricing Manager published the interim or interim reserve prices for which the error claim has been made.

10. The Pricing Manager must publish a notice as soon as practicable following a decision by the Authority of the Authority's recommendations pertaining to a pricing error claim.

11. A shortage situation notice must be published by the Pricing Manager to the market by 09:00 on the day the system operator advises the Pricing Manager of a shortage situation (see RD-010). A shortage situation notice must not be published in relation to a trading period if an infeasibility situation, metering situation or SCADA situation exists in that trading period and has not been resolved by 09:00. This prohibition remains in place even if the infeasibility situation, metering situation or SCADA situation is subsequently resolved after 09:00.

12. Following the publication of a shortage situation the Pricing Manager must determine if a scarcity pricing situation exists. With scarcity applied the pricing model is re-run. The Pricing Manager must publish a scarcity pricing situation where indicated by the pricing model (See CP-030~~).~~

Data inputs:

Information pertinent to a provisional pricing situation that includes the affected trading periods, the type of situation and the reason for the situation. Information pertinent to a claim of pricing error. Information pertinent to a shortage situation notice and scarcity pricing situation notice as noted above.

Processing:

The Pricing Manager:

1. Compiles and publishes the appropriate report(s) on WITS.

Data outputs:

Metering notice:

- each trading period affected by the situation,
- the nodes that were estimated

Infeasibility notice:

- each trading period affected by the situation.

High spring washer price situation notice:

- trading periods affected,
- each transmission security constraint that has bound in the relevant trading period(s).

Shortage situation or scarcity pricing situation notice:

- trading periods affected,
- whether the situation pertains to a single island or is national.

Provisional price situation

- trading periods affected.

Interim and interim reserve prices notice:

- trading periods affected.

Pricing error notice:

- participant making error claim,
- reason proposed for error,
- trading period(s) affected by error.

Pricing error decision notice:

- participant making error claim,
- reason proposed for error,
- trading period(s) affected by error,
- Authority's decision,
- Authority's reasons,
- Actions to be taken to correct the error, if appropriate.

Sub-process:	**PP-080 Publish price index information**
Process:	Publish prices and notices
Source:	Pricing Manager
Destination:	Clearing Manager
Code references:	
Dependencies:	RD-010, MR-010, PP-010, PP-020, PP-030

Description:

The price index is a seven-day rolling trading period average regional electricity price. It is weighted by load (demand) for each of four regions (Upper North Island, Lower North Island, South Island and New Zealand).

For each region, the index is formed by multiplying the price by the load and dividing the total load of the region.

The load (demand) used to weight prices is the metered load that is used in the calculation of final, interim and provisional prices.

Business requirements:

1. The Pricing Manager must calculate price index information daily.

2. The information calculated each day must cover the previous 7 trading days.

Data inputs:

Published prices ($/MWh) for energy (PP-010, PP-020, PP-030) for the last 7 days
GXP bus load data (RD-010) for the last 7 days
GXP Regions data (MR-010)

Processing:

The Pricing Manager:

1. Calculates the rolling 7-day price index for each region (Upper North Island, Lower North Island, South Island and New Zealand) per day i.e.:

    a. Extracts the published prices of the last 7 trading days for the GXPs that are required to be included in each region, as indicated in the GXP Regions data. Data with a load of zero is excluded.

    b. Calculates the load weighted average as the sum of the prices multiplied by the load for each GXP, trading date and trading period in the region divided by the sum of load in the region.

    c. Sums the results of b for each region and divides by 10 to obtain a price in cents per kWh.

2. Recalculates the regional price index for all the affected days when the pricing manager has republished as interim the price for any of the previous six days. The price index for the day that has changed, and each of the following days, is recalculated and republished. 3. Formats the information appropriately and sends the report to WITS for publication.

Data outputs:
Price index information

Sub-process:	**RA-010 Send daily reports to Authority**
Process:	Report to Authority
Source:	Pricing Manager
Destination:	Authority
Code references:	13.149(c) 13.150(c), 13.213, 13.216
Dependencies:	

Description:
The Pricing Manager sends the market administrator a daily compliance report and a daily situation report.

Business requirements:
1. The Pricing Manager must send the reports by 09:00 every day. 2. The reports must cover the period from 07:00 on the previous trading day to 06:30 on the day the report is due. 3. The daily compliance report must include : • any provisional prices that have been published; • any pricing errors that have been claimed; • any situation where the Pricing Manager believes that it or another participant has breached the Code. 4. The daily situation report must include : • a statement as to whether for each trading period flows at any branches were at maximum capacity; • a statement as to whether for each trading period the status of circulating HVDC link and branch flows were abnormal.

Data inputs:
Provisional prices for energy and reserves. Code breaches. HDVC and branch flows.

Processing:
The Pricing Manager: 1. Compiles the daily compliance and daily situation reports and sends them to the market administrator.

Data outputs:

1. The time of publication of provisional prices and provisional reserve prices
2. Claims of pricing errors.
3. Code breaches:
    - date when prices were or will be published late;
    - whether the delay in publication was due to the Pricing Manager;
    - time of the breach;
    - nature of the breach;
    - participant deemed responsible for breach;
    - participants affected by the breach;
    - reason for the breach, if known.
4. Branch and HDVC link flows per:
    - trading period.

Sub-process:	**RA-020 Send monthly performance report to Authority**
Process:	Report to Authority
Source:	Pricing Manager
Destination:	Authority
Code references:	
Dependencies:	

Description:
The Pricing Manager sends the Authority a performance report each month detailing performance levels achieved in the previous month.

Business requirements:
1. The Pricing Manager must submit a report to the Authority each month detailing their performance according to the measures defined in their service provider agreement (SPA).

Data inputs:
Monthly performance statistics

Processing:
Each month the Pricing Manager: 1. Compares the actual system performance figures against the target levels specified in the SPA. 2. Present the comparison as a report and sends it to the Authority.

Data outputs:
Monthly performance report.

Sub-process:	**MR-010 Manage GXP regions and exceptions**
Process:	Maintain reference data
Source:	Pricing Manager
Destination:	
Code references:	
Dependencies:	

Description:
The Pricing Manager maintains the relationship between GXPs and the regions used in the price index calculation.

Business requirements:
1. The Pricing Manager must maintain a list of GXPs together with their region and whether they are to be excluded from the price index calculation.

Data inputs:
GXP Regions data – GXP, region, exclusion indicator.

Processing:
The system: 1. Validates and stores valid GXP Regions data.

Data outputs:
Valid GXP Regions data

Sub-process:	**MR-020 Manage notice reference data**
Process:	Maintain reference data
Source:	Pricing Manager
Destination:	
Code references:	
Dependencies:	

Description:
The Pricing Manager maintains: • templates for pricing error claim notices • templates for metering notices

Business requirements:
1. The Pricing Manager requires templates with pre-formatted notices as required by the Code. 2. The templates contain the email addresses required for the notices.

Data inputs:
Notices with correct Code details. Recipient's email addresses required in the email notices.

Processing:
The system: 1. Stores the templates and recipients.

Data outputs:
Notices with pre-populated text and recipients.