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Unidentified Gas Analysis

DESC 19th May 2015

Background

- UNC Modification 0432 (Project Nexus Settlement) introduces new daily gas allocation regime
- Initial view of Unidentified Gas will be visible each day
- Current processes do not identify UG on the day – no current information on likely levels of UG
- Note: UG will be an initial view at D+5 – meter point reconciliation will correct allocation to actuals for all sites – opposite entry will change UG in the LDZ
- For more detail on Mod 0432 UG arrangements, see Xoserve Mhub package on UG on Xoserve.com
  - Change Programme → UKLink Replacement → Documents → Presentations

Objective of the analysis

- Main objective – simulate possible outcomes of the allocation processes
- Give an initial view of likely levels and ranges of UG at D+5
- Investigate possible drivers of levels of UG
- Phase 2 – identify suitable Algorithm Performance measures for the new regime

Comparison to Current UG arrangements

- UG is not currently identified in the Allocation process – NDM Energy is the balancing figure
- UG is currently a fixed monthly re-distribution from SSP to LSP markets
- The UG Expert estimates an amount of permanent UG – after meter point reconciliations have occurred
- Permanent UG value in the AUG Table is not comparable to the initial estimates from this analysis

Note on Modification 0473

- Modification 0473 approved by Ofgem
- Re-introduces the concept of an AUG Expert post-UKLink replacement
- New expert will determine weighting factors to be applied to daily throughput when sharing out UG
- Interim table of factors included in the new AUG Framework document – to be used until expert makes first determination
- Mod 0473 does not affect the calculation of total UG
- Sector splits not considered in this presentation

Unidentified Gas Formula

- Total LDZ Throughput – Shrinkage – DM Measurements – NDM Estimates = Unidentified Gas
- UG identified at LDZ level
- UG could be negative for an LDZ for a day e.g. where
  - LDZ throughput is too low
  - DM measurements are too high
  - NDM estimates are too high
- UG identified in both Nominations and Allocations calculations – this analysis only looks at Allocations

Data used in the analysis

- Daily data at LDZ level
- Actual DM and LDZ measurements
- Actual NDM AQs
- Gas Years analysed:
  - 2011/12
  - 2012/13
  - 2013/14
- Simulated the new algorithm to derive estimates of what UG would have been using
  - Revised ALPs and DAFs under the new seasonal normal basis
  - Revised CWV definitions

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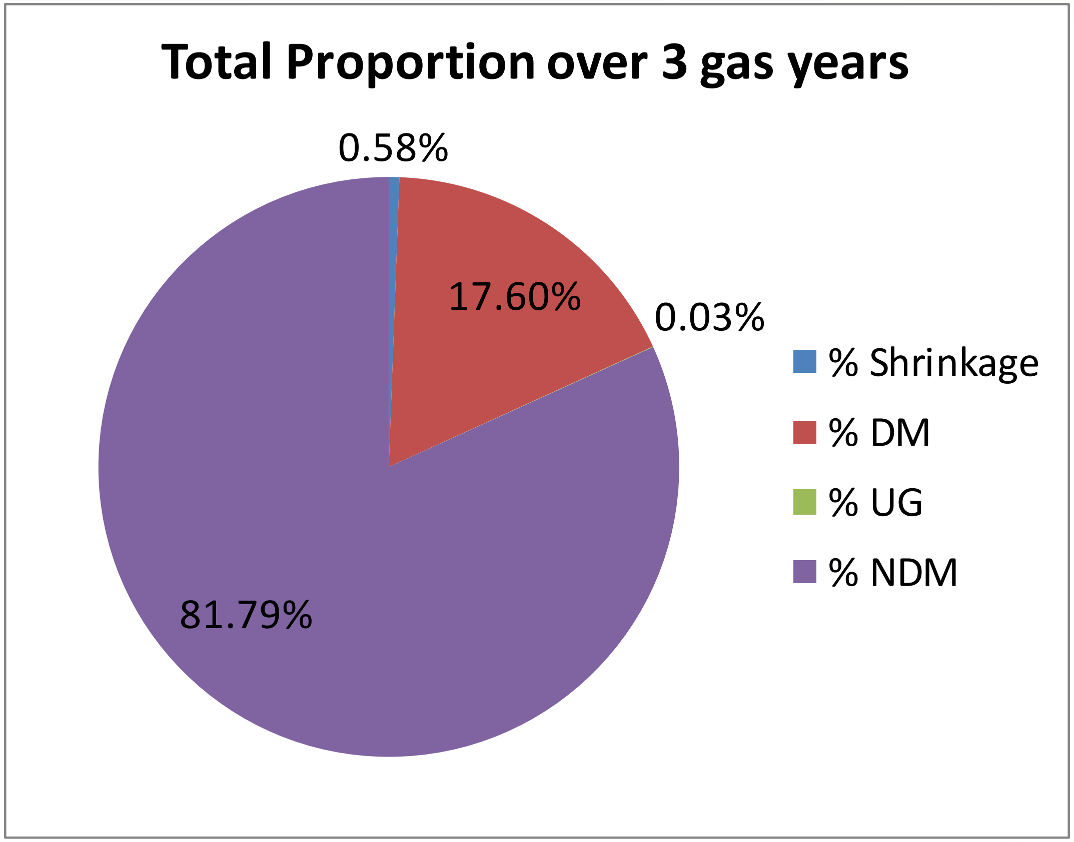
UG Analysis – Proportion Summary



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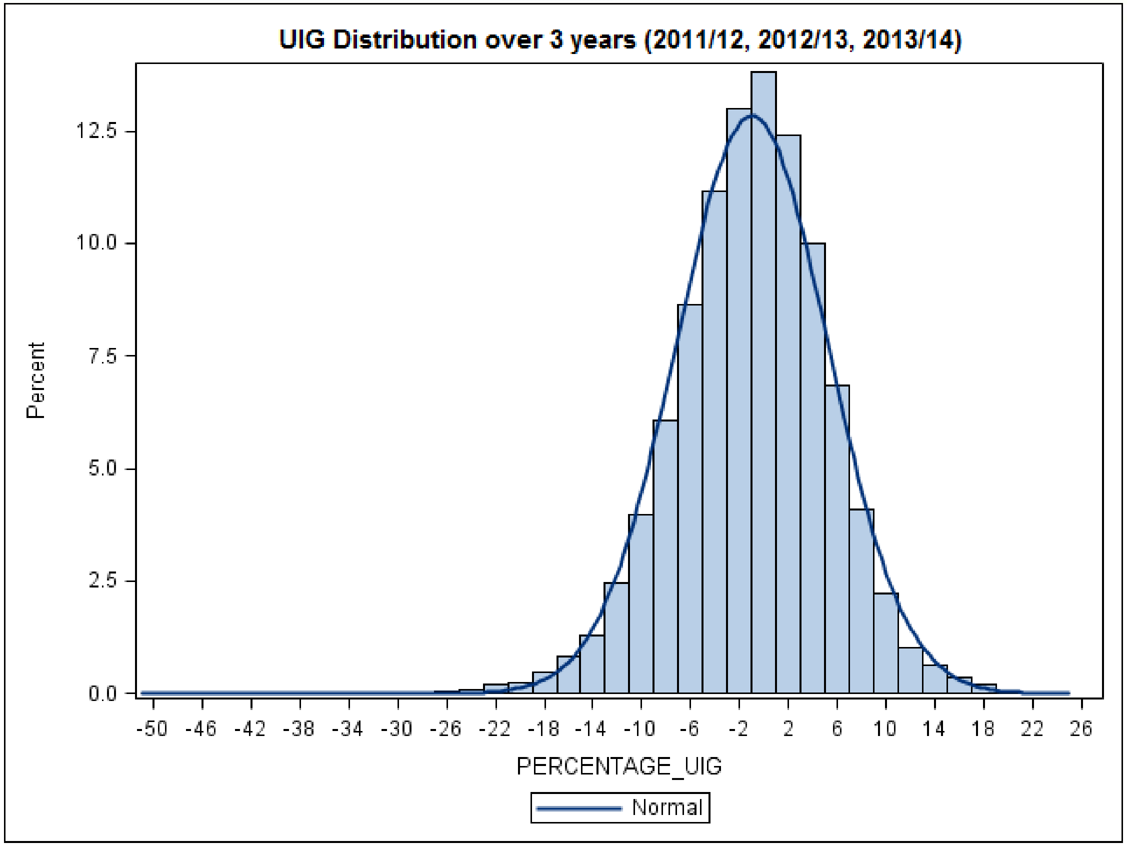
Distribution of UG



Mean = -1.01
Std Dev = 6.22
95% of the UG values are between -13.45% and 11.43%

We are 95% confident that the population mean for UG is contained in the interval -1.11% and -0.91%

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UG Analysis – Summary Statistics

The table below displays some summary statistics for the percentage UG (across all LDZ's).
The possible causes in the fluctuations (positive to negative) will be explored later on.

Gas Year	No. of Obs	Mean	Std.Dev	Minimum	Maximum
2011/12	4758	-2.48	6.16	-30.79	18.93
2012/13	4745	1.47	5.93	-50.54	23.62
2013/14	4745	-2.03	5.78	-33.95	19.93

Gas Years	No. of Obs	Mean	Std.Dev	Minimum	Maximum
2011/12, 2012/13, 2013/14	14248	-1.01123	6.218346	-50.5431	23.6198

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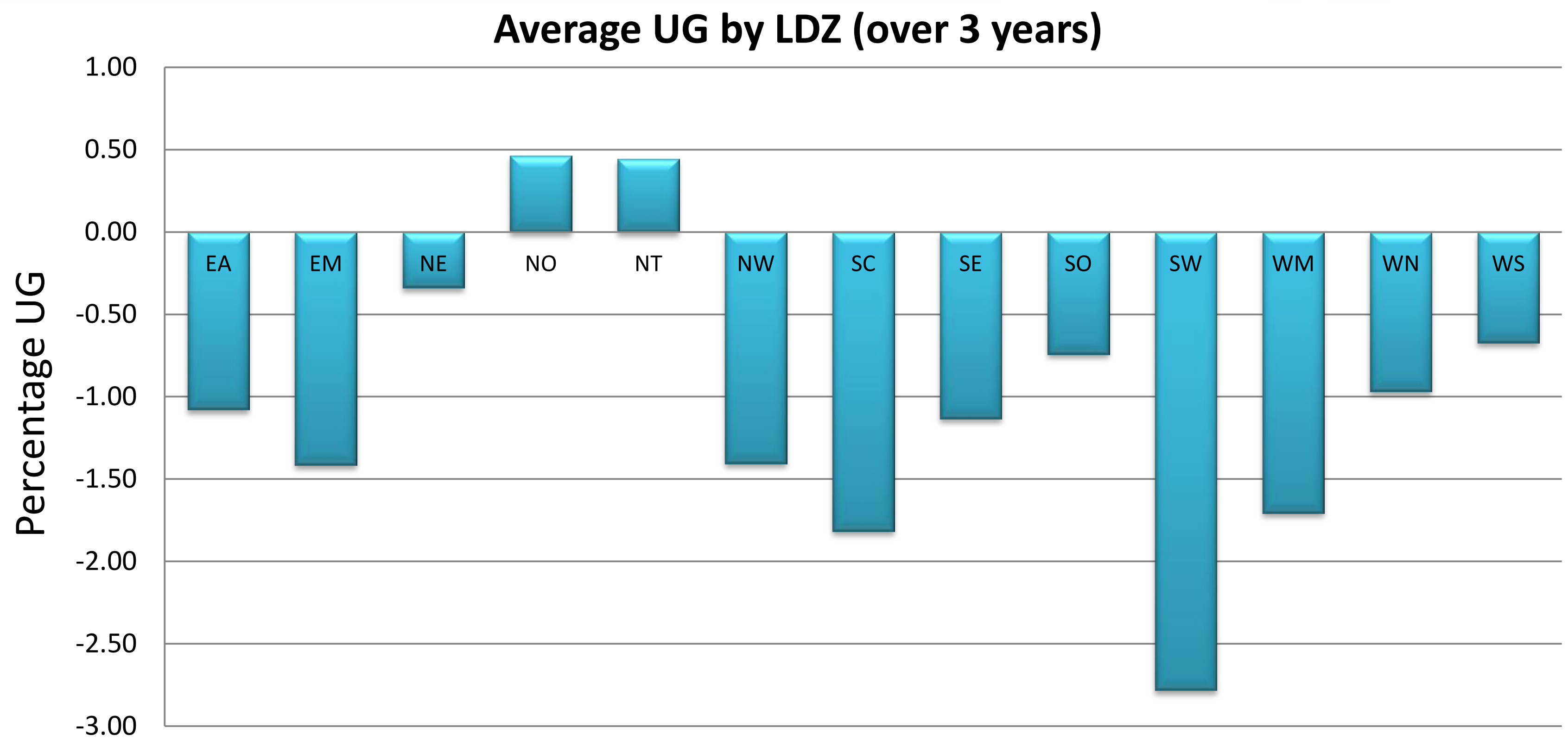
UG Analysis – Summary Statistics

LDZ	No. of Obs	Mean (over 3 years)	Std.Dev	Minimum	Maximum
EA	1096	-1.08	5.87	-17.46	18.58
EM	1096	-1.41	5.35	-20.54	18.92
NE	1096	-0.34	5.83	-23.02	17.23
NO	1096	0.46	5.75	-26.48	23.44
NT	1096	0.44	6.34	-18.99	20.51
NW	1096	-1.41	6.24	-28.02	18.04
SC	1096	-1.82	5.99	-26.34	15.24
SE	1096	-1.13	6.14	-29.38	21.71
SO	1096	-0.74	5.77	-22.87	17.71
SW	1096	-2.78	6.91	-30.79	18.16
WM	1096	-1.71	6.02	-26.24	18.93
WN	1096	-0.97	7.40	-27.74	19.34
WS	1096	-0.67	6.23	-50.54	23.62

Average % UG by LDZ



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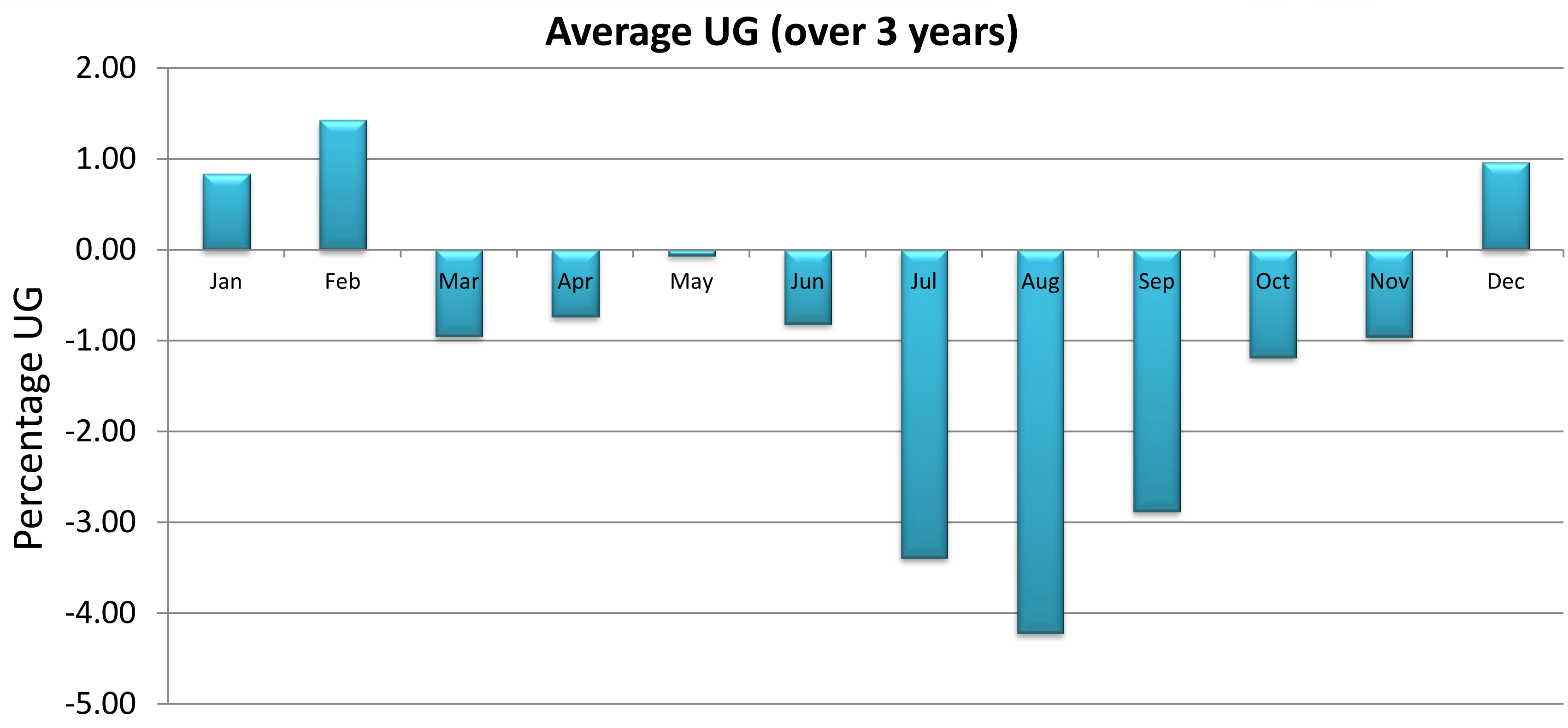
UG Analysis – Summary Statistics

Month	No. of Obs	Mean (over 3 years)	Std.Dev	Minimum	Maximum
Jan	1209	0.84	4.02	-16.88	19.93
Feb	1105	1.43	4.26	-17.33	13.61
Mar	1209	-0.95	7.46	-26.48	19.17
Apr	1170	-0.74	7.91	-27.81	23.62
May	1209	-0.06	7.29	-50.54	23.44
Jun	1170	-0.81	6.43	-23.02	18.93
Jul	1209	-3.39	5.56	-24.45	18.92
Aug	1209	-4.22	5.37	-23.69	13.76
Sep	1170	-2.88	6.79	-29.38	20.51
Oct	1209	-1.18	5.89	-30.79	16.05
Nov	1170	-0.96	4.94	-16.95	18.73
Dec	1209	0.96	4.25	-33.95	13.98

Average % UG by month



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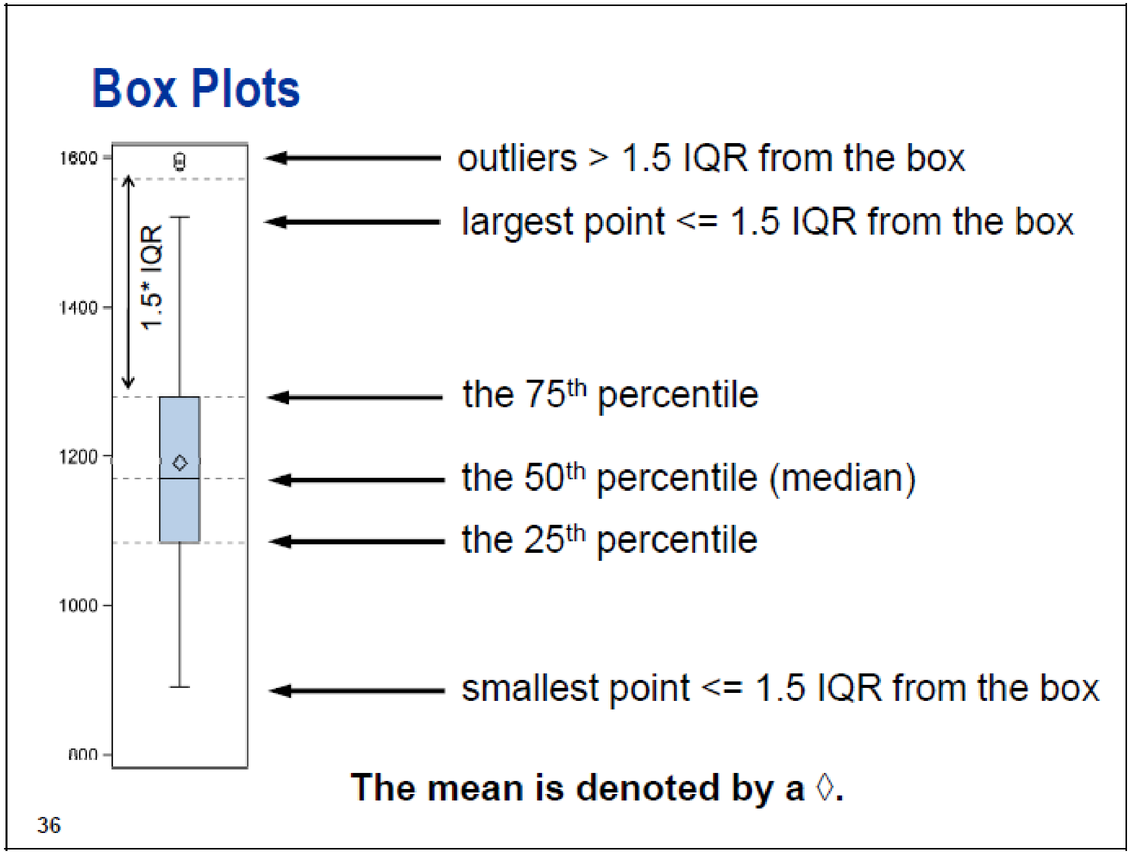
GB CWV comparison over the 3 years

	Average GB CWV		Average GB CWV		Average GB CWV		Average GB CWV over the 3 gas years
Oct-11	12.04	Oct-12	9.99	Oct-13	12.01	Oct	11.35
Nov-11	8.73	Nov-12	6.53	Nov-13	6.33	Nov	7.20
Dec-11	4.81	Dec-12	4.01	Dec-13	5.37	Dec	4.73
Jan-12	4.58	Jan-13	3.02	Jan-14	4.61	Jan	4.07
Feb-12	3.80	Feb-13	2.94	Feb-14	4.98	Feb	3.91
Mar-12	8.36	Mar-13	3.48	Mar-14	7.43	Mar	6.42
Apr-12	8.54	Apr-13	8.44	Apr-14	10.88	Apr	9.28
May-12	12.41	May-13	11.96	May-14	13.17	May	12.51
Jun-12	14.13	Jun-13	14.53	Jun-14	15.06	Jun	14.57
Jul-12	15.02	Jul-13	15.64	Jul-14	15.59	Jul	15.42
Aug-12	15.40	Aug-13	15.52	Aug-14	14.96	Aug	15.29
Sep-12	13.57	Sep-13	14.03	Sep-14	14.73	Sep	14.11

On average, it appears that gas year 2012/13 was colder in comparison to the other two gas years

For information: – interpretation of a Box Plot



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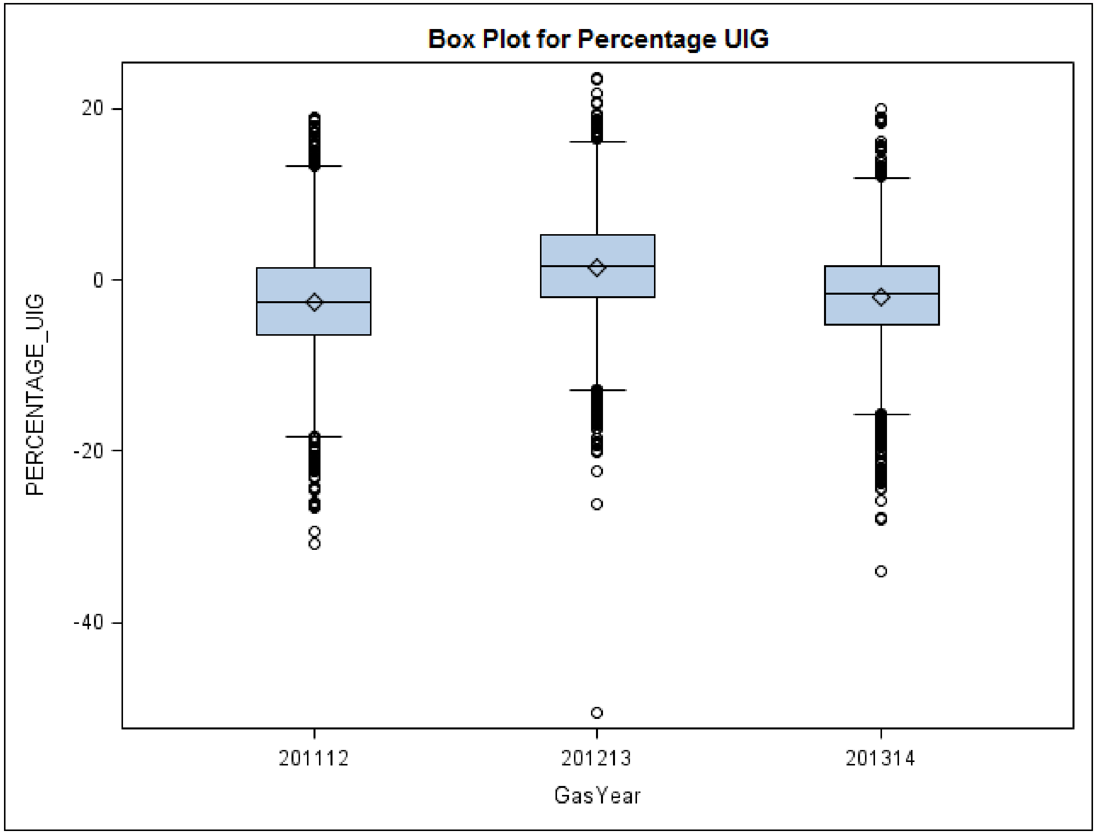
Box plots


Box Plot for Percentage UIG
PERCENTAGE_UIG
20
0
-20
-40
201112
201213
201314
GasYear

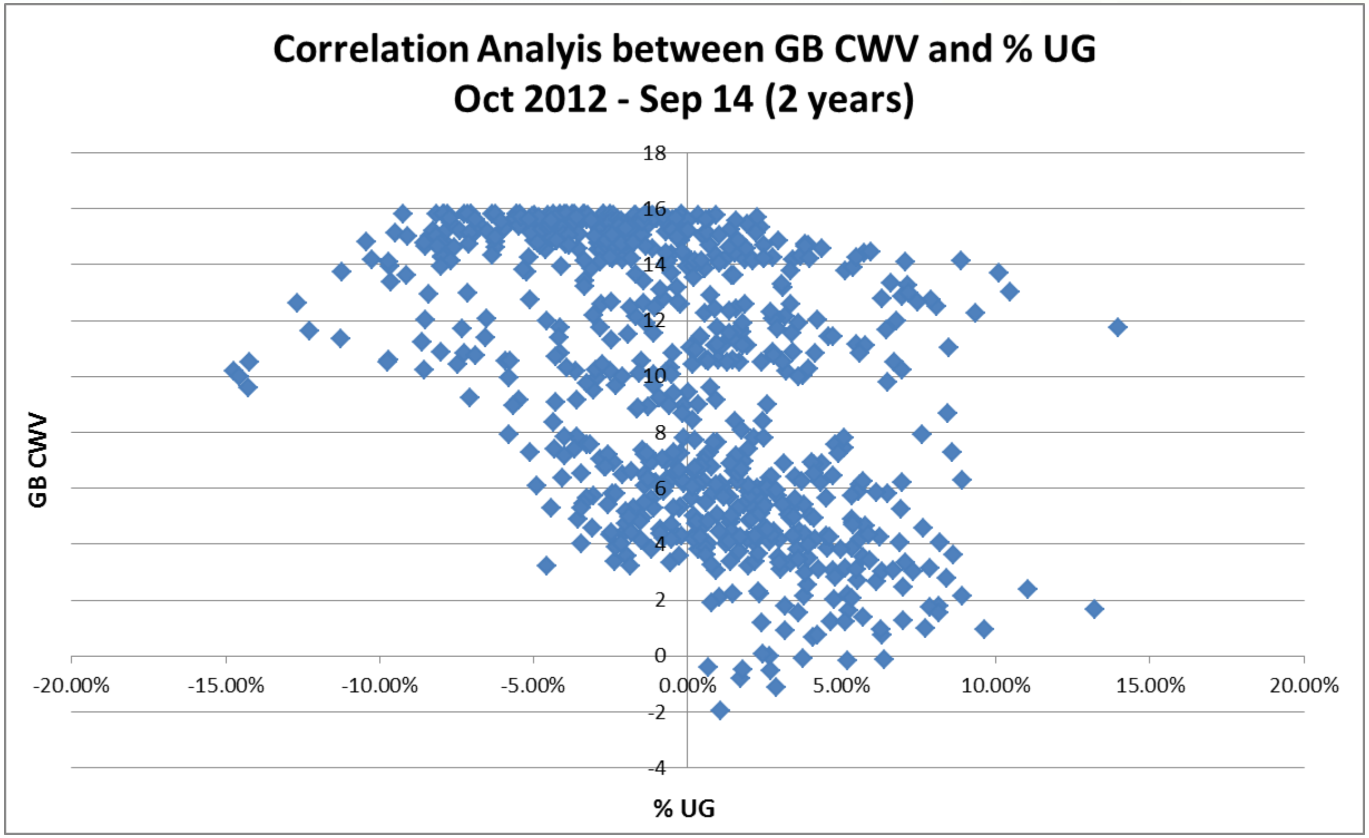
Regression Analysis over 3 years

Simple linear regression was carried out on the following variables to investigate if the variation in UG could be explained.
The data used for the analysis was at LDZ level over the 3 gas years.

x	y	R^2
CWV	UG	0.0759
SUMNDMEST	UG	0.0439
DMENERGY	UG	0.0027
SNCWV	UG	0.0254
WCF	UG	0.1286

The following graphs also allow us to explore any possible relationships:
(Please note that the GB CWV and national UG values was used for visual purposes only – and not used in the analysis).

Exploring the relationship between UG & CWV



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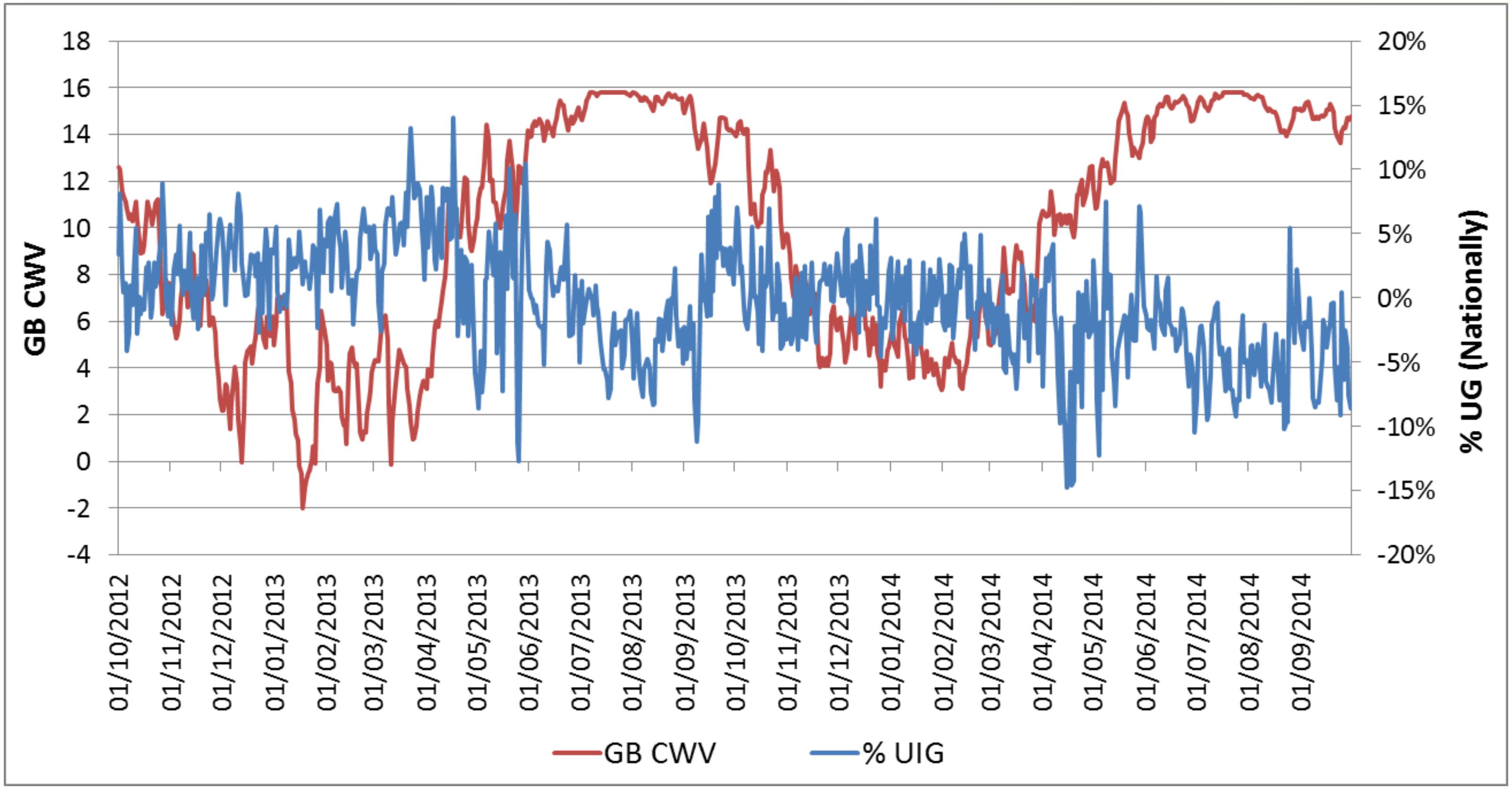
Exploring the relationship between UG & CWV



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Multiple Regression Analysis

- After investigating the individual variables through simple linear regression, it was clear that there is large proportion of variation in unidentified gas that is still unexplained.
- Further analysis was then carried out which allowed for several independent variables to be investigated simultaneously.

  It also allowed for other variables to be explored (e.g. day of the week and month).
- The first model to be explored using multiple regression contained all of the variables tested in simple linear regression earlier, to see how well they performed together.

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Multiple Regression Results

MULTIPLE LINEAR REGRESSION ANALYSIS FOR UG
The REG Procedure
Model: MODEL1
Dependent Variable: UIG
Number of Observations Used 14248

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.277943E17	2.555886E16	535.83	<.0001
Error	14242	6.793321E17	4.769921E13		
Corrected Total	14247	8.071264E17			

Root MSE	6906461	R-Square	0.1583
Dependent Mean	32963	Adj R-Sq	0.1580
Coeff Var	20952		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	2230185	312043	7.15	<.0001
Shrinkage	1	-2.95189	0.40776	-7.24	<.0001
DMEnergy	1	0.00808	0.00580	1.39	0.1634
SumNDMEst	1	0.01064	0.00212	5.02	<.0001
CWV	1	-157555	26394	-5.97	<.0001
WCF	1	-1354117	37127	-36.47	<.0001

Model Selection

- The number of variables to be used in the analysis = 54
(this includes all weather variables, demand variables at LDZ and EUC level, dummy variables for: day of the week, holidays and month)

- With such a large number of variables, eliminating one variable at a time using standard multiple regression can take an extreme amount of time.

- Due to the large number of variables, Stepwise Regression seems to be a sensible automated method to select the best model.

Stepwise Regression

- Stepwise Regression starts with an empty model and incrementally builds a model one variable at a time. Variables already in the model will not necessarily remain (like Forward selection). The Backward component of the method removes variables from the model that do not meet the significance criteria (0.05)

- When carrying out the analysis, the best model gave an R^2 of 31.2%. There is still a large proportion of variation in UG that is still unexplained.

- The variables that appeared to be insignificant were NDM demand, shrinkage, Mon-Thu, Fri, holidays and EUC bands below band 3.

- The significant variables were WCF, CWV, DM demand, Saturday, Sunday and EUC bands 3+

Conclusions

- There is still a large proportion of variation in UG that is unexplained.
- There does not appear to be a strong relationship between CWV and UG.
- UG is most likely to be negative in the summer months.

Next Steps

- Continue to monitor UG levels through 14/15
- Look at potential new algorithm performance measures
- For the information to be publicised at other forums
- Prioritise further work as part of the ad-hoc work list