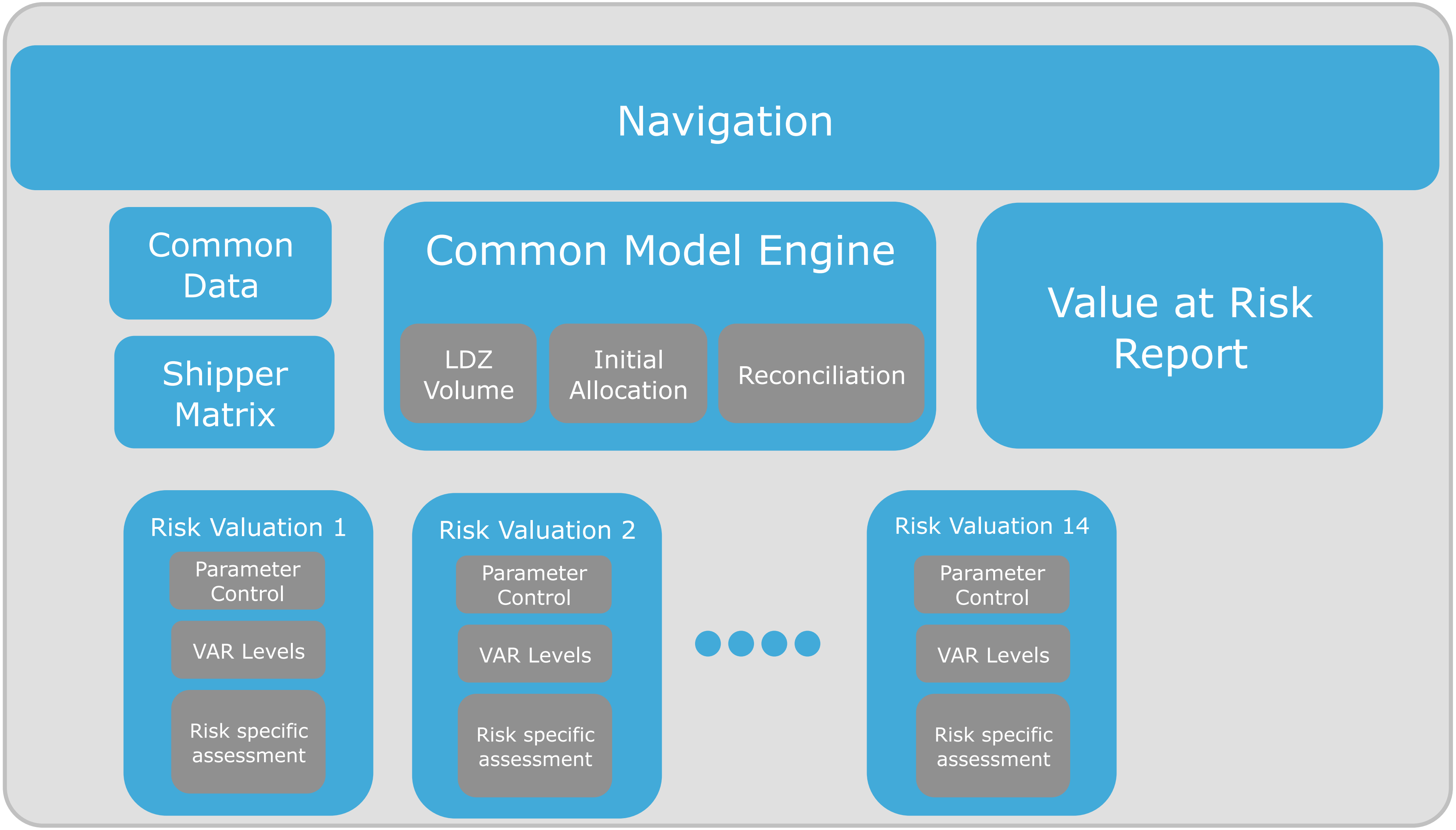
Dynamic Settlements Model

INVESTOR IN PEOPLE

Model Structure



Model Principles

- The model contains 7 shippers which represent:
  - Two small shippers;
  - Two medium shippers;
  - Two large shippers; and
  - 1 shipper that makes up the remainder of the market.
- Performance risks identified will be quantified using the model and documented in the final report.
- The PAW should update the shipper matrix and common data to run scenarios.
- For each risk we have assessed the value at risk between the expected scenario and the 95% worst case scenario.

Compensatory errors

Determining the 95% Worst Case Scenario

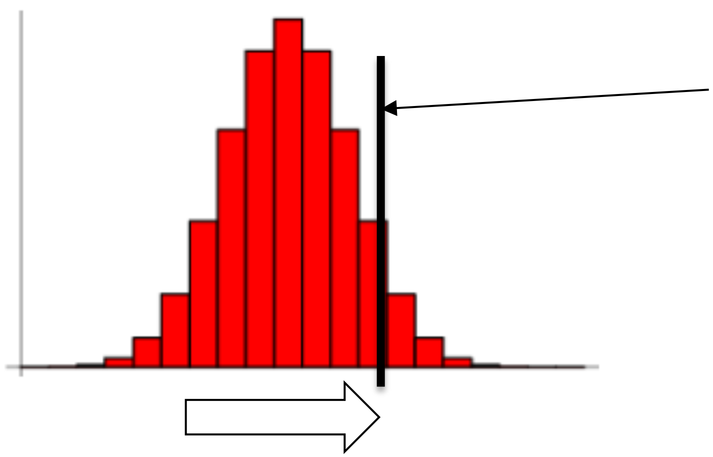
- To evaluate the 95% worst case scenario in each case we have used either a Poisson, Binomial or Normal distribution.

- Binomial and Poisson distributions are for discrete events, i.e. this can be used for customers changing shipper, where only a whole number of change of shipper events can occur.

- Normal distributions are used for continuous probability such as energy consumption.

Binomial Distribution

- Is a discrete probability distribution with parameters n and p.
- n is the number of independent events, n must be a whole number.
- p is the probability of a success occurring, p must be between 0-1
- X is number of success that occurring from a total of n trials.
- The probability mass distribution function is shown below;



X number of successes determines the 95% worst case

Probability = 0.95

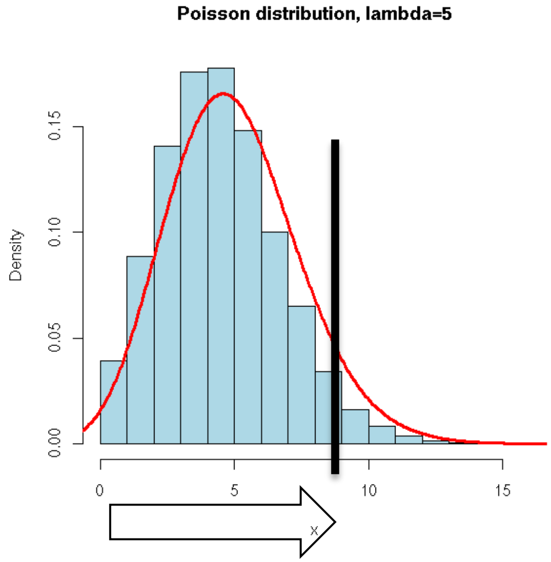
Formula for an event X using a binomial distribution, where q = 1-p
The cumulative probability has been used to determine 95% worst case

$$P(X) = \frac{n!}{(n-X)!\,X!} \cdot (p)^X \cdot (q)^{n-X}$$

http://mathworld.wolfram.com/BinomialDistribution.html

Poisson Distribution

- Poisson distribution is a discrete probability distribution with parameter λ. There must be a whole number of events.
- λ = mean number of successes, λ > 0.
- Poisson can be used as an approximation for a binomial distribution when n is large and p is small.
- A Poisson distribution is not symmetrical.
- Probability mass distribution function is shown below;



Area under curve is the probability = 0.95

http://zoonek2.free.fr/UNIX/48_R/07.html

Formula for a distribution of Poisson – (λ)
This formula shows the probability of exactly x events, the cumulative probability is required to obtain the 95% worst case scenario

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

where

$x = 0,1,2,3,4,\ldots\ldots$

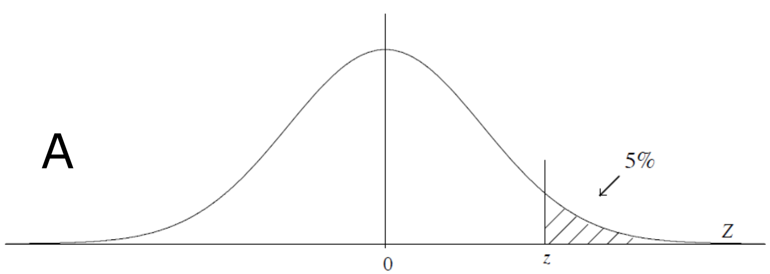
$e = 2.71828$

$\lambda =$ long run average

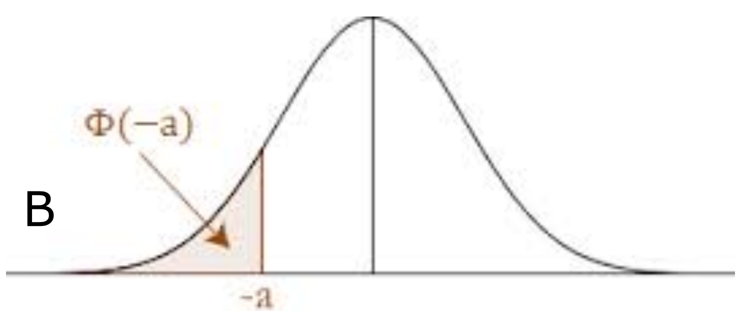
Normal Distribution

- To be used for continuous probability distributions taking a symmetrical distribution.
- Normal distribution take parameters μ and σ^2.
- μ = mean and σ^2 = standard deviation of a set of data.
- Probability density function is as follows; $P(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$

- In diagram A below z is the number of successes, this shows a 95% score of less than z.
- Diagram B shows how to find the 5% probability where there is a negative mean (where AQs are decreasing).



http://sydney.edu.au/stuserv/documents/maths_learning_centre/normal2010web.pdf



https://statistics.laerd.com/statistical-guides/normal-distribution-calculations.php

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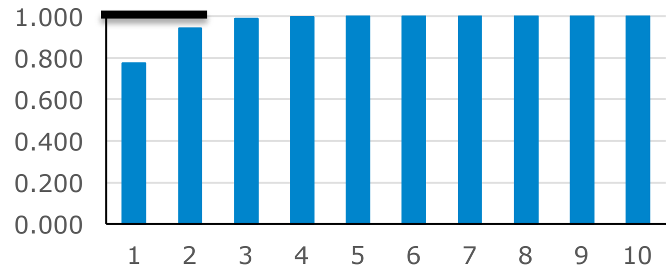
1. Identified LDZ offtake measurement errors

Risk

We have assessed the risk created by offtake measurement errors to initial allocation. Any error is initially allocated to NTS shrinkage, when the LDZ throughput is corrected volume adjustments will be picked up through unidentified gas.



Data Used

Data from the measurement errors register has been used to determine that the probability of any offtake meter having an error on a given day is 0.0641. On average there are 14.38 meters per LDZ. Each identified error causes on average 96,464 kWh error per day.

Distribution Applied

Binominal distribution where n = 14.38 and p = 0.0641

X- Bi (n, p)

95% worst case scenario is 2 errors on offtake meters in the same LDZ on a given day.

2.Undetected LDZ measurement errors

Risk

We have assessed the risk created by undetected offtake measurement errors to allocation and reconciliation. LDZ throughput is never corrected.

Data Used

Data from the measurement errors register has been used to determine that the probability of any offtake meter having an error on a given day is 0.0641 and being detected. We have determined that 10% of errors remain undetected, therefore the probability of an offtake meter having an error on a given day and it being undetected is 0.00641. On average there are 14.38 meters per LDZ. On average each identified error causes 96,464 kWh error per day.

Distribution Applied

Binominal distribution where n = 14.38 and p = 0.00641

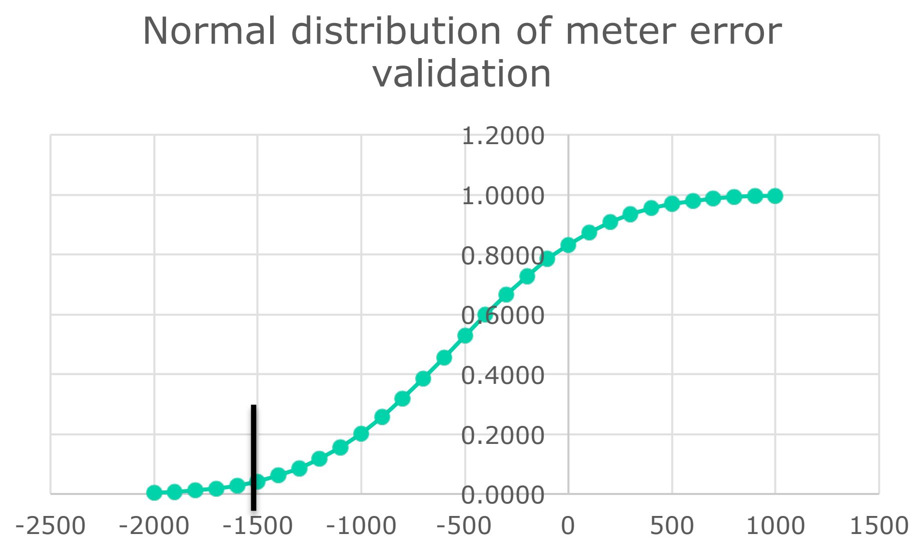
X- Bi (n, p)

95% worst case scenario is 1 error being undetected on a given day.

3. Meter read validation failure

Risk

We have assessed the risk to initial allocation created by meter read validation failure. Validation failure is defined by either the correct read not being accepted by Xoserve or an incorrect read is used for individual meter point reconciliation.



Data Used

Xoserve's sample of meter reads from the East Midlands to determine that 5.53% of meter reads do not have a read accepted in 12 months.

Mod 81 Report 10 2014 to determine the average AQ reduction was 2.16% which was an average reduction of 538.

Distribution Applied

Normal distribution where $\mu = -538$ and $\sigma^2 = 556$
X- Normal (μ, σ^2)
95% worst case scenario is 1500 reduction in consumption for all meters which remain unread.

4. Failure to obtain meter readings within the settlement window

Risk

We have assessed the risk of shippers failing to obtain meter reads within the settlement window.

Data Used

Xoserve's sample of meter reads from the East Midlands to determine that 0.2% of meter reads do not have a read accepted in 12 months.

Mod 81 Report 10 2014 to determine the average annualised AQ reduction was 2.16%. This is then used as a compound reduction of 2.16% per year for 4 years.

95% worst-case

95% worst case scenario is 10% annual reduction in consumption for all meters which remain unread for the whole settlement window.

5. Estimated reads used on daily read sites

Risk

Estimate read for daily read sites within product 1 and 2 create a risk as their consumption is more volatile and has a greater impact on the gas network. Where there are read failures estimates are generated to match the consumption 7 days previously. Where there is no consumption history the estimate will be as AQ/365. The use of estimated reads will only materially impact settlement if there is no replacement read within gas flow day+5.

Data Used

Mod 81 Report 10 2014 for EUC 07-09

Average AQ increase by MPRN = 840,154

Standard deviation = 8 GWh

Distribution Applied

Normal distribution where $\mu = 840{,}154$ and $\sigma^2 = 8{,}227{,}834$

X- Normal (μ, σ^2)

95% worst case scenario is each estimate is 39,452 below the actual consumption on a daily basis.

6. Read submission frequency for product 4

- TBC – This maybe similar to risk 3.

7. Insufficient Maintenance of the Supply Point Register

Risk

There is a risk that if the supply point register is not accurately maintained meter read failures will occur. When meter readings are obtained the meter point detail submitted by the shipper must match the supply point register. Where logic checks fail and the read submitted does not match the supply point register the read will not flow through into settlement.

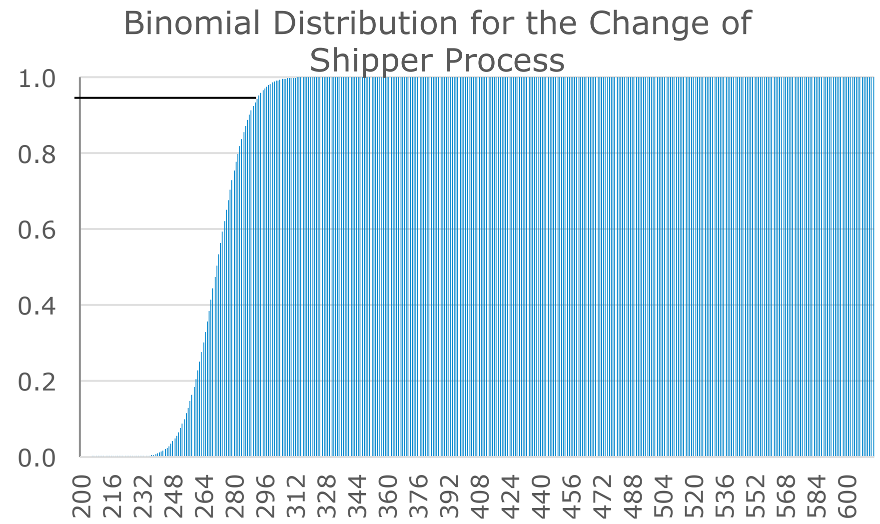
95% worst case scenario

As an estimate to the 1 in 20 scenario we have used the affect caused by incorrectly labelling the imperial and metric indicator.

8. Change of Shipper

Risk

Where a change of shipper is completed using an estimate transfer read, the closed reconciliation period of the previous shipper will end on an estimate and the new reconciliation period will begin on the same estimate. The risk is that the reconciled energy between each shipper involved in the transfer process does not reflect true consumption.



Data Used

2,782,040 change of shipper events per annum data provided by Xoserve.

12.81% of the total MPRNs.

Probability of a transfer read being an estimate is 35% from data provided by Xoserve.

Distribution Applied

Binomial distribution with n=772 CoS events per day and p=0.35

95% worst case is 293 estimates per day based on a low standard deviation derived from Xoserve sample data

We have then used the average number of days between meter reads and the expected change in consumption between the AQ.

9. Late or incomplete check reads

Risk

There is a risk created by shippers not completing the check reads. Shippers are required to complete check reads for all metering equipment that derives a read. This risk will assess the impact of check reads not being completed within the 12/24-month timescales. The risk of not completing these check reads is that drift and other errors are not identified.

95% worst case

5% of check reads are not completed, with a difference between check reads and actuals being 1% change in consumption.

10. Shipperless Sites

Risk

The performance risk to allocation is created when shippers withdraw from sites that are still consuming gas creating shipperless sites.

Data Used

Data of shippers withdrawing from MPRNs provided by Xoserve.

Distribution Applied

Binomial distribution with n= 201 isolations per day p=0.05 the probability of an isolation being completed in error

95% worst case scenario is 15 shipperless sites created per day.

11. Theft of Gas

Risk

Where theft of gas occurs, the amount of gas consumed will not be accurately identified. Any difference will be allocated to the unidentified gas adjustment. The energy will be allocated evenly across all market segments, which may not reflect the market segment or product category where the theft occurred.

Data

The AUGE 2015/2016 statement (page13) indicates that theft estimates vary between 0.006% and 10% of LDZ throughput. Theft being undetected creates a risk to accurate settlement allocation. Undetected theft creates a risk to initial and final allocation. The AUGE highlight that there have been no proven theft on daily metered sites, so the VAR will only apply to product 2-4.

95% Worst Case scenario

As we have little data to model using a probability distribution the 1 in 20 worst case has been modelled as 10% of throughput.

Fair Use of the AQ correction process

Risk

It is expected that shippers will complete AQ corrections in an unbiased way working AQs that are increasing and decreasing at the same rate. There is no regulation to enforce this approach. The risk is that a shipper works AQ correction with only those with the largest financial positive impact to their portfolio.

Data Used

2014 Mod 81 Report 2 showing the number of current AQ values which decrease.

It is based on 27 AQ corrections per day.

Distribution Applied

Applied a normal distribution to the decrease in challenges and determined that a 1 in 20 worst case would result in 83% of AQ corrections decreasing.

X-Normal (μ, σ^2)

μ = 56%

$\sigma 2$ = 16

Lack of WAR Band calculation for qualifying sites in product 4

Risk

There is a risk that where a Winter Annual Ratio (WAR) is not calculated to determine a site-specific winter consumption for a monthly read site with an AQ > 293,000kWh, the profile between days will be incorrect. WAR should be calculated for EUC 03 and above and will have the greatest impact where these MPRNs are allocated into product 4. The profile between days through the winter will not reflect true consumption.

Data Used

2014 Mod 81 report data from EUC 03-09 to determine the average AQ.

Average AQ = 906, 249 kWh

95% worst case

Only 5% of MPRNs which qualify having a site specific WAR with an impact to initial allocation of 2% between days.

Fair use of retrospective updates

Risk

There is a risk that shippers will take a biased approach to retrospectively updating information held on the supply point register. Where retrospective updates have an impact on consumption a reconciliation or a re-reconciliation will be completed. It would be possible for a shipper to use the retrospective updates process only where they are advantaged financially.

Data Used

Using the average AQ derived from the Mod 81 report.

Estimate of 0.1% which determines the percentage of MPRNs requiring a retrospective update that affect reconciliation.

Estimate of percentage change to initial allocation for a given day is 1%.

Distribution Applied

A poisson distribution with parameter λ =187 which is the average impact to reconciliation.

95% worst case is a 210 kWh difference at reconciliation

Next Steps

- Publish the final draft model on 19th December with a user guide.
- Stakeholder comments to be provided by 9th January.
- Agree a date for a workshop to walk through the model.