Profiling Operations Guidelines

Version 1.1

5 March 2015

893922-3

Version control

Version	Date amended	Comments
1.0	4 September 2012	First draft for legal review
1.1	5 March 2015	Update to contact details and style

Overview

These Guidelines for Profile Operations (guidelines) provide a high level operational view of how profiles operate in the New Zealand electricity market.

Participants should be aware of obligations when configuring their systems contained in Parts 10, 11, and 15 of the Electricity Industry Participation Code 2010 (Code).

Disclaimer

These guidelines are provided as general information only, and not as legal advice. They are not legally binding. If there is any inconsistency between the content of these guidelines and the Code, the Code takes precedence.

Glossary of abbreviations and terms

Advanced metering infrastructure	AMI
Authority	Electricity Authority
Board	Electricity Authority Board
Code	Electricity Industry Participation Code 2010
HHR	Half-hour
NHH	Non half-hour
NSP	Network supply point
Residual profile shape	RPS
Trader	Person who buys or sells from or two the clearing manager
Unaccounted for electricity	UFE

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Market Overview

Introduction

1. Before full retail competition for the supply of electricity to consumers commenced 1 April 1999, all the energy conveyed through each network supply point (NSP) was purchased by one local network. Each local network was a monopoly franchised trader supplying exclusively to all consumers on the network.

2. Since that time, the New Zealand electricity market has evolved to a fully de-regulated competitive market. Generators of any size may now sell electricity directly to either the electricity market or another participant, traders are free to purchase from the electricity market, and both generators and traders may hedge with any party.

3. Consumers are free to switch retailers regardless of the configuration of their metering installation. The average period to switch a consumer between retailer is less than four business days.

4. The New Zealand electricity market works on a gross pool basis: all generation must be sold to the clearing manager, and all purchases must be made from the clearing manager. All purchases from the clearing manager are derived from the reconciliation information, which is determined by the reconciliation manager. The resolution of settlement is by NSP per trading period.

5. The Electricity Authority (Authority) contracts market operations service providers (MOSPs) to run software that perform the functions of:

   (a) registry manager

   (b) reconciliation manager

   (c) pricing manager

   (d) clearing manager

   (e) FTR manager

   (f) wholesale information services manager (WITS)

   (g) extended reserve manager

   (h) system operator.

6. The New Zealand electricity market comprises three distinct stages of settlement:

   (a) physical settlement by the reconciliation manager using the global reconciliation methodology

   (b) financial settlement by the clearing manager for sales to and from the electricity market using final price per half hour per NSP

   (c) financial settlement for hedges.

Reconciliation Methodology

7. The Code places specific obligations on participants, and the functional specifications for the registry manager and reconciliation manager details interoperability requirements for physical settlement to occur.

8. In brief, traders must:

   (a) ensure the metering installation on a site they trade complies with the Code

   (b) read the meters for:

      (i) HHR certified metering installations: 100% of meters must be read every month

      (ii) NHH certified metering installations: 90% of meters must be read every four months per NSP, and 100% of meters must be read every 12 months per NSP

   (c) provide volume information to the reconciliation manager in the format contained in the reconciliation managers functional specification. The Code requires traders to submit volume information for each meter register they are responsible for, and aggregated to certain criteria. This is termed 'submission information' and includes:

      (i) for half hour metering installations: the aggregated half hour volume per NSP, network owner's loss category code, flow direction, day, and trading period

      (ii) for NHH metering installations: the aggregated reconciliation period (reconciliation period) volume per NSP, network owner's loss category code, and flow direction. Deriving the reconciliation period volume for NHH metering installations includes a process known as the 'forward/historic estimate process'

   information necessary for this aggregation criteria is contained within the registry for each consumer point of connection.

9. In brief, the reconciliation manager's system:

   (a) scales the shape file so that the volume of electricity under the shape file for a reconciliation period is exactly the same as the NHH submission volume provided to the reconciliation manager by the trader. This process synthesises the NHH submissions into trading periods by applying a profile shape[1] that is either:

      (i) determined by the reconciliation manager (where the profile shape is an Authority profile); or

1 A profile shape is a series of values for a month that represents consumption by trading period. It is scaled in the reconciliation process by the volume of electricity determined by the trader in their submissions for the profile code to synthesise HHR information

(ii) provided by the profile owner (where the profile is not an Authority approval but has been approved by the Authority).

(b) applies network losses to the NHH (profile shaped) submissions and HHR submissions

(c) aggregates all of the loss adjusted submission information into network areas, and determines the difference between the total inflows and outflows of electricity in a network area. The difference between the inflows and outflows is known as UFE

(d) aggregates all of the loss adjusted submission information for each trader and NSP, and calculates UFE on a pro rata basis to each trader. The allocation of UFE ensures that payment for electricity injected into the grid by generators matches purchases from the grid by traders

(e) aggregates the loss adjusted submission information and allocated UFE for each trader and NSP. This aggregated information is termed reconciliation information, and represents the physical settlement sales to the clearing manager by generators, and the physical settlement purchases from the clearing manager by traders.

Global Reconciliation Methodology

9. The New Zealand electricity market uses a global reconciliation methodology to determine an allocation used for physical settlement.

10. Differencing methodology was used for the period 1 October 1996 to 1 May 2008. However, the electricity market determined that settlements using the methodology were unfair, non-transparent, as unexplained additional losses were unfairly allocated to the one trader, when it could be due to the actions of any other trader.

11. The use of differencing methodology meant that the accuracy of consumption quantities submitted by all other traders had significant cost implications for the differencing trader (incumbent trader). Incumbent traders did not have access to information to know if they were fairly or unfairly treated, or where to go to determine why their financial losses were so high, if necessary. This created an unfair competitive advantage for the other traders.

12. Effectively, differencing methodology is suitable only for immature electricity markets, where the amount of trading is limited or strictly regulated.

13. Global reconciliation does not have the same problems as differencing reconciliation, and the adoption of global reconciliation has ensured that the New Zealand electricity market is fully competitive.

Advantages of global reconciliation

14. The advantages of global reconciliation are:

(a) all buyers and sellers to and from the electricity market, buy and sell on the same terms and conditions

(b) no buyer or seller is advantaged or disadvantaged more or less than any other participant trading at the same NSP

(c) lost electricity that may be caused by factors such as metering inaccuracies, data errors and omissions, inaccurate network losses, theft, or fraud are equally shared amongst all participants

(d) physical settlement is based on actual meter readings that are referenced to NSP and a fair share of the network losses that are incurred in conveying electricity.

Disadvantages of global reconciliation

15. The disadvantages of global reconciliation are:

(a) all buyers and sellers in the electricity market must buy and sell from the clearing manager

(b) buyers and sellers must provide submission information to the reconciliation manager

(c) complex systems are required to ensure that complete submission information is provided

(d) allocation methodology is complex.

Profiling

16. Profiling is a methodology used to equitably convert electricity consumed NHH volume information into HHR volume information. This allows the NHH volume information to be used in the HHR market settlement process.

17. Approximately 40% of the New Zealand electricity market is settled by profiles. It is expected that with the roll out of AMI meters that are half hour capable, many traders will elect to use HHR settlement methods. HHR settlement tends to be a much simpler method of settlement than profiling. However, the volumes of HHR information being handled and stored is significant.

18. The accuracy of profiling has a considerable bearing on the end accuracy of reconciliation and the resulting allocation to the incumbent.

19. Profiling is a statistically proven and economically efficient way of enabling the electricity industry to meet the Government's requirement to give domestic consumers a choice of trader.

20. The profiling comprises two independent steps:

    (a) converting meter readings into volume information for reconciliation periods. In the New Zealand example, this process is carried out by traders. This is termed the forward/historic estimate process

    (b) converting volume information per reconciliation period into half hour volumes. In the New Zealand example this process is carried out by the reconciliation manager. This is termed profiling.

Forward/historic estimate process

21. The terms forward estimates and historic estimates are defined in Part 1 of the Code.

22. The reconciliation process works on reconciliation periods[2]. Because non-half hour meter readings can occur on any day within a reconciliation period or not at all in a particular reconciliation period, there needs to be a process that can equitably allocate the volume of electricity consumed or generated into each reconciliation period that meter readings span.

23. The forward/historic estimate process allocates electricity volumes measured by NHH metering installations into true reconciliation periods. These processes are described in the next sections.

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2 A reconciliation period is a calendar month

Seasonal adjustment shape

24. A key input to the calculation of historical estimates is the seasonal adjustment shape. This shape file is produced by the reconciliation manager each time an initial reconciliation or revision reconciliation is ru;n. The shape file is produced for each NSP, and each trader must ensure that they use the correct NSP and the latest shape file version available when carrying out historic estimate calculations .

25. The process for calculation of the seasonal adjustment shape is described in clauses 14 to 18 of Schedule 15.5 of Part 15.

Meter readings and permanent estimates

26. Meter readings and estimates of meter readings can only have permanence in the reconciliation process if an audited validation process is followed. Once validated, meter readings are known as “validated meter readings”, and estimates are known as “permanent estimates”.

27. Prepay meters should have meter readings calculated from purchases for the purpose of reconciliation manager submission information. The calculated readings may be validated as permanent estimates.

28. All meter readings must:

    (a) comply with the requirements in the Code, including validation. If a meter reading does not comply with the requirements of the Code, the meter reading may not be used in the forward/historic estimate process, although a trader may elect to use that meter reading for the purpose of customer invoicing or line charge.

    (b) be carried out at regular intervals, and the ongoing reading statistics must be reported to the market administrator. The Code states that the maximum reading periods are:

        (i) 90% of meter registers every 4 months per GXP

        (ii) 100% of meter registers every 12 months per GXP

        (iii) at least once during the trader's period of ownership of the ICP.

29. All meter readings, estimates, and permanent estimates must be archived as raw meter data in accordance with the Code.

Forward Estimates

30. Forward estimate describes the process of estimating consumption for a reconciliation period where there is no subsequent meter reading that spans the reconciliation period. That is, the volume information is estimated by the trader.

31. There are two types of forward estimates that are used:

(a) when a meter reading or permanent estimate does not span the reconciliation period:

(i) no meter reading or permanent estimate exists within, or subsequent to, the reconciliation period; or

(ii) a meter reading exists within the reconciliation period, but no meter reading exists subsequent to the reconciliation period; or

(b) when a meter reading spans the reconciliation period, but no shape file is available (this will only occur for business day 4 submissions, where a meter reading has been carried out in the first 4 days of the month following the reconciliation period).

32. The Code requires that forward estimates are replaced with historical estimates as meter readings become available that span reconciliation periods. Regular revisions are carried out by the reconciliation manager each month (R1, R4, R7, and R14). Traders are required to assemble submission files with the most accurate information available. Eventually, by the time R14 is reached, all forward estimates should have been replaced with historical estimates.

33. The Authority specifies an accuracy limit that is imposed on forward estimates. Currently the accuracy limit is 15%, by NSP. This is the maximum change that can be tolerated under the rules for a month for the difference between each file presented for forward estimates and the final historic estimates at R14.

Issues with forward estimates

34. For the business day 4 initial submission (R0) of the previous reconciliation period, all of the consumption is a forward estimate. No seasonal adjustment shape file is available to ascertain if settlement load is increasing or decreasing from the previous month.

35. Forward estimate methodology is at the discretion of the trader.

36. Forward estimates must be replaced by subsequent business day 13 submissions (R1, R3, R7, and R14) as meter readings and seasonal adjustment shape files become available.

Historic Estimates

37. Traders must use the historic estimate process where the following is available:

(a) validated meter readings or permanent estimates that span a reconciliation period

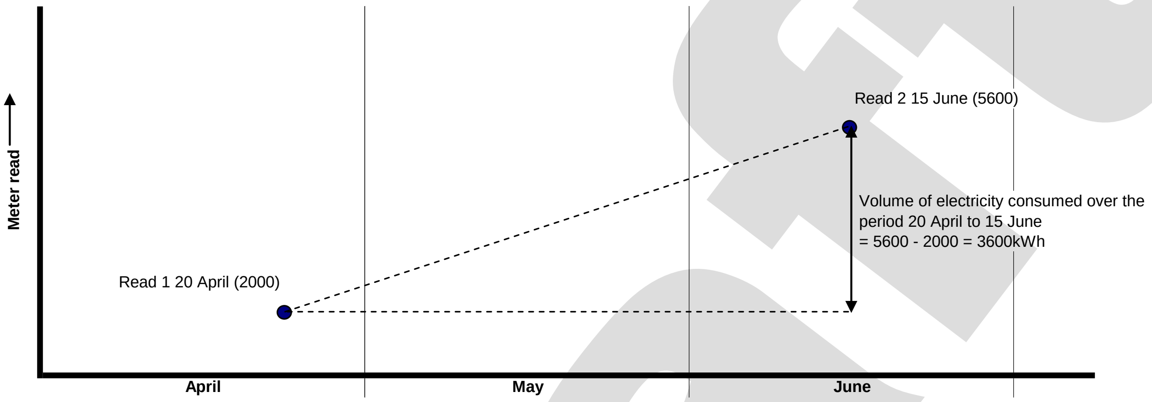
(b) seasonal adjustment shape files.

Allocation of volume information into reconciliation periods

38. The Code requires traders to use the seasonal adjustment shape to pro rata volumes of electricity per meter register into reconciliation periods.

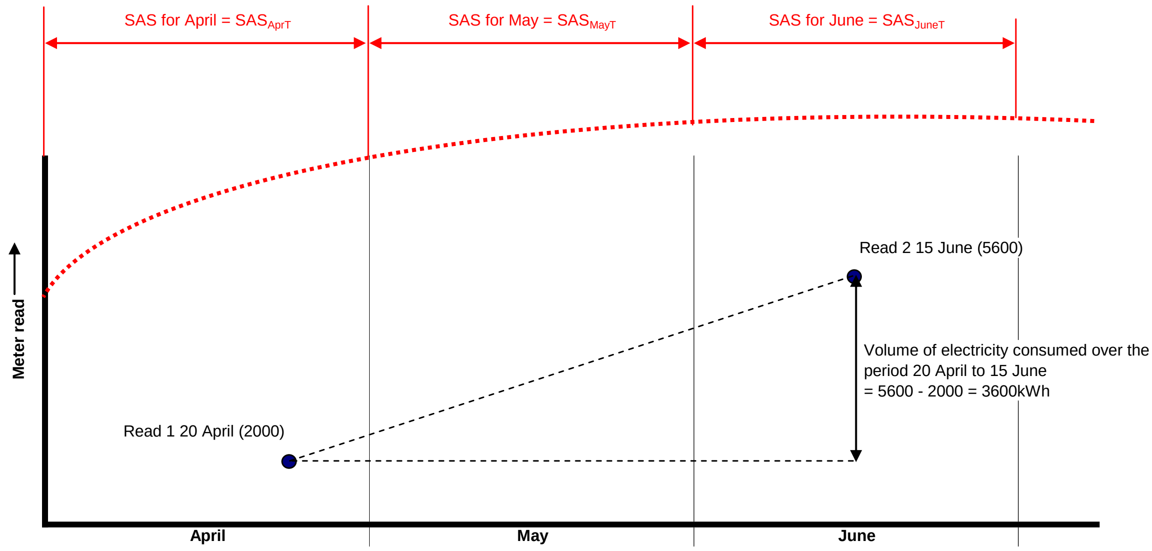
Step 1 – determine the period that meter readings span

39. In the below example, a meter is read on 20 April and has a reading of 2,000kWh. It is subsequently read on 15 June at 5,600kWh. The volume of electricity consumed over this period is 3,600kWh (5,600kWh less 2,000kWh).



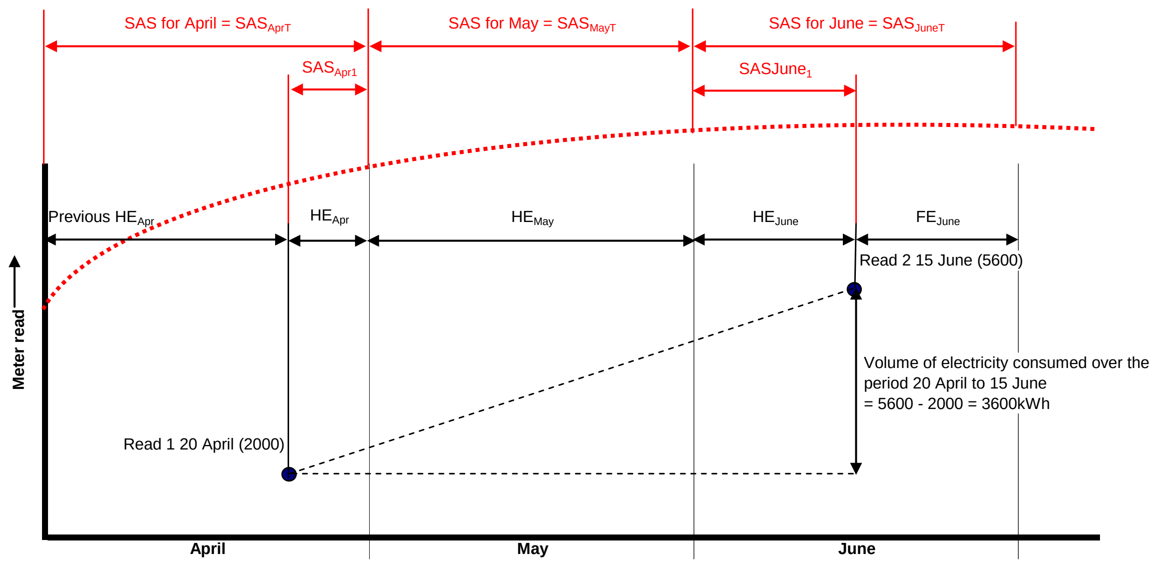
Step 2 – obtain the latest seasonal adjustment shape information from the reconciliation manager

40. The trader must obtain the seasonal adjustment shape (GR-030) from the reconciliation manager for each NSP that the trader trades on. Assembling the seasonal adjustment shape may provide a curve similar to the below, although in reality it will not be smooth and it will vary each day within a month.



Step 3 – allocate meter reading volumes into reconciliation periods

41. The electricity volume over the meter reading may now be calculated using the following formula:



SAS_{Apr1} = the sum of the seasonal adjustment shape for the period 21 April to 30 April inclusive

SAS_{June1} = the sum of the seasonal adjustment shape for the period 1 June to 15 June inclusive

SAS_{AprT} = the sum of the seasonal adjustment shape for the period 1 April to 30 April inclusive

SAS_{MayT} = the sum of the seasonal adjustment shape for the period 1 May to 31 May inclusive

SAS_{JuneT} = the sum of the seasonal adjustment shape for the period 1 June to 30 June inclusive

HE_{Apr} = Historic estimate volume for the meter reading that is allocated to April using;
HE_{Apr} = Electricity volume x $SAS_{Apr1}/(SAS_{Apr1} + SAS_{MayT} + SAS_{June1})$

HE_{May} = Historic estimate volume for the meter reading that is allocated to May using;
HE_{May} = Electricity volume x $SAS_{MayT}/(SAS_{Apr1} + SAS_{MayT} + SAS_{June1})$

HE_{June} = Historic estimate volume for the meter reading that is allocated to June using;
HE_{June} = Electricity volume x $SAS_{June1}/(SAS_{Apr1} + SAS_{MayT} + SAS_{June1})$

FE_{June} = forward estimate estimated for the balance of June for which a subsequent meter reading was not available.

Previous HE_{Apr} = the historic estimate carried over from the calculation on the previous meter readings.

42. From these definitions, the trader is able to determine the reconciliation manager's submission information for the meter register as follows:

Submission information for April = Previous HE_{Apr} + HE_{Apr}
Submission information for May = HE_{May}
Submission information for June = HE_{June} + FE_{June}

43. The trader then repeats this process for each meter register for each reconciliation period during which the trader has responsibility under the Code.

44. Once the trader allocates the meter register volume information into reconciliation periods, the submission information may be aggregated into common aggregation criteria. The registry contains this aggregation criteria, and it is available by ICP as follows:

(a) NSP code

(b) reconciliation type

(c) profile code

(d) loss category code

(e) flow direction

(f) dedicated NSP

(g) forward/historical estimate volume.

Issues with historic estimates

45. The seasonal adjustment shape accuracy is highly dependent on the accuracy of traders' submission of data for both HHR consumption and HHR embedded generation.

46. When the NSP load is highly seasonal, i.e. load builds and drops rapidly on the seasonal shoulders, and meter readings span a period of two or more months, a lead lag effect is created with volume settlement. This shows as either =ve or –ve UFE. This allocation of UFE is temporary, and is caused by poor forward estimate processes by traders.

47. The longer the period between meter readings on highly seasonal load, the purchase advantage may be greater or lesser, depending on how nodal prices vary over a calendar month. This is because the trader allocates the volumes on an average, and perhaps not as accurately as would have occurred if regular readings were carried out.

Accuracy of meter readings

48. Inaccurate actual or customer meter readings will allocate volumes of energy into incorrect reconciliation periods.

49. The inaccuracy created is one of allocation of volumes into months. While the correct volume is settled over time, the correct financial settlement does not occur, i.e. other trader's load may be financially penalised.

How profiling works

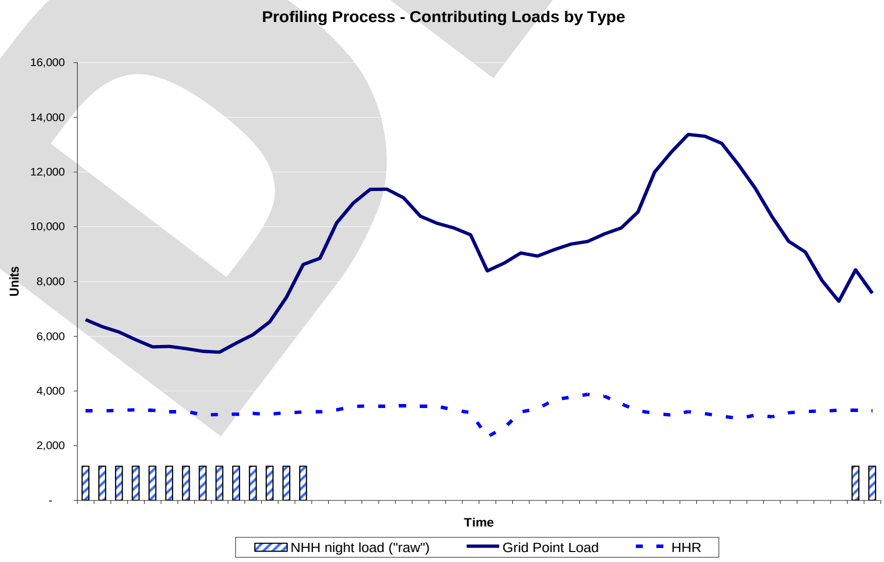
Introduction

50. The quantity of electricity conveyed through a NSP in each half hour is accurately metered and well known. However, the NSP metering does not tell us how much of the energy is sold to each trader. When consumer metering is by half hour, the quantity of electricity purchased by each trader at the NSP can be accurately established. The consumption quantities measured for each consumer in each half hour are adjusted upwards by an amount equal to network losses between the consumer connection and the NSP to accurately determine the energy purchased by the trader.

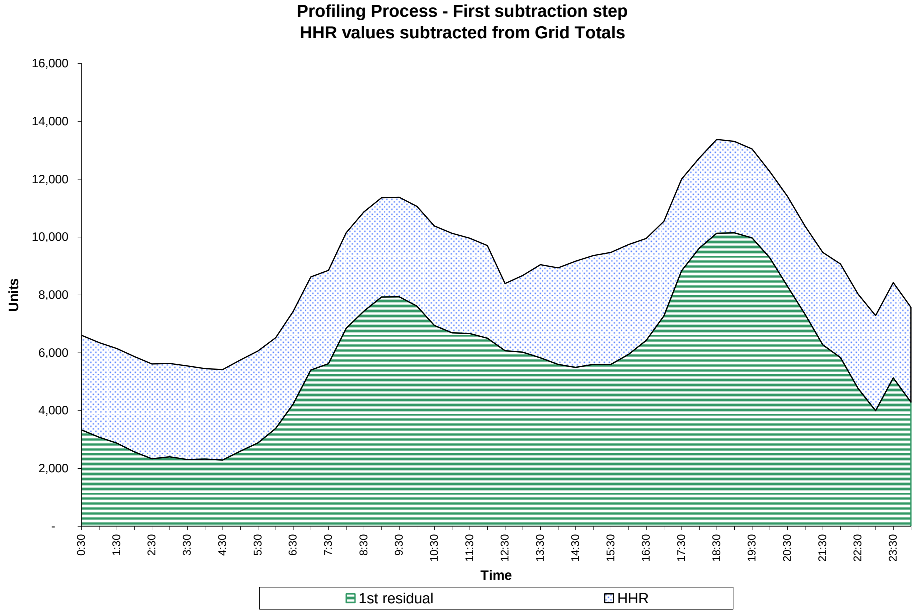
51. When consumption is measured at longer intervals, for example monthly, it is not so easy to allocate each kWh into the correct half hour at the NSP, and hence determine which kWhs are purchased by each trader. However, some loads operate at known times and can be allocated directly into the appropriate half hours in each day. This allocation of consumption from these measured or known loads is the process of profiling. The reconciliation manager allocates the consumed kWhs into NSP half hours according to profiles. Once these known loads are allocated, all other NHH consumption is profiled according to the remaining RPS profile.

52. An example of a known profile is off peak "night rate" consumption where a network may turn night load consumption meter registers on at 11pm, and off again at 7am. The night load register accumulates kWhs only in the intervening half hours and, when reconciled to the NSP, the energy is only allocated (profiled) into these half hours. If this were not done, some part of the night load energy would be allocated into every half hour of the day which is clearly an undesirable level of accuracy. The night load energy is said to be allocated to NSP half hours according to the "night load" profile.

53. The reconciliation manager subtracts sets of consumption data progressively from NSP measured quantities to leave a final residual profile shape. This is illustrated in the following diagrams.

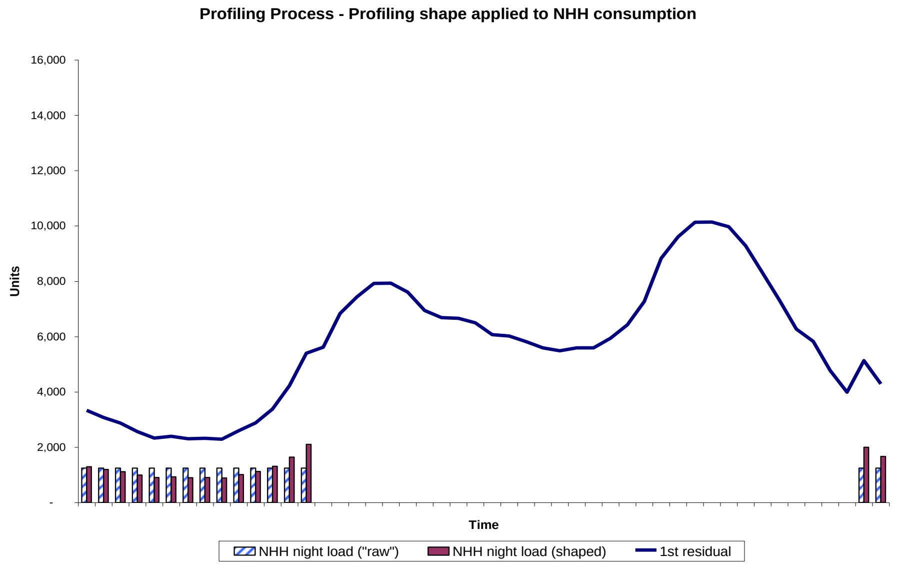


54. We have determined that 20MWh of night load metered energy was recorded. It is shown here allocated equally into each half hour during which the load was turned on.



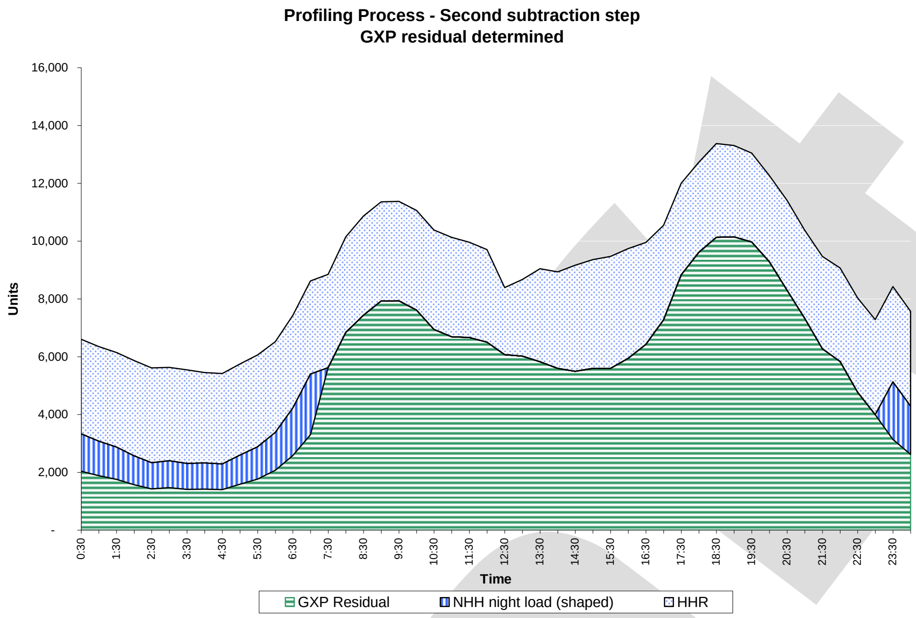
55. First the HHR data that was recorded in each half hour is subtracted from the GXP total, leaving the number of kWh in each half hour that were not half hour metered.

56. This result is termed the first residual and demonstrates that the distribution of NHH kWh consumed is not even throughout the day: more of the kWh were consumed in the peak periods around 9:00am and 7:00pm than at other times.



57. Here we see the 20MWh of night NHH load allocated (shaped) into each half hour: they are allocated according to the GXP residual shape. Note that this load occurs at different times to the GXP residual, and if this load were allocated purely according to

the GXP residual profile there would be allocation errors not only for the night load but for all remaining load allocated into the GXP residual.



58. Lastly the night time kWhs in each half hour are subtracted from the first residual leaving the final result which is the GXP residual. When further profiled load is available it would also be removed from this result to further increase the accuracy of the GXP residual shape.

59. All other NHH metered kWh that are reported by independent traders will be allocated into the half hours of the GXP residual by proportion according to the GXP residual shape. Any night load submitted by traders who may not be using a night load profile will be incorrectly allocated, the majority of it being placed in the day time peak half hours.

60. Any remaining kWh are then allocated to the incumbent trader. In the global reconciliation model where all traders submit consumption quantities, what is left is unaccounted for energy (which would be zero in a perfect world).

61. To ensure traders pay a more accurate overall wholesale price for the electricity they purchase, it is important that profiling is used wherever possible, and that whenever profiling is used statistical accuracy is preserved.

Profiling accuracy

62. Profiling is not an inherently accurate process by trading period. However, it is highly accurate over the period of a meter reading. Profiling is an estimation that allows legacy and lower cost NHH meters to be used in an electricity market that settles by trading period.

63. Given the advent of lower cost AMI meters, traders in the future may elect to move from mass market NHH submissions to HHR submissions, and profiling may then become a minority settlement method.

Profiles and competition

64. Electricity distributors have traditionally taken the opportunity to encourage consumption of electricity away from periods of peak demand. They do this because networks (including the national transmission grid) have to be built to carry the peak period load, and to operate at a reduced capacity (reduced investment utilisation) at all other times. Transferring load away from peak periods alleviates network congestion, reducing the investment required in network capacity.

65. Similarly, due to normal economic drivers, the electricity market operates the cheapest generation first and, as load increases, brings on line the more expensive generators. Therefore, electricity suppliers have been able to offer cheaper base load night rate electricity as an incentive for consumption deferral. This cheaper night rate energy is metered separately from that consumed at other times, which gives rise to the concept of applying a profile to allocate the energy consumed to the correct half hours.

66. The effects of wholesale market price variations due to short term effects, such as generation failure or transitional network constraints, is significantly reduced by traders entering into contracts for difference, or hedges, against wholesale market price variations.

67. Profiles can be used to accurately allocate consumption that is not metered. A good example is street lighting, where we know the times a defined amount of load is turned on and off. This allows the use of a profile to allocate consumption into half hour periods at night when street lights operate.

68. Profiles do not themselves generally confer any competitive advantage. Rather, they facilitate the correct identification of energy consumed at particular times so that the nodal price can be applied.

69. Traders can identify NHH load that is subject to time control and develop their own profiles. An example of this is night only load, or time of use load. Profiling allows NHH volumes of electricity to be reconciled into periods where the nodal wholesale purchase cost is lower. This allows the trader to pass a price benefit to consumers that may give them a commercial advantage over other traders on the same network.

70. An interesting counter to the correct use of profiling is that profiles and reconciliation operating incorrectly can also allow energy that was sold by a trader during the day at a high price to be allocated to night time half hours, and therefore purchased at a lower price (albeit the incorrect one). The design and implementation of the reconciliation and profiling system must ensure this perverse commercial incentive cannot and does not arise. The goal must be correct allocation thus contributing towards achieving the Government's policy objective to ensure traders pay the correct amount for the electricity they purchase.

Types of Profiles

71. Profiles for allocating consumption into the correct half hours are created in two ways. The profile shape can be derived from either statistically sampling a representative group of consumers where HHR metering has been installed (sometimes called deemed profiles or statistically sampled profiles) or from an engineering calculation. Once these quantities are removed from the NSP metered quantities, the resulting distribution of kWhs in half hours is termed the residual RPS profile.

72. Where a participant determines a profile that has a different shape to the RPS, the participant has a Code obligation to provide the shape to the reconciliation manager each month for each NSP, for each profile type. Formats for this are included in the reconciliation manager's functional specifications.

Engineering profiles

73. Engineering profiles are calculated based on an absolute knowledge of the load represented and do not need to be sampled. Often the profiles will be for unmetered load where the shape is non-characteristic of the GXP load, such as streetlights.

Statistical profiles

74. Statistical profiles are established by sample measurement where the normal non half hour metering is replaced by half hour metering for the sample. In establishing these types of profiles, a trader may decide to focus on a particular category of consumer such as dairy farmers, fast food outlets, banks, service stations, or retirement villages. Profiles of average consumers are built up over time from the HHR meters installed on the statistically representative group of connections, which describe how much electricity an average consumer in the category uses in each half-hour of the day.

Industry and consumers benefits from profiling

75. Networks (including the national transmission grid) communicate the high cost of maintaining adequate peak load capacity through high peak time prices. The correct use of profiles facilitates these charges being transferred to end consumers by traders.

76. The inability of the existing profiles to reflect dynamic load switching by networks is an issue.

77. In times of adequate fuel supply for electricity generation, the electricity market determines that when the national distribution system is lightly loaded the cheapest generation will run and, as load increases, higher priced generation comes on line and pushes up the wholesale market price. It is economically desirable that consumers receive these price signals as in the case of network peak loading charges, and profiling facilitates this.

78. Analysis of the commercial effect on traders of applying profiles rather than relying on the GXP residual has demonstrated there is little commercial incentive for traders. This

is because, for them alone, the payback time on the investment in profiles at current costs is excessive.

79. It becomes more imperative to apply profiles when network and generation savings through correct allocation of consumption energy and associated pricing signals are included in the picture.

80. If profiles are applied and increase the accuracy of energy allocation, end consumers stand to benefit mostly through having the option to respond to network and generation pricing signals. This not only allocates the cost of electricity used more equitably, but will provide long term incentives to continue the use of peak load mitigating technology such as peak load control.

Problems with profiles

81. Because any errors introduced by the application of incorrectly defined profiles may have large financial implications, the creation and maintenance of profiles have been strictly mandated by the Code. The Authority:

    (a) individually considers each profile application

    (b) audits the application of profiles every two years

    (c) includes the use of profiles in traders' annual recertification audits.

82. Profiles are not as accurate as using HHR information.

83. Obtaining controlled times for engineered or NSP derived profiles has been problematic, as equipment and remote signals are usually operated by another party.

84. Each trader must follow the detailed process of profile specification, approval, and maintenance for every non-Authority profile they want to use.