REVIEW OF DAILY ALLOCATION OPTIONS

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AUTHOR:

Andrew Walker

GAS INDUSTRY COMPANY LIMITED

Contents

Note on confusing acronyms
In this paper 'D+1', 'D+1 results', 'D+1 model', 'D+1 allocations' etc all refer to the *GIC* process that allocates gate injection volumes between shippers.
The *First Gas* process of producing daily running mismatches positions is termed 'BPP D+1'.
Also 'AQ' is allocated quantity, not authorised quantity.

Background (I) – current approach

- The D+1 model produces daily allocation results for shippers using a mixture of telemetry data and regression models built on historical data with seasonal and market share inputs

- The model is optimised for accuracy at a pool (BPP) level. The driver for this design was daily pipeline cash-outs under MBB

- The model divides its pool level allocations between gas gates using an iterative algorithm. D+1 results are required at a gas gate level to support First Gas's daily BPP process.

- Using GIC's D+1 results as an input, First Gas publishes BPP D+1 positions throughout the month pursuant to the *BPP D+1 Pilot Agreement*

- At the start of the following month GIC uses the special allocation process to 'legitimise' the intra-month D+1 results under the Reconciliation Rules

Background (II) – GTAC proposals

- GTAC proposals include:

  o Abolishing current BPPs

  o Balancing at a whole-of-system level

  o Shippers nominating daily capacity at a delivery zone level (for uncongested shared delivery points)

- At the same time, First Gas is procuring an OATIS replacement that will be capable of producing (if required) deemed daily delivery quantities using a simple allocation methodology (such as scaled DNC)

- These factors challenge how a D+1 model might be optimally designed and whether a D+1 model is required at all

- In addition, the pilot can't go on for ever so the GIC D+1 system will eventually (if required) have to be replaced with a formal, rules-based production system

Background (III) – DAWG

- The DAWG has a few bones of contention:
  - Is D+1 necessary under the proposed GTAC?
  - Would D+1 results just be used for balancing or also for informing daily nominations?
  - Would D+1 give materially better results than a simple built-in scaling rule in the First Gas system?
  - Is D+1 accurate enough that building a production system would be worthwhile/value for money?

- At the June DAWG meeting, some alternative daily allocation options were introduced, with varying degrees of accuracy, cost and timeliness

- GIC undertook to expand the analysis of the daily allocation options over a 12 month period but noted it did not have the information required to model a scaled DNC approach

- This paper presents the results of the analysis

Six datasets compared (I)

- The analysis compares three existing datasets and three new options:

Daily allocation options	
[1]	D+1 (official results)
[2]	Initial allocation (as published)
[3]	Interim allocation (as published)
[4]	Gas gate market share
[5]	D+1 TOU and gate market share on residual
[6]	All TOU on telemetry and gate market share on residual

- "market share" is the volume market share at the gas gate from the previous month's initial allocation – including TOU for [4] and excluding TOU for [5] and [6]

- The interim allocation [3] is the baseline for accuracy comparisons

Six datasets compared (II)

- TOU allocations in [5] are identical to those in the current D+1 [1], that is, either known AG1, modelled AG1 or modelled AG2

- Option [6] assumes perfect next-day knowledge of consumption at all TOU sites. TOU allocations in [6] are taken from interim allocation data

- Analysis of a ">20TJ telemetry" threshold was proposed at the June DAWG meeting, but could not be completed in the available time. Results would sit somewhere between options [5] and [6]

- Each shipper has been provided with its own datasets

Six datasets compared (III) – delivery zones

- When it was released on 10 August, the draft GTAC introduced delivery zones. These are groupings (for pricing & nomination purposes) of shared, non-congested, gas gates

- There are 17 proposed delivery zones. Greater Hamilton is the only shared gate not in a delivery zone

- The modelling of allocation options [4] to [6] has been repeated with market shares calculated at delivery zone-level to allow a comparison with gas gate-level results

- Delivery zone results aren't analysed here, but each shipper has been provided with its own datasets in addition to the gas gate-level results

Gas gate market share example

- If a shipper's initial allocation results for July 2017 are:

Gate	(a) TOU AQ	(b) Non TOU AQ	(c) Shipper's total AQ	(d) Total non TOU AQ	(e) Total gate injection
GTA03610	12,000	36,000	48,000	80,000	96,000
TWA35610	5,000	0	5,000	35,000	50,000
HST05210	8,000	4,000	12,000	32,000	40,000

- For each day in August 2017, the shipper knows that under option [4] it will be allocated 50%, 10% and 30% of the daily throughput at GTA, TWA and HST respectively – column (c) divided by column (e)

- Under options [5] & [6], the shipper will receive its TOU allocations (determined by telemetry and/or the D+1 model) plus 45%, 0% and 12.5% of the mass market residual at each respective gate – column (b) divided by column (d)

- A shipper will know its deemed delivery quantities a lot earlier in the day under option [4] since gate injection is the only input. [5] & [6] depend on other shippers' TOU allocations on the day

System-level results (I)

- On a visual inspection of total allocated volumes under each option, the results appear to depend on the type of shipper

- If you are a shipper with a large number of customers, varied portfolio and large volumes, life looks pretty rosy under all options, except that the three new options don't perform quite as well as the current D+1 going into winter (May-July)
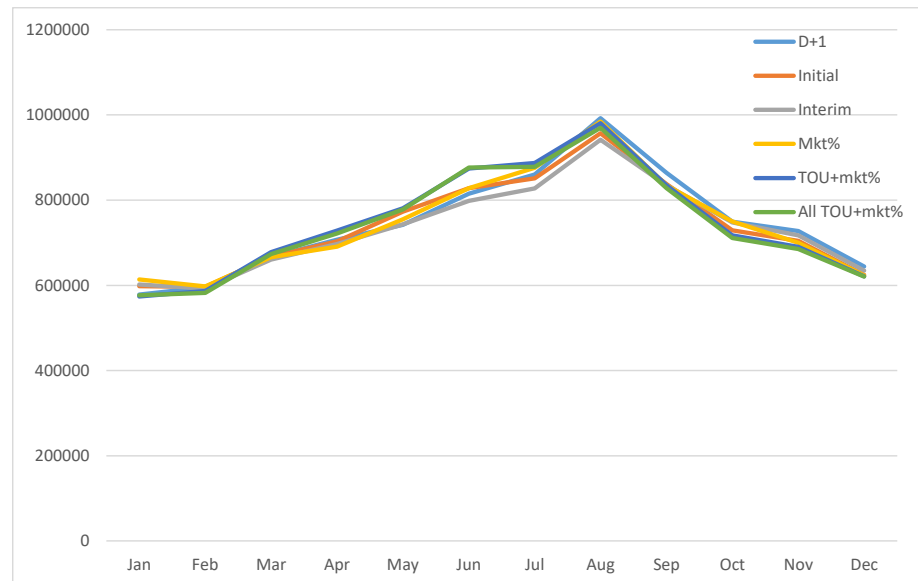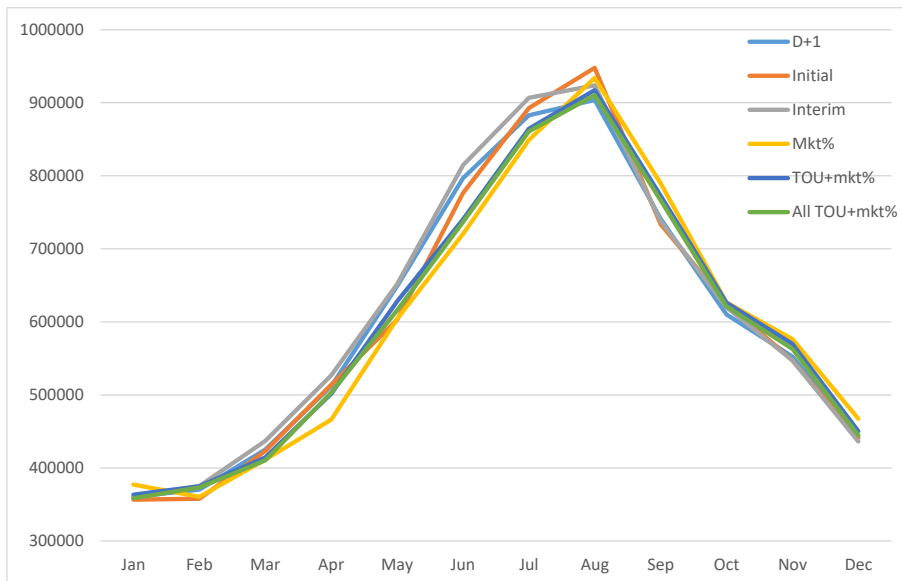

- Results presented here are two 'large' shippers (one per chart), with volumes aggregated across all gas gates and days of the month

System-level results (II)

- If you are a shipper with mass market customers only, options [5] & [6] perform as well as the current D+1 and are comparable with the initial

- The gas gate market share option [4] (yellow line) is the most common outlier, displaying a clear time lag effect
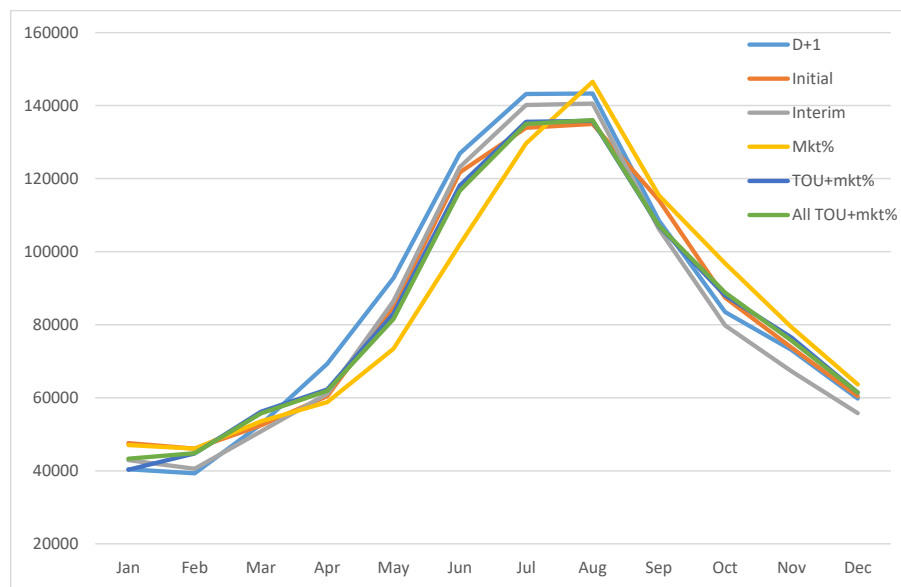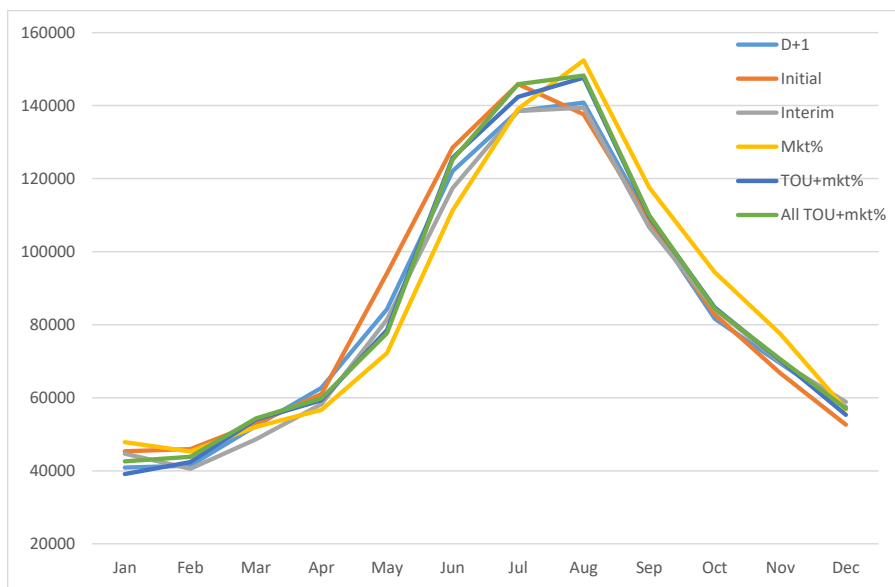
- Results presented here are two mass market shippers (one per chart), with volumes aggregated across all gas gates and days of the month

System-level results (III)

- If you are a shipper with fewer customers but larger TOU volumes, the gas gate market share option [4] is significantly worse than the others

- The difference between the dark blue and green lines – options [5] and [6] respectively – illustrates how much each shipper could benefit from additional telemetry
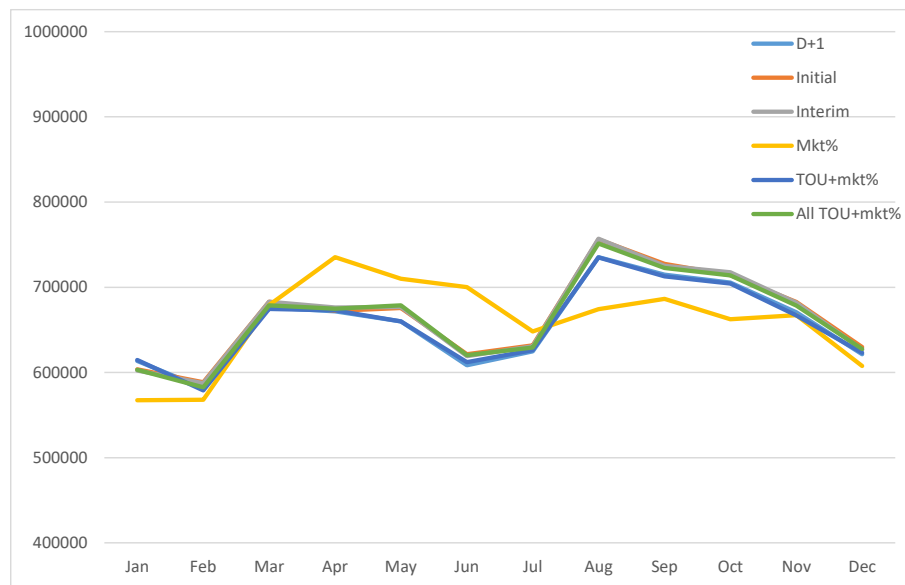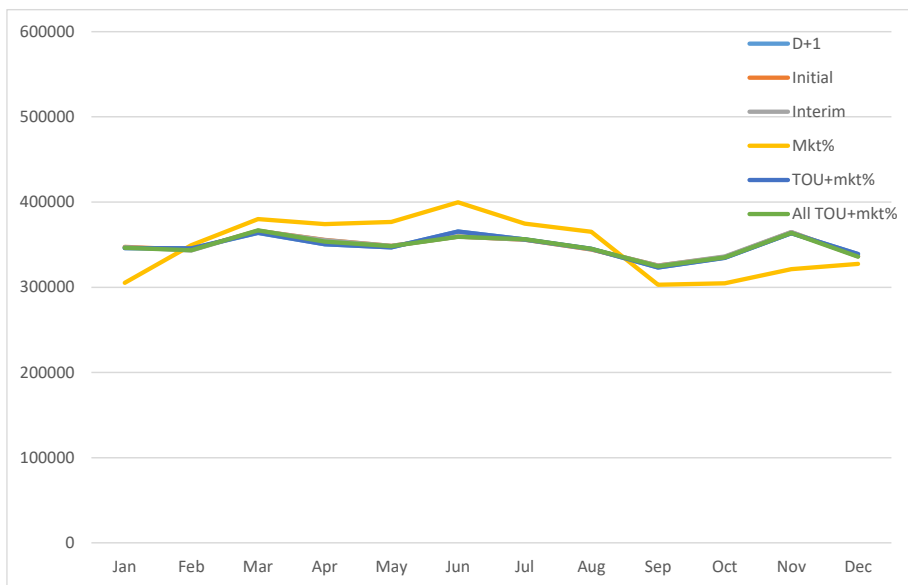
- Results presented here are two TOU-dominant shippers (one per chart), with volumes aggregated across all gas gates and days of the month

System-level results (IV) – interim baseline

- The system-level results from the previous three pages are re-framed here with the interim allocation as the baseline (x-axis) to illustrate any seasonal bias and under/over-allocation bias in the allocation options

Two 'large' shippers – difference from interim allocation
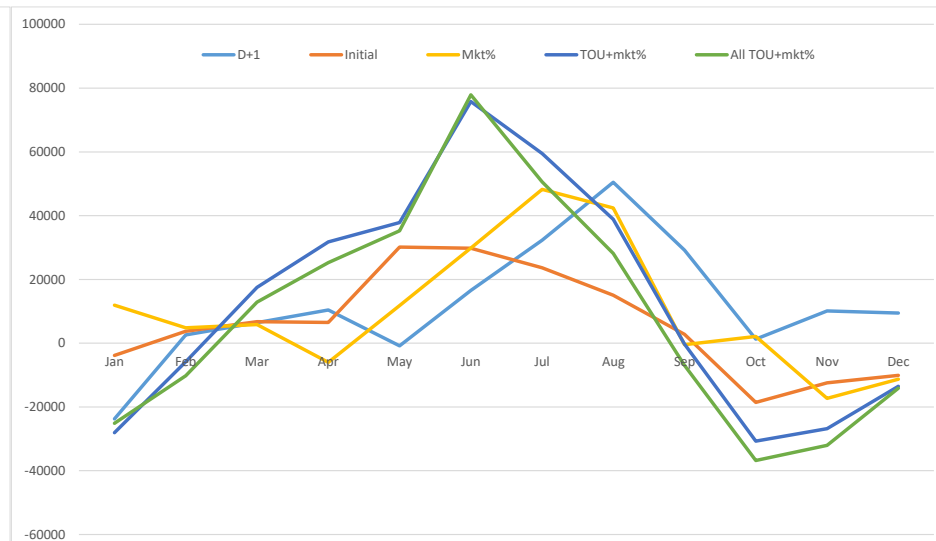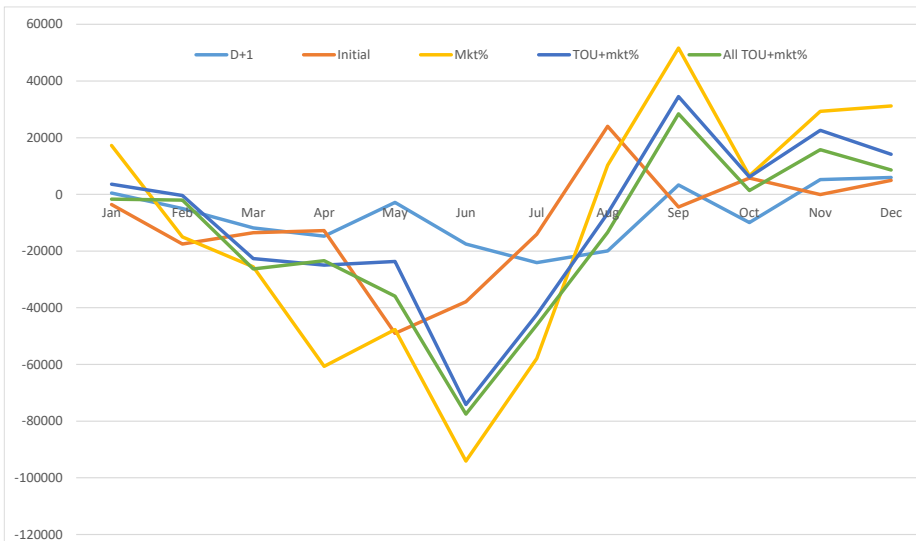
System-level results (V) – interim baseline

- The system-level results from the previous three pages are re-framed here with the interim allocation as the baseline (x-axis) to illustrate any seasonal bias and under/over-allocation bias in the allocation options

Two mass market shippers – difference from interim allocation
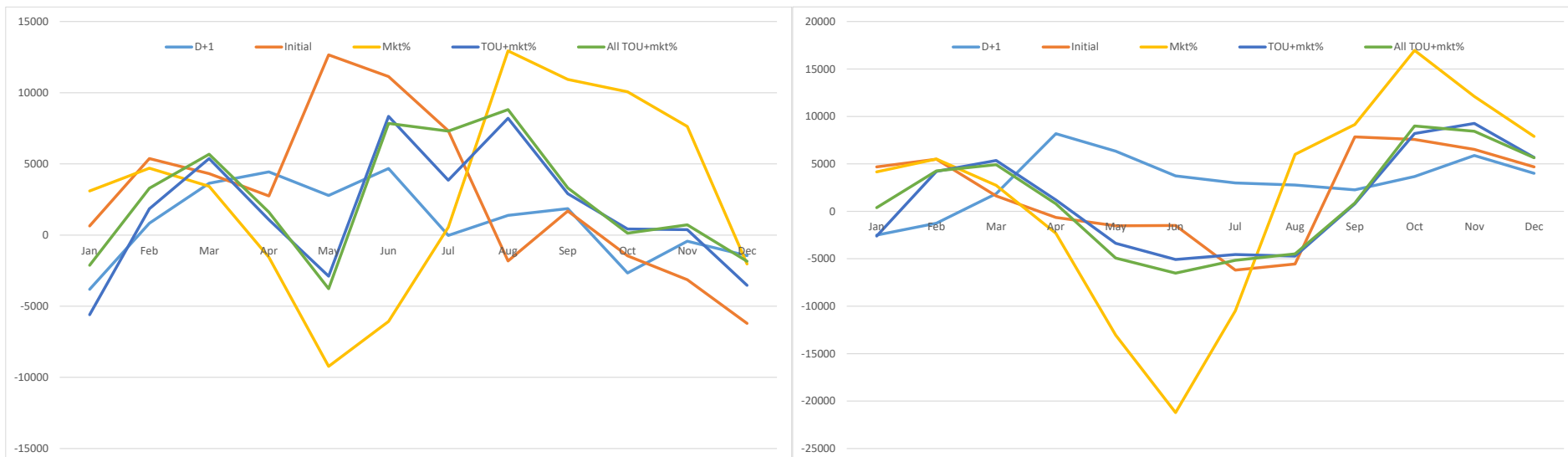
System-level results (VI) – interim baseline

- The system-level results from the previous three pages are re-framed here with the interim allocation as the baseline (x-axis) to illustrate any seasonal bias and under/over-allocation bias in the allocation options

Two TOU-dominant shippers – difference from interim allocation

Gate-level results (I)

- For gas gates with low proportions of TOU (eg TWA, BEL, GTW, GTT, ROT)

  o the results echo the aggregate level i.e. accuracy varies depending on your customer portfolio

  o the gate-level options, [4] to [6], generally outperform the current D+1 [1] as you might expect

  o the initial allocation [2] generally outperforms all of the daily options

- For gas gates with high proportions of TOU (eg WHK, TKS, WTA)

  o the retailer with the dominant load has reasonable accuracy under all the daily options, but with some divergences in options [1] and [5] if TOU sites don't have telemetry

  o other retailers at the TOU-dominant gates have wider fluctuations between the different options (particularly where there is AG2 TOU at the gate) with no clear winner

  o for gates with seasonal TOU load e.g. dairy at Cambridge, Edgecumbe and Reporoa the market share option [4] is wildly wrong in the off peak season

- Example gas gate allocations follow

Gate-level results (II) – Tawa A

- The below charts are allocations for the six shippers at Tawa A (18% TOU)
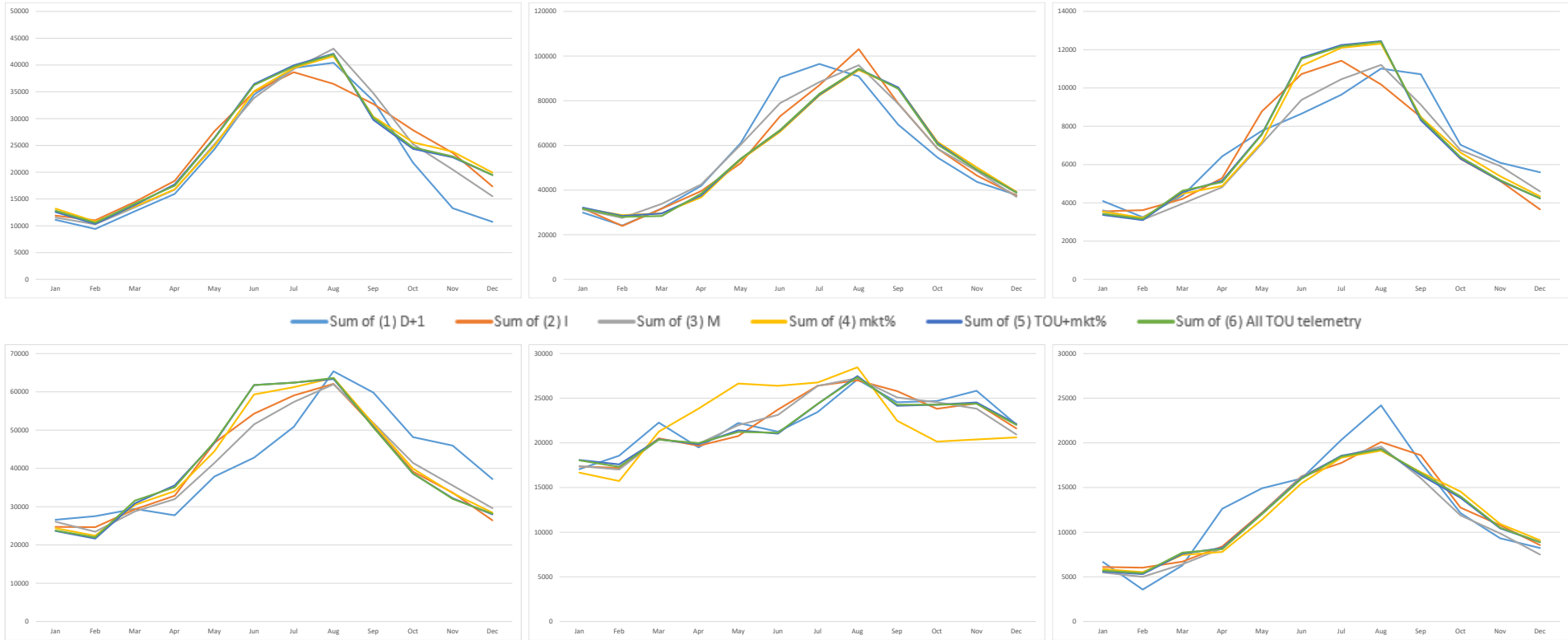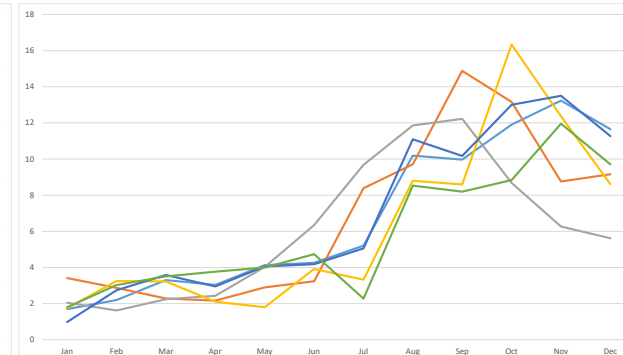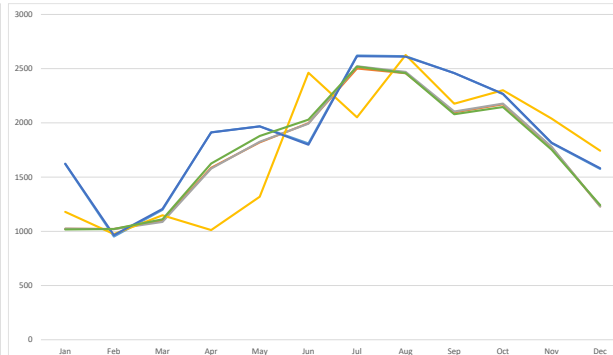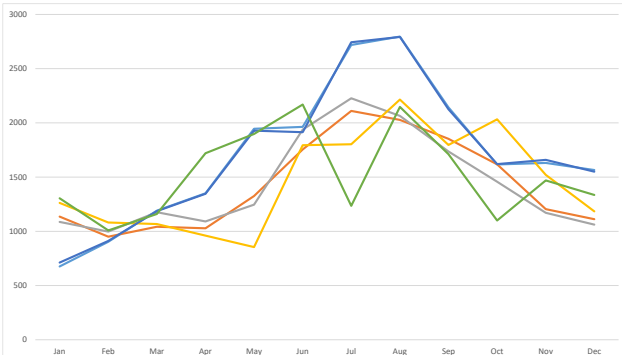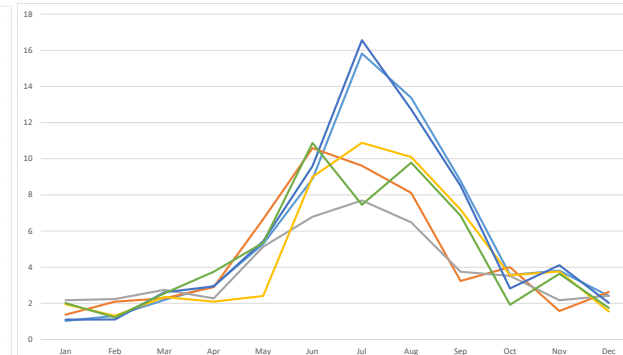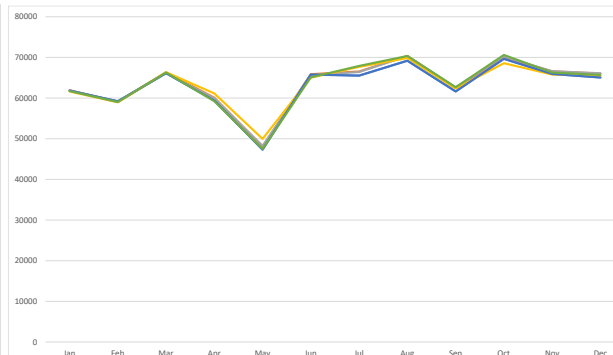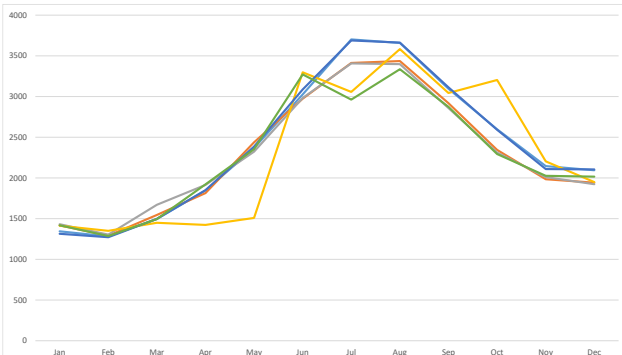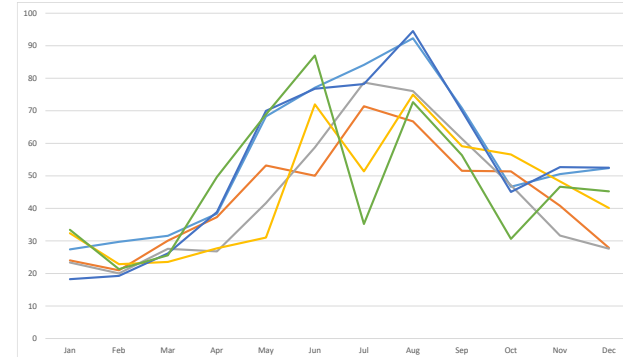
Gate-level results (III) – Tauranga

- The below charts are allocations for the six shippers at Greater Tauranga (11% TOU)

Legend: Sum of (1) D+1 — Sum of (2) I — Sum of (3) M — Sum of (4) mkt% — Sum of (5) TOU+mkt% — Sum of (6) All TOU telemetry
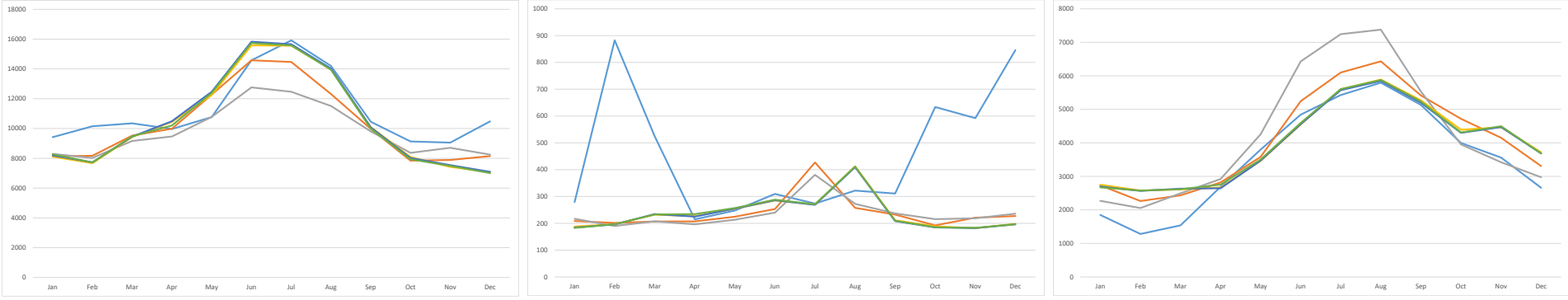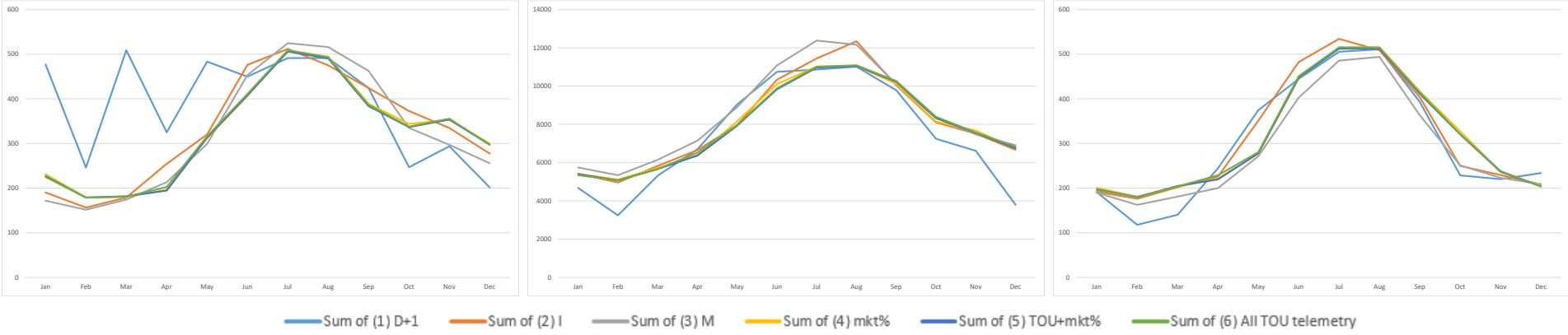
Gate-level results (IV) − Whakatane

- These charts are allocations for the seven shippers at Whakatane (97% TOU)

- Similar situation at Te Kuiti South (99% TOU) and Waitoa (96% TOU)

Gate-level results (V) – Cambridge

- The below charts are for the six shippers at Cambridge (86% TOU)

- Similar situation at Edgecumbe (100% TOU) and Reporoa (99% TOU)

Legend: Sum of (1) D+1 — Sum of (2) I — Sum of (3) M — Sum of (4) mkt% — Sum of (5) TOU+mkt% — Sum of (6) All TOU telemetry
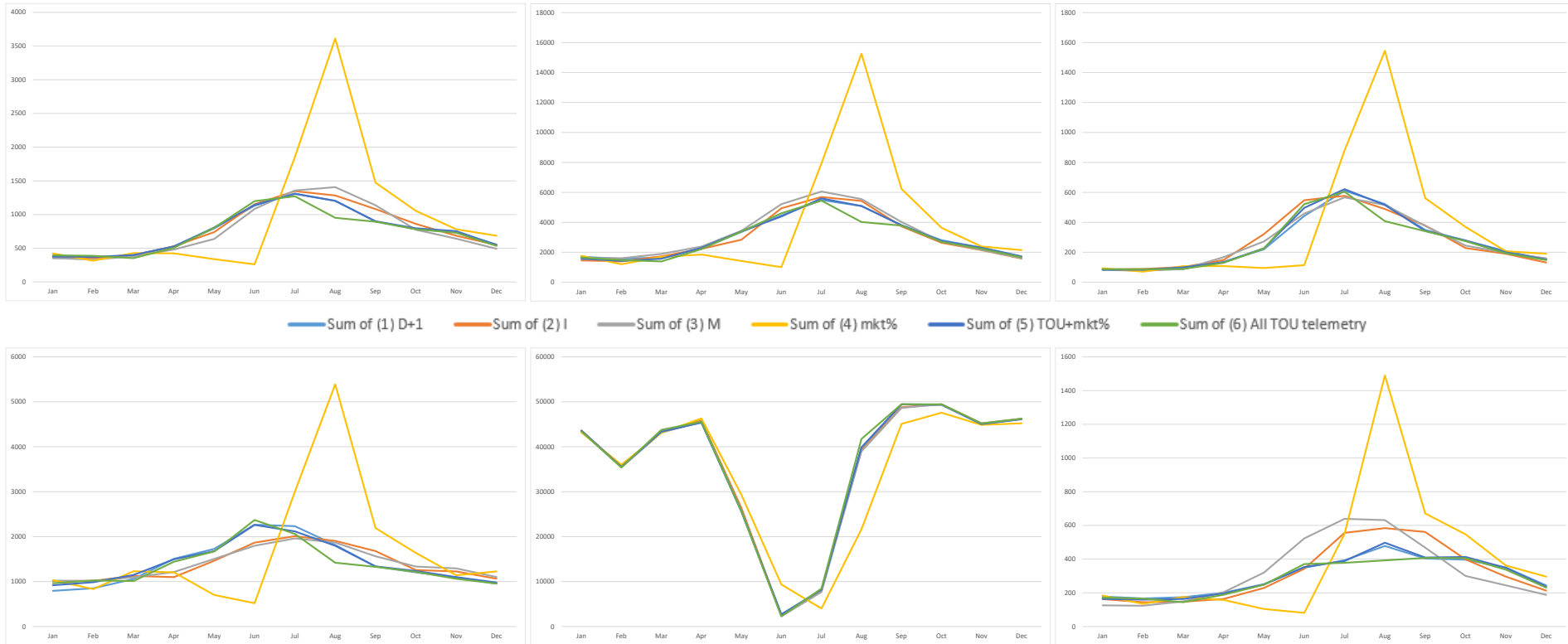
Analysis of errors (I) – calculation

- The previous charts give a good overview but they mask the noise going on at a daily level

- This section considers how the different options perform at a daily level (when compared to the interim allocation) by looking at the distribution of volume errors and percentage errors.

- Comparisons are still at an aggregate physical level (summed across gates) otherwise the results get swamped by zeroes and 'high percentage-low gigajoule' errors

$$AQ \;=\; \begin{array}{c} \sum (AQ_{ASH}, AQ_{BEL}, AQ_{CAM}, \ldots. AQ_{WVY}) \\ \text{or} \\ \sum (AQ_{DZ1}, AQ_{DZ2}, AQ_{DZ3}, \ldots. AQ_{DZ17}) \end{array}$$

- For each day:
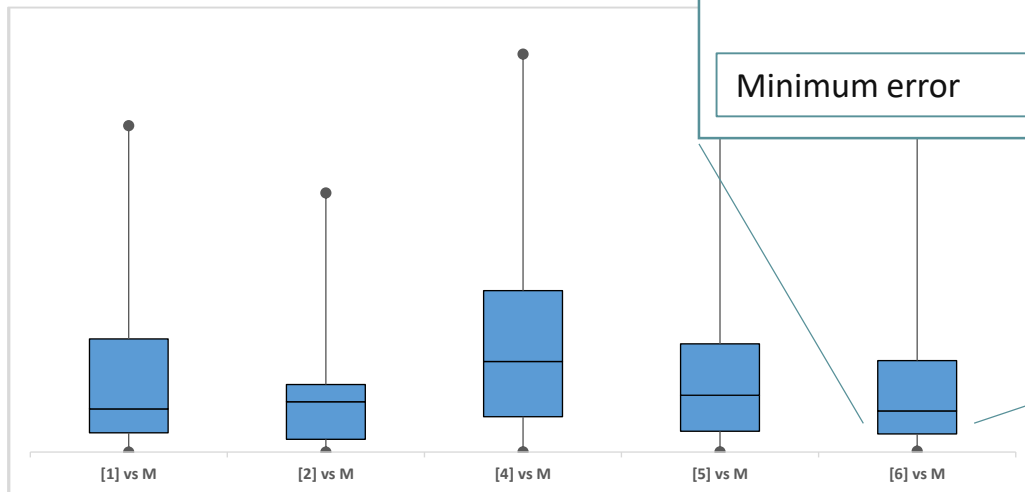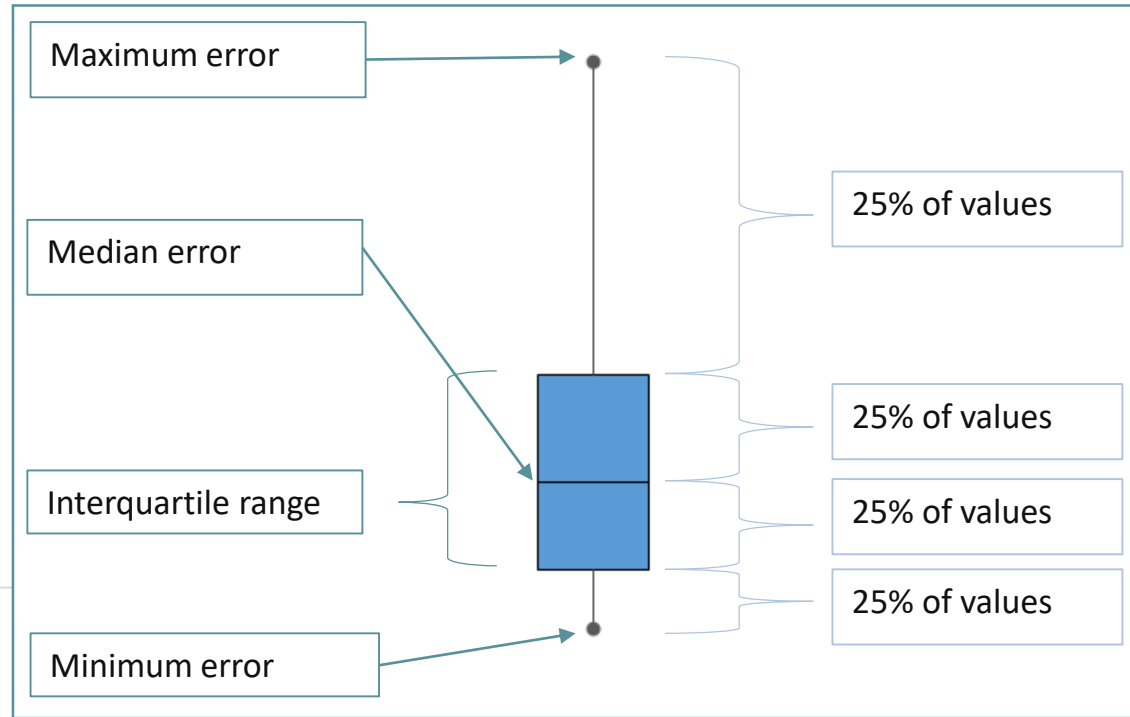
$$\text{Volume error} \;=\; abs(AQ_M - AQ_{D+1})$$

$$\text{Percentage error} \;=\; \frac{abs(AQ_M - AQ_{D+1})}{AQ_M}$$

- This produces 366 error values for each shipper (2016 was a leap year)

- Box plots are used to illustrate the distribution of errors for each option

Analysis of errors (II) – box plots

The sets of five box plots on the following slides represent errors between:

- D+1 [1] versus interim ('M')
- Initial [2] versus M
- Market share [4] versus M
- D+1 TOU & gate market share [5] versus M
- All TOU on telemetry & gate market share [6] versus M

Maximum error

Median error

Interquartile range

Minimum error

25% of values

25% of values

25% of values

25% of values

[1] vs M   [2] vs M   [4] vs M   [5] vs M   [6] vs M

Blue boxes show volume errors

Yellow boxes show percentage errors

Analysis of errors (III) – combined results

Collecting together the errors for all shippers, the overall picture is:

- All errors are skewed toward lower values (ie large errors aren't as frequent as small ones)
- the initial allocation [2] has smaller and lower-ranging errors than the other options
- the market share option [4] has larger volume errors, and both the volume and percentage errors are more widely distributed than the other options. About two-thirds of errors are smaller than 10% for option [4], whereas at least 90% of errors are less than 10% for the other options
- Current D+1 [1] and the other TOU-plus-market-share options [5] & [6] have similar error distributions but the errors in [5] are slightly worse than [1] and [6]
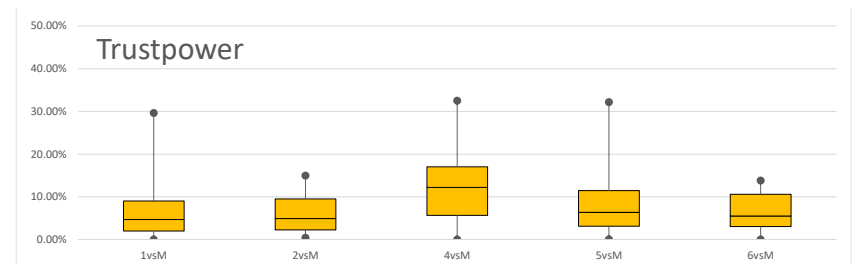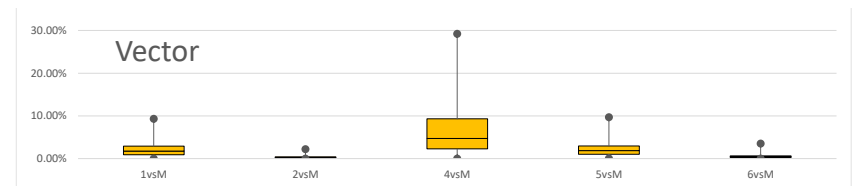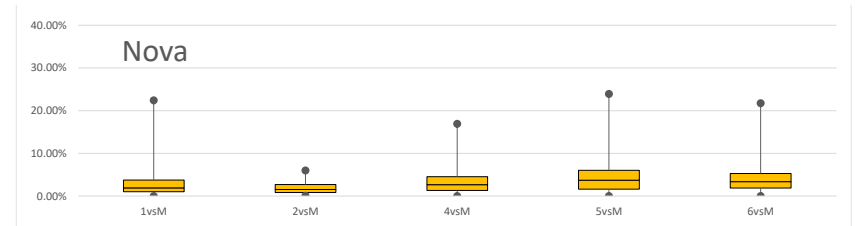

Distribution of volume errors

Distribution of percentage errors
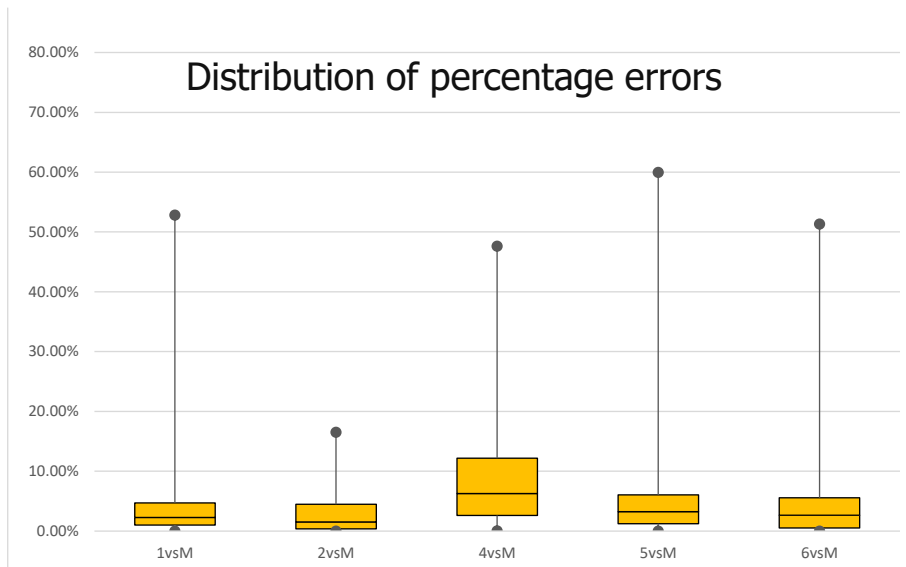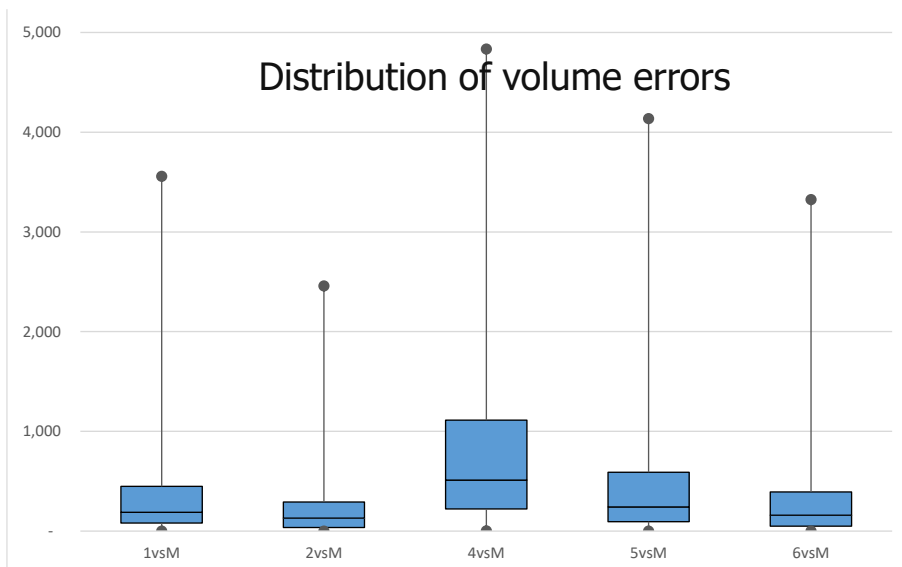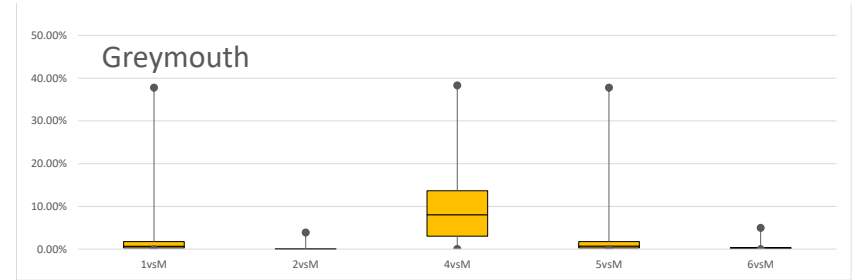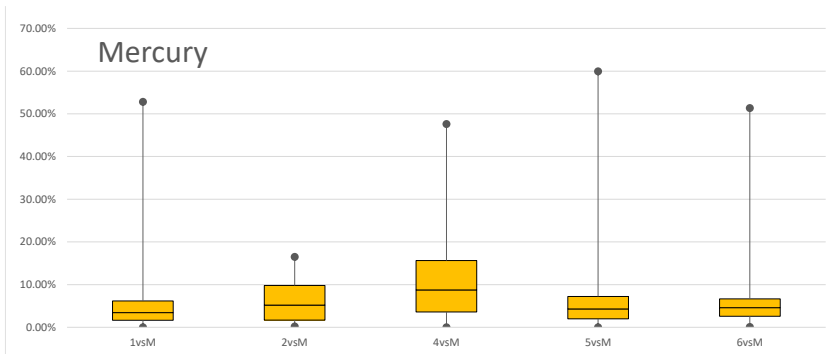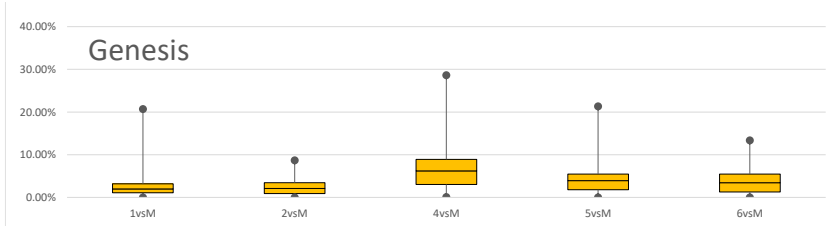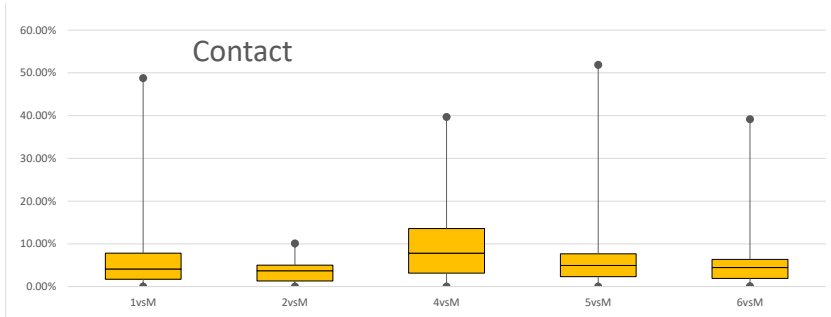
Analysis of errors (IV) – shipper results

- The following slides show the error distribution for each option at the shipper level (for volume errors then percentage errors)

- The results hold no big surprises:

  - The general pattern in the data, across all options, is that shippers with large allocated volumes have larger volume errors and smaller percentage errors and vice versa for the smaller (generally mass market only) shippers

  - The accuracy of the different options varies from shipper to shipper. For some shippers there is a significant difference between the error distributions of the different options and for others they are closely correlated

  - While option [4] is usually the worst-performing option on both a volume and percentage measure, this is not the case for every shipper

  - All shippers are better off when there is more TOU on telemetry – option [6] compared to option [5] – but TOU-dominant shippers see the biggest step change in accuracy

Analysis of errors (V) – shipper results (GJ)
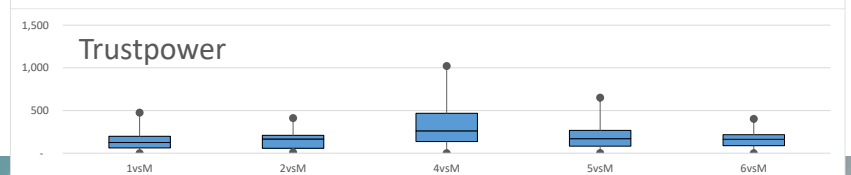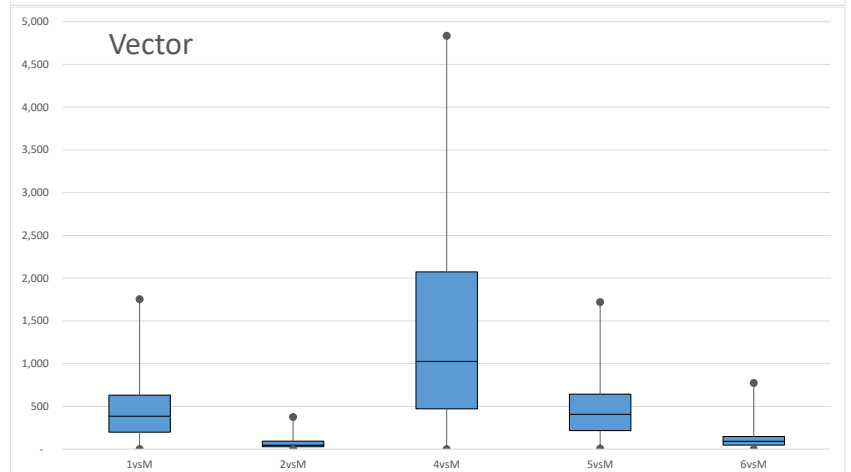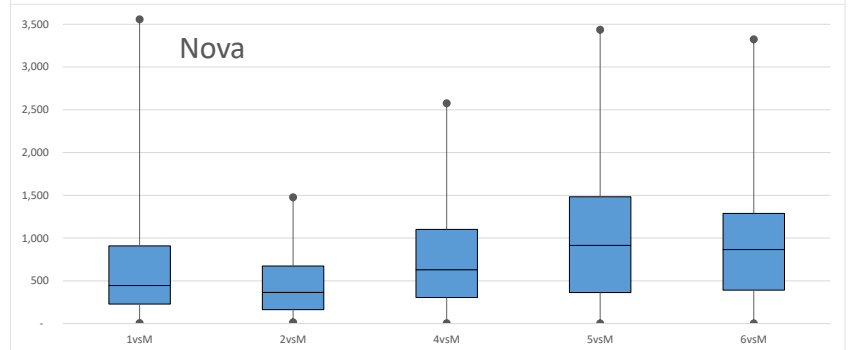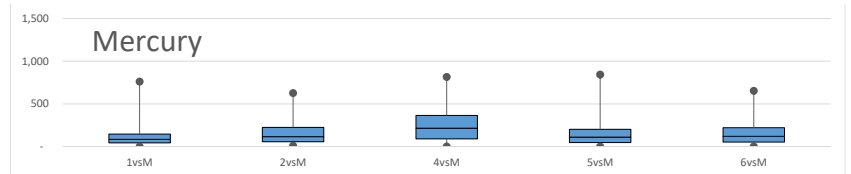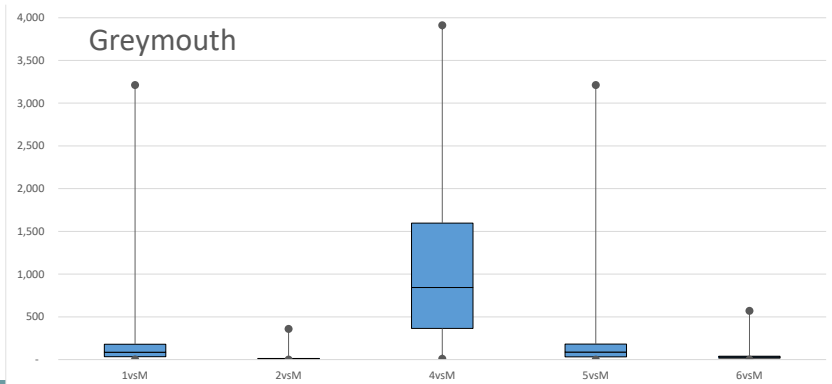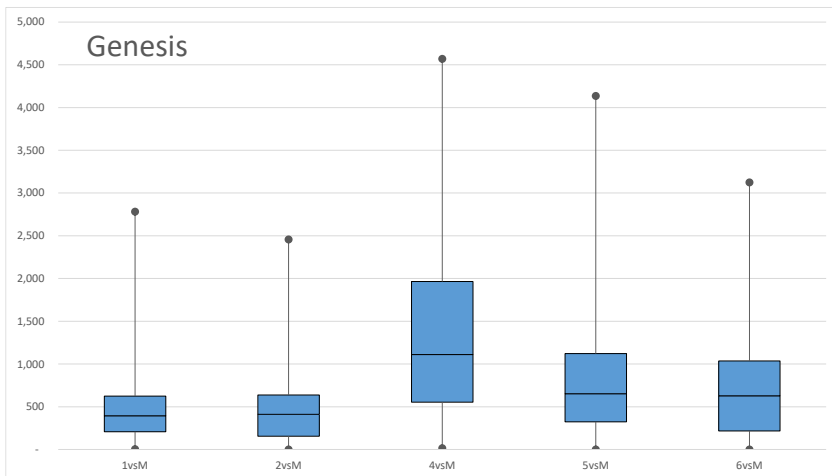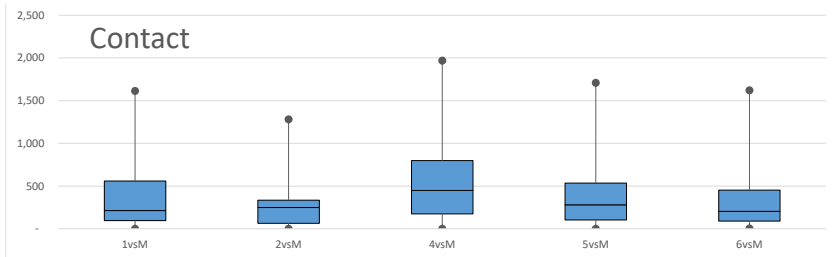
Same vertical scale on all charts

Analysis of errors (VI) – shipper results (%)

Observations

- Results confirm a few common-sense perceptions:

  o A simple market share approach is the least accurate option

  o The initial allocation outperforms the other options for all retailers (but of course this isn't available as a D+1 daily allocation option)

  o The accuracy of TOU-plus-market-share options is higher with more telemetry but only really approaches the accuracy of the initial for the TOU-dominant retailers

- The strength of the market share option lies in its timeliness and cost, not its accuracy.

- Modelling new approaches using historical data has limited usefulness for predicting the value of D+1 under the proposed GTAC arrangements

- One of the biggest unknowns is still how daily allocations can/will be used under the proposed GTAC arrangements

GIC proposal (I)

Rather than asking shippers to decide now whether or not D+1 should proceed post 1 October 2018, continue the D+1 pilot for the first 12 months of GTAC and then make a more informed decision

GIC proposal (II) – benefits

- Allows shippers to see the value of D+1 allocations under GTAC

- Fewer moving parts at a busy time for the industry:
  - Delays the requirement to change the Reconciliation Rules
  - Delays design & implementation of a formal D+1 system
  - Delays the cost of a formal D+1 system

- Ensures that the OATIS-replacement system will be capable of using external daily allocation results for calculating mismatch from the get go

- A scaled DNC approach could be investigated (for comparison purposes) once the new arrangements are underway and a steady flow of data is available (though this would be nominations with the benefit of D+1)

- 12 months is a reasonable extension given the extra cost required to tailor D+1 to the GTAC world

GIC proposal (III) – requirements

- GIC D+1 model will need some tweaks:

  - If D+1 is only going to be used for balancing, then we could simply aggregate existing outputs to system-level – relatively simple change

  - If D+1 is required at a gas gate/delivery zone level (to inform capacity nominations, then the mass market regression models would need to be re-written

- Monthly special allocation process will continue

- If shippers want the GIC D+1 results to continue being used by First Gas intra-month (before the special allocation occurs), this needs to be written into the GTAC or in a new side agreement (replacing the *BPP D+1 Pilot Agreement*)

- …but a side agreement would only need to cover a small amount of the content of the current agreement – the daily BPP process and wash-up process in the current agreement would presumably become part of the new code