



**Demand Estimation Technical Work Group**  
EUC Modelling 2018/19  
Small NDM Single Year Modelling Results

15<sup>th</sup> May 2018

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## Section 3:

# Small NDM Sector Modelling Results

# Small NDM Sector: (<2,196 MWh pa)

- Small NDM for Demand Estimation purposes <2,196 MWh
- EUC consumption ranges are not prescribed in Uniform Network Code. There are no proposed changes to the AQ ranges used in EUC definitions for Gas Year 2018/19, however, 3 additional EUCs have been modelled and are proposed to represent each of Band 1 and 2. These 3 EUCs will represent Domestic, Non-Domestic and Pre-payment consumers
- Current EUC Bands / Consumption Ranges for Small NDM:
  - Consumption Band 1: 0 – 73.2 MWh pa
  - Consumption Band 2: 73.2 – 293 MWh pa
  - Consumption Band 3: 293 – 732 MWh pa \*
  - Consumption Band 4: 732 – 2,196 MWh pa \*
  - Note: Bands 3 and 4 also include 4 x Winter Annual Ratio (WAR) Bands alongside the Consumption Band EUC
- Small NDM is the main component of the overall NDM (89% of total AQ)

## Section 3 part 1:

Small NDM Consumption Bands: 1 to 4

AQ Range: <2,196 MWh pa

Single Year Results for 2017/18 sample data

# Small NDM Consumption Bands: Agreed Modelling Runs

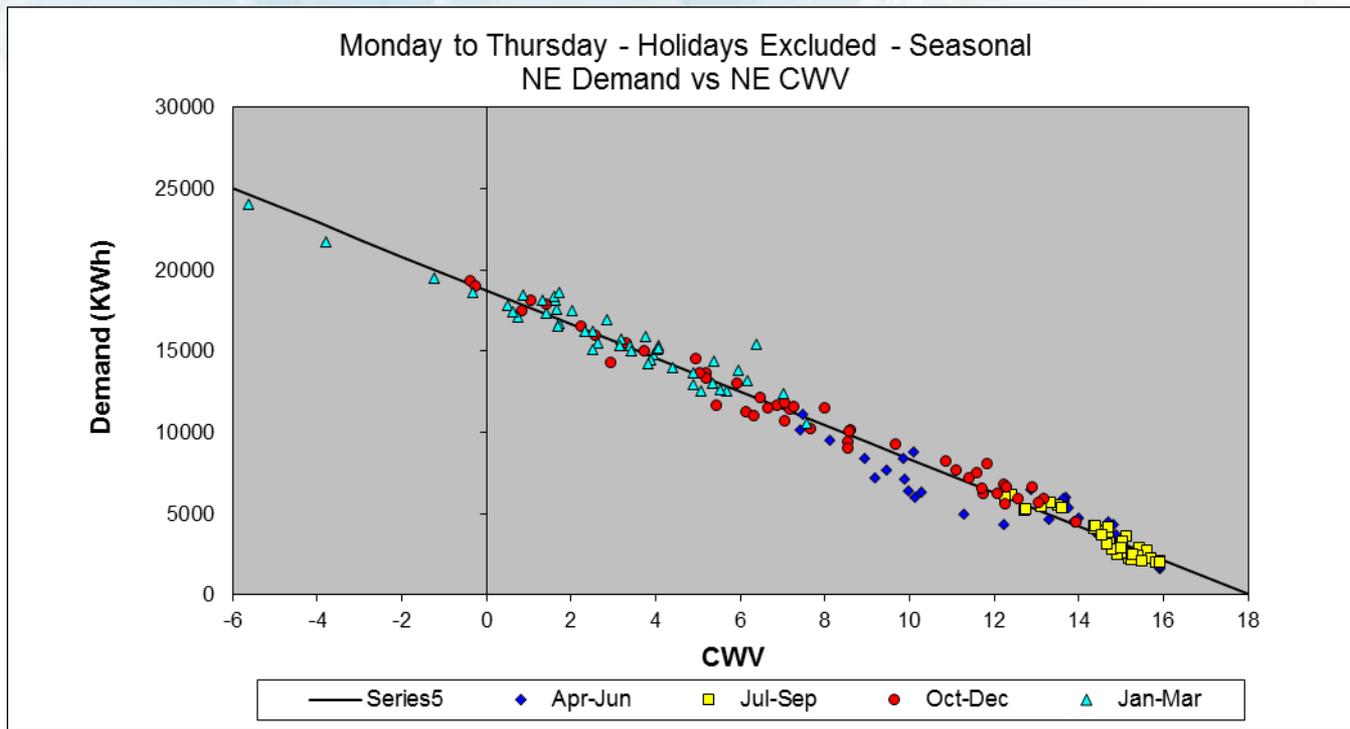
EUC Bands: Range	Comments on 2017/18 data TWG Agreed Modelling Runs
Band 1: 0 to 73.2 MWh pa Domestics Only	Individual LDZ analysis (NW/WN combined)
Band 1: 0 to 73.2 MWh pa Non Domestic	Individual LDZ analysis (NW/WN combined)
Band 1: 0 to 73.2 MWh pa PrePayment	Individual LDZ analysis (NW/WN combined)
Band 2: 73.2 to 293 MWh pa Domestics Only	National Aggregation: (All 13 LDZs) <u>or</u> 2 LDZ groups: (SC/NO/NW/WN/NE/EM/WM, EA/NT/SE/WS/SO/SW)
Band 2: 73.2 to 293 MWh pa Non Domestic	Individual LDZ analysis (NW/WN combined)
Band 3: 293 to 732 MWh pa	Individual LDZ analysis (NW/WN combined)
Band 4: 732 to 2,196 MWh pa	Individual LDZ analysis (NW/WN combined)

# Small NDM Modelling Results: EUC Band 1 – Domestic Sites Only

0 to 73.2 MWh pa Domestic Sites	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	35%	99%	151
NO	36%	98%	150
NW / WN	33%	98%	170
NE	35%	98%	175
EM	34%	98%	163
WM	32%	99%	176
WS	32%	98%	155
EA	33%	99%	204
NT	31%	99%	170
SE	30%	99%	177
SO	29%	99%	191
SW	31%	99%	186

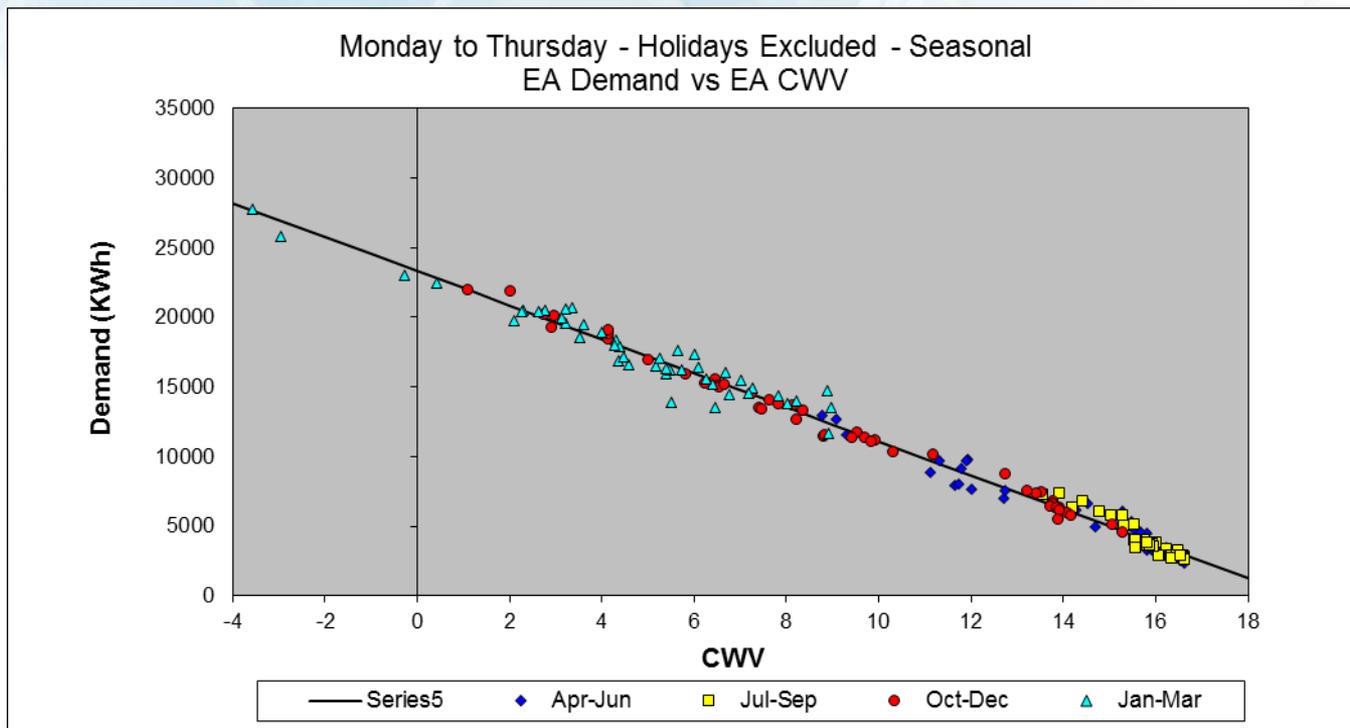
- ILFs generally in line with last year
- R<sup>2</sup> on average slightly higher (98.52%) than last year. Highlighted rows indicate the best and worst R<sup>2</sup> values.
- Sample sizes have reduced for all LDZs in comparison to 16/17. All LDZs have less than the suggested sample size which are needed to represent the population with 95% confidence (as presented at the Feb '18 DESC meeting).

# Small NDM Modelling Results: NE LDZ, EUC Band 1 Domestic



- NE has the lowest  $R^2$  values of models in this band – 98.00% (all days)
- Updated post meeting

# Small NDM Modelling Results: EA LDZ, EUC Band 1 Domestic



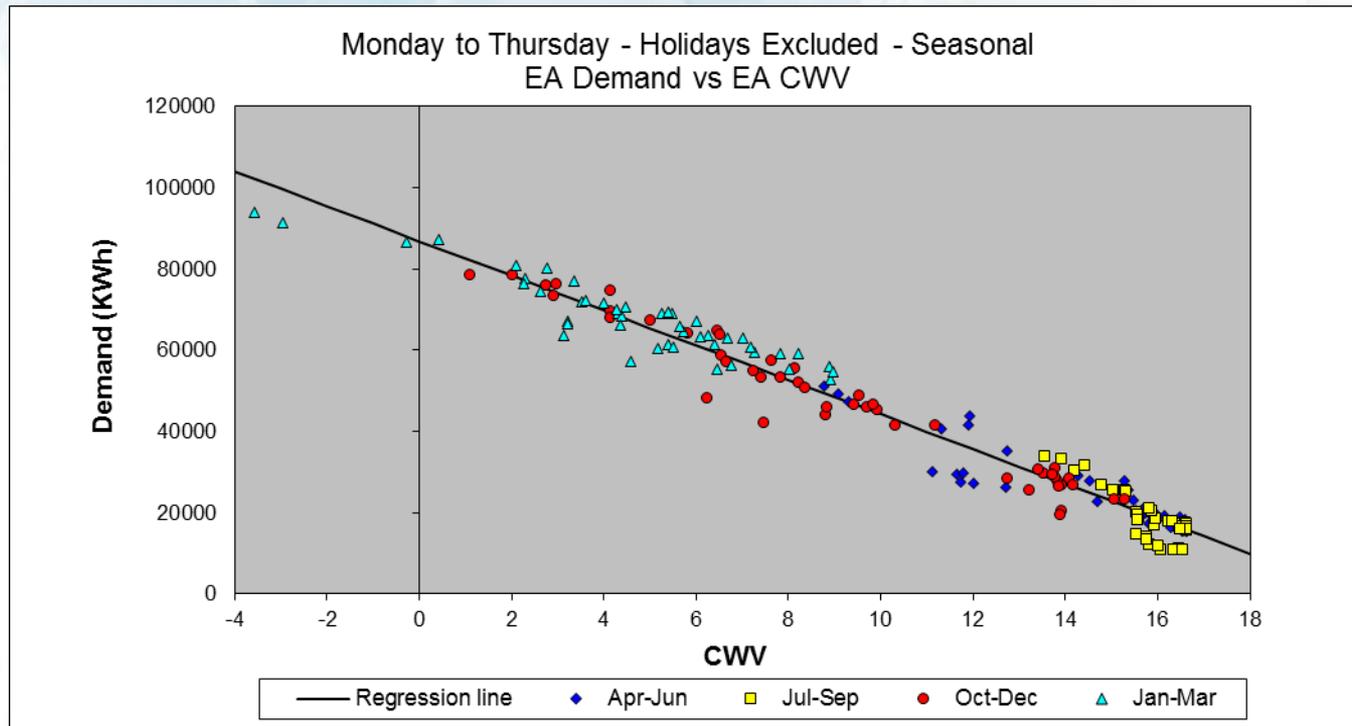
- EA has one of the highest  $R^2$  of the models in this band (all days) 98.80%
- Updated post meeting

# Small NDM Modelling Results: EUC Band 1 – All Non Domestic Sites

0 to 73.2 MWh pa Non-Domestic Sites	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	34%	97%	496
NO	36%	97%	113
NW / WN	34%	98%	256
NE	33%	98%	160
EM	32%	97%	214
WM	31%	98%	244
WS	33%	97%	95
EA	32%	96%	328
NT	36%	98%	254
SE	32%	98%	255
SO	31%	98%	210
SW	32%	97%	158

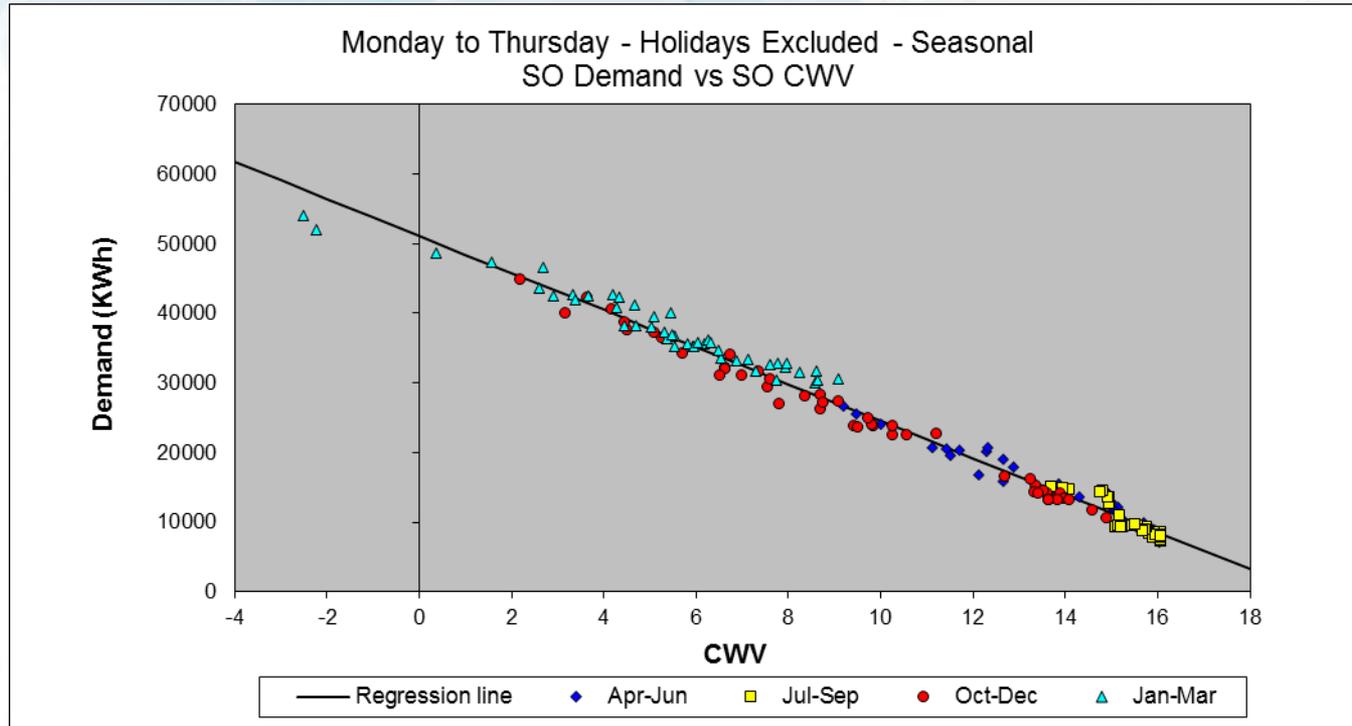
- All LDZs (except for SC) have less than the suggested sample size.
- The average R<sup>2</sup> is 97.40%.
- There is no comparable model as this is the first time EUC Band 1 Non Domestic sites have been modelled on their own.

# Small NDM Modelling Results: EA LDZ, EUC Band 1 Non Domestic



- EA has the lowest  $R^2$  values of models in this band (all days) 96.40%
- Updated post meeting

# Small NDM Modelling Results: SO LDZ, EUC Band 1 Non Domestic



- SO has the highest  $R^2$  of the models in this band (all days) 98.30%
- Updated post meeting

# Weekend Effects

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- With the introduction of new EUC models, observing  $R^2$  values and ILFs may not be enough on its own to confirm a difference in the underlying behaviour.
- Interrogating the weekend effects is a good way to examine if the new EUCs are displaying an increase or decrease in demand where expected, and not just observing the strength of Demand/CWV relationship.
- Band 1 Domestic – we would expect to see an overall increase in demand on the weekends.
- Band 1 Non Domestic – we would expect to see a decrease in demand on the weekends.
- Band 2 Domestic – we would expect to see a similar trend as a Band 1 Domestic profile (an overall increase in demand on weekends).
- Band 2 Non Domestic – we would expect to see a similar trend as a Band 1 Non Domestic profile (decrease in demand on weekends).
- The following slides show the results from the modelling runs on the new EUCs.

# Analysis of weekend effects – Band 1

LDZ	01 Domestic			01 Non Domestic		
	Fri	Sat	Sun	Fri	Sat	Sun
SC	not sig. +	not sig. +	not sig. +	0.958	0.720	0.697
NO	not sig. +	not sig. +	not sig. +	not sig. -	0.795	0.709
NW	not sig. +	1.05	not sig. +	not sig. -	0.877	0.803
NE	not sig. +	not sig. +	not sig. +	0.966	0.818	0.776
EM	not sig. +	not sig. +	not sig. +	0.959	0.748	0.692
WM	not sig. +	1.046	not sig. +	0.962	0.802	0.754
WN	not sig. +	1.05	not sig. +	not sig. -	0.877	0.803
WS	not sig. +	not sig. +	not sig. +	not sig. -	0.873	0.770
EA	not sig. +	1.041	1.028	not sig. -	0.690	0.672
NT	not sig. +	1.038	not sig. +	not sig. +	0.824	0.785
SE	1.029	1.057	1.038	not sig. -	0.848	0.822
SO	not sig. +	1.041	1.025	not sig. +	0.878	0.819
SW	not sig. +	1.049	1.037	not sig. -	0.854	0.825

The difference that we are seeing between the domestic and non domestic profiles are as expected.

Overall, Band 1 domestic customers display a slight increase in demand (values greater than 1) on weekends when compared to a Mon-Thu model. In some cases this difference is not statistically significantly different to a Mon-Thu model.

Band 1 Non Domestic customers display an overall decrease in demand (values less than 1) on weekends. This ranges anywhere between 4-30% reduction.

# Pre Payment Data

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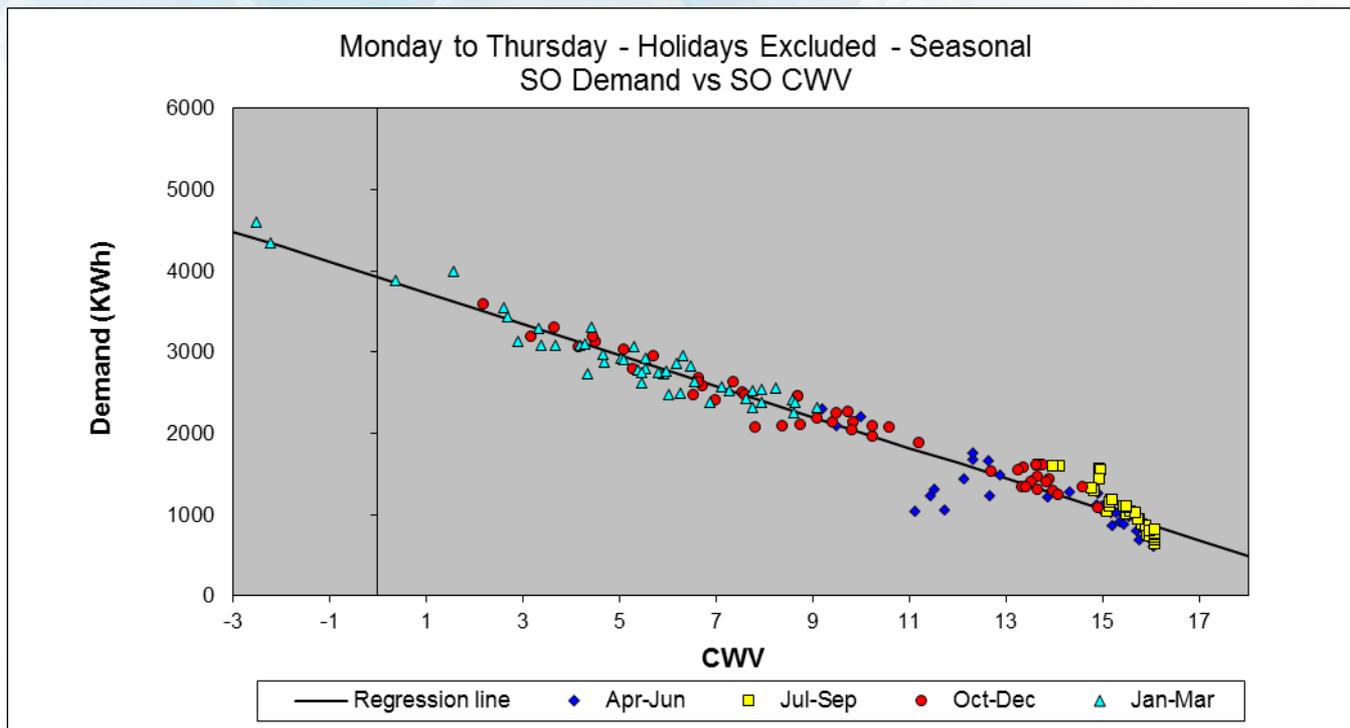
- Third party pre payment meter data was provided. This consisted of 2600 MPRs .
- The data provided was a series of periodic reads (non daily) within the date range of 01/04/2017 to 31/03/2018, with an average of 130 reads per MPR.
- After applying validation rules to the data, there were 1962 MPRs.
- The missing days were then infilled using the 01B WAALP.
- The following charts show some unusual data points (blue data points). These are where the days had to be infilled due to the absence of a read at the start of the analysis period.
- Analysis previously presented at DESC indicates pre-payment customers exhibit a 'flatter' less weather sensitive profile when compared to the standard 01B domestic customer. The observed ILF results from this years analysis appear to support this.

# Small NDM Modelling Results: EUC Band 1 – PrePayment Sites

0 to 73.2 MWh pa PrePayment Sites	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	40%	97%	112
NO	40%	98%	137
NW / WN	38%	98%	433
NE	40%	98%	126
EM	38%	98%	329
WM	37%	98%	317
WS	38%	96%	107
EA	38%	97%	110
NT	37%	97%	112
SE	37%	98%	100
SO	36%	96%	35
SW	37%	97%	44

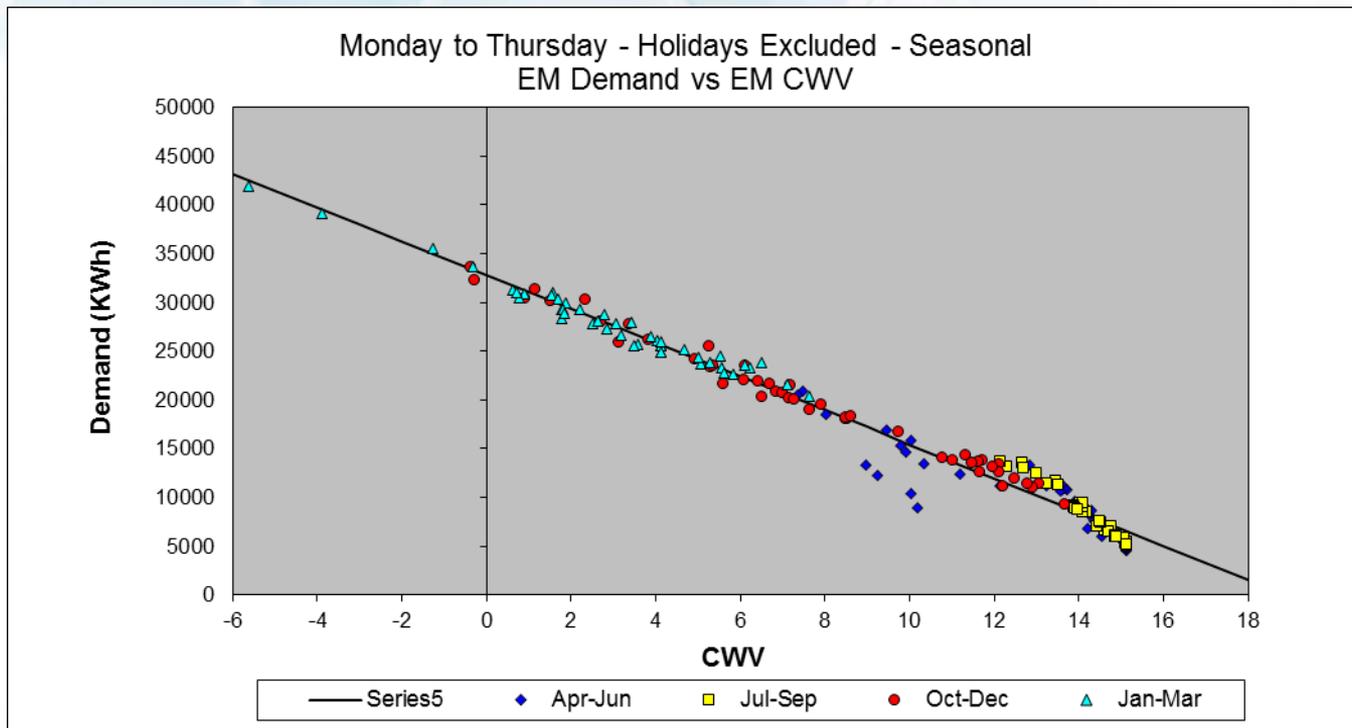
- All LDZs (except NW/WN) have less than the suggested sample size
- The average R<sup>2</sup> is 97.20%.
- There is no comparable model as this is the first time EUC Band 1 PrePayment sites have been modelled on their own.

# Small NDM Modelling Results: SO LDZ, EUC Band 1 PPM



- SO has the lowest  $R^2$  values of models in this band (all days) 96.00%
- Updated post meeting

# Small NDM Modelling Results: EM LDZ, EUC Band 1 PPM



- EM has the highest  $R^2$  of the models in this band (all days) 97.80%
- Updated post meeting

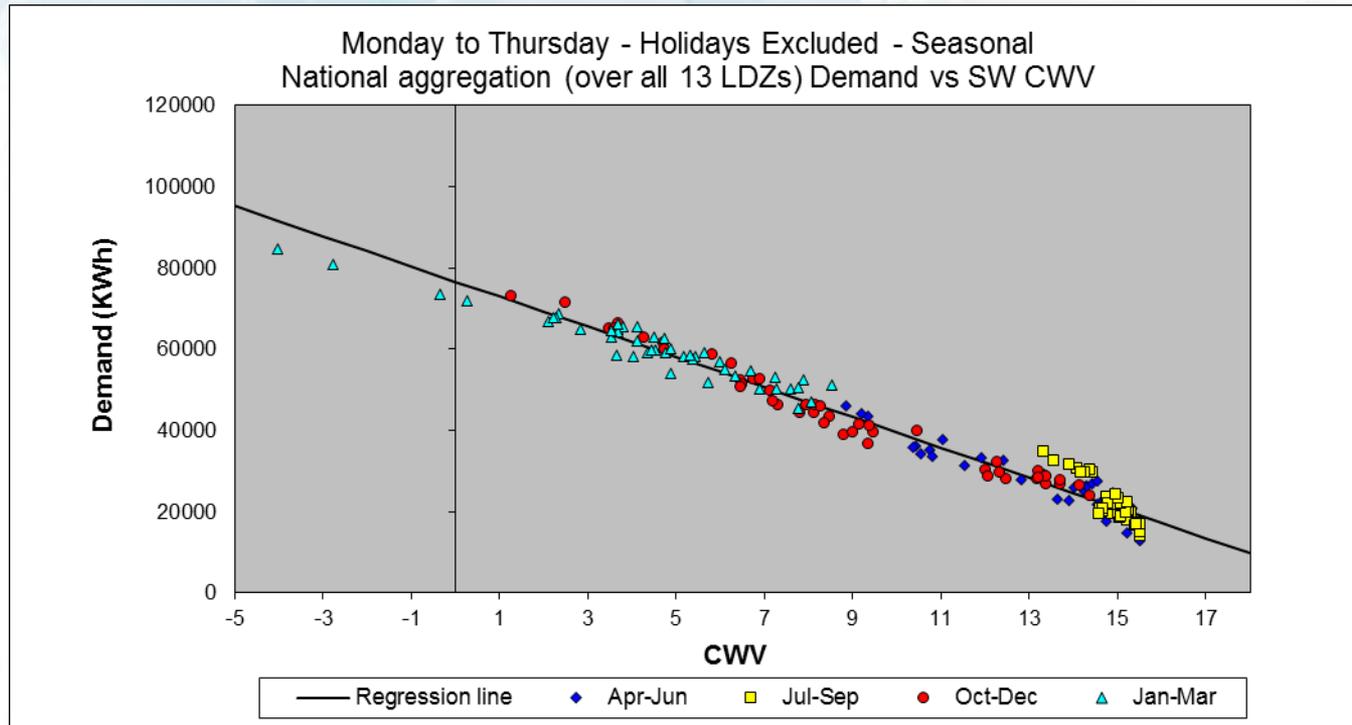
# Small NDM Modelling Results: EUC Band 2 – Domestic Sites Only

Run 1: All LDZ's				Run 2: 2 LDZ Groups			
National	38%	98%	133	(SC/NO/NW/WN/NE/WM/EM)	40%	98%	67
				(WS/EA/NT/SE/SO/SW)	36%	98%	66

**Indicative Load Factor (ILF)** : **R<sup>2</sup> Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

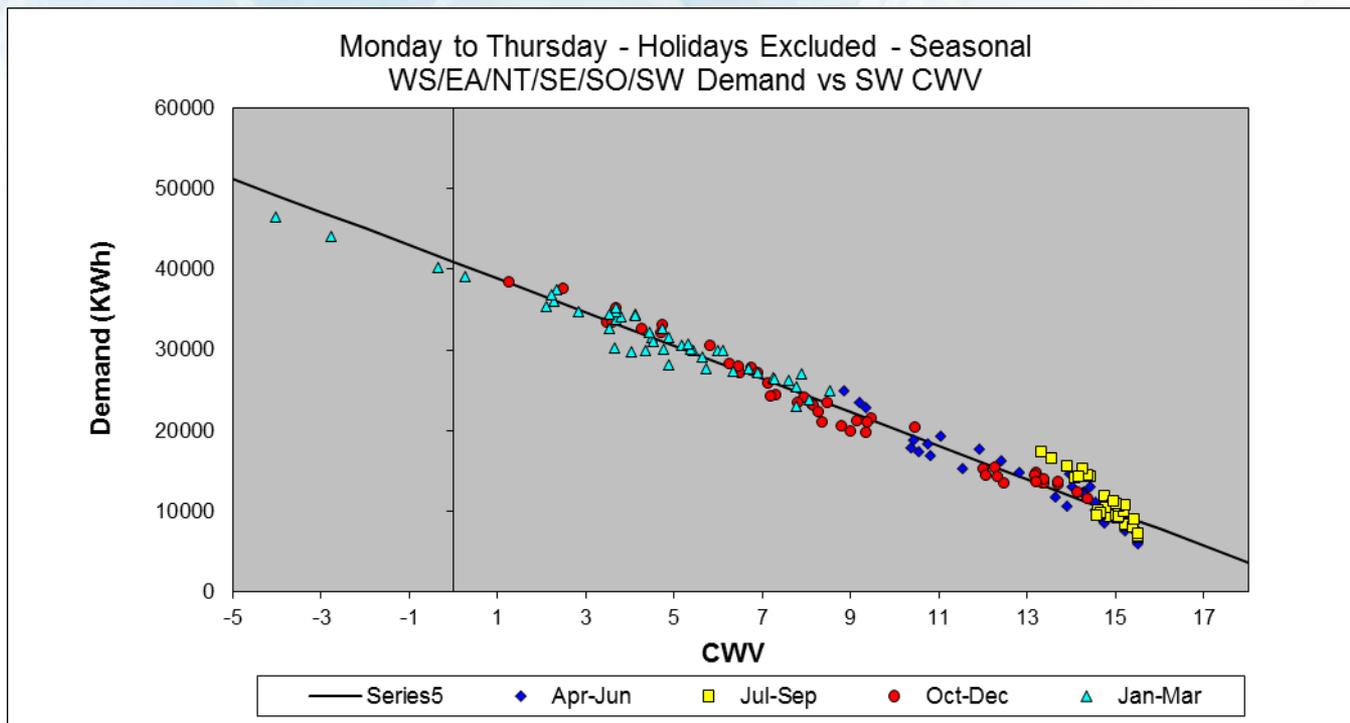
- A decision to be made by TWG between the All LDZ aggregation or the 2 LDZ groups.
- There is no comparable model as this is the first time EUC Band 2 Domestic sites have been modelled on their own.
- Sample sizes for both options are below the suggested size.
- *(Note – there is a difference in sample size numbers reported in the April TWG meeting due to an error in the spreadsheet).*

# Small NDM Modelling Results: EUC Band 2 Domestic All LDZs (Run 1)



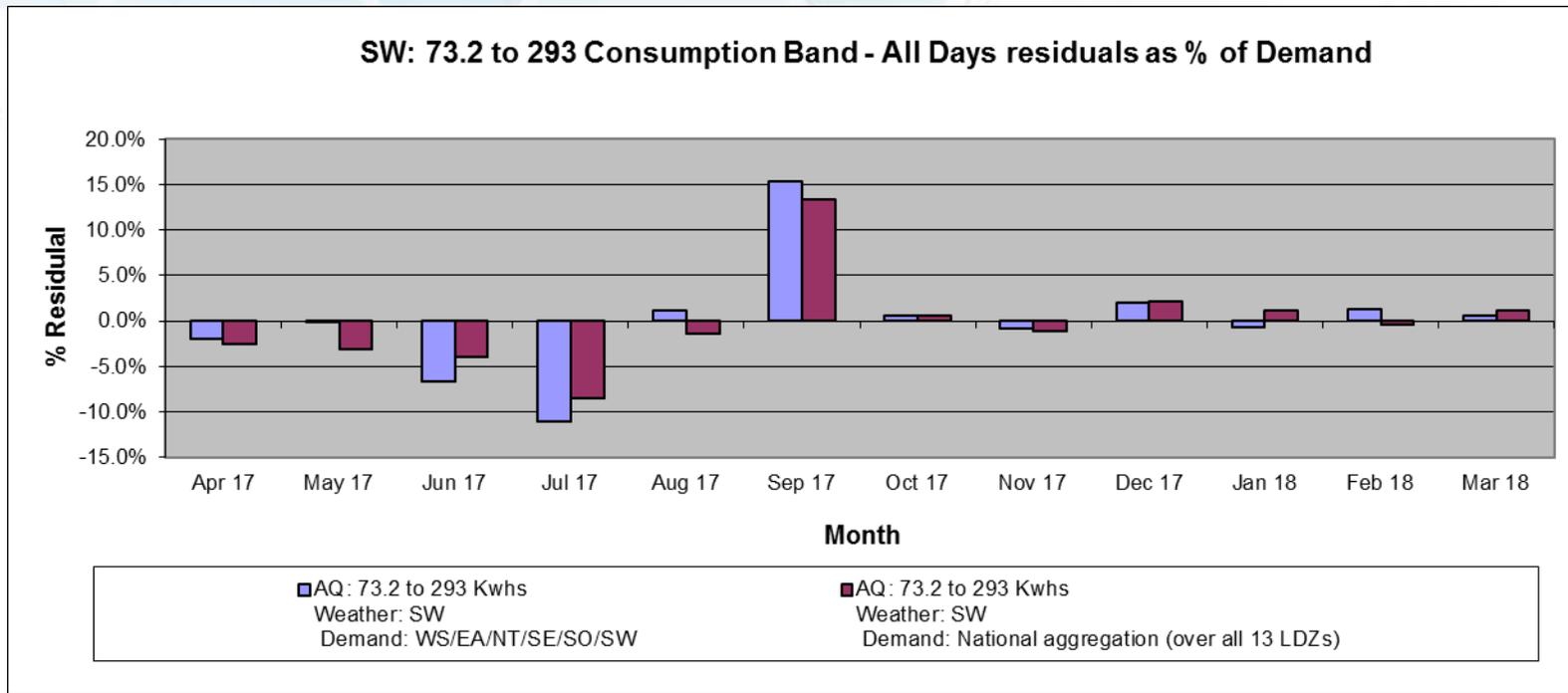
- Overall  $R^2$  of 98.36%
- SW is the LDZ with the lowest  $R^2$  of 97.20%
- Updated post meeting

# Small NDM Modelling Results: EUC Band 2 Domestic 2 Groups (Run 2)



- Overall  $R^2$  of 97.94%(SC/NO/NW/WN/NE/EM/WM) and 98.62% (WS/EA/NT/SE/SO/SW)
- SW is the LDZ with the lowest  $R^2$  of 97.70%
- Updated post meeting

# Small NDM Modelling Results: EUC Band 2 – Domestic Sites Only



- Comparison of monthly residuals (all days) for the specific SW for the two models tested. (SW was selected as it had the lowest  $R^2$  value)
- [TWG to decide on preferred model](#)

# Analysis of weekend effects – Band 2 cont...

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- Band 2 Domestic sample sites were provided by Technolog.
- Spot checks were taken internally to confirm that these sites are genuine domestic sites. It appears that the vast majority that make up the profile are domestic sites.
- The following table displays the results of the weekend effects.
- The direction of the difference that we are seeing between the domestic profiles are not what we necessarily expected.
- In the 'All LDZs' aggregation it shows that the Fri day and Saturday behaviour is not statistically different to the Mon-Thu profile. It also shows that on Sundays, an 02 Domestic customer has a decrease in demand in comparison to the Mon-Thu profile.
- In the '2 Groups' aggregation there appears to be a clear distinction between the 2 groups. In the northern LDZs it shows that the weekend effects are not statistically different to the Mon-Thu profile. In the southern LDZs it shows that on a Friday the domestic customer has an increase in demand. On a Saturday there is no statistical difference to a Mon-Thu profile and on Sundays it shows an overall decrease in demand in comparison to the Mon-Thu profile.
- Band 2 Non Domestic customers display an overall decrease in demand on weekends, which is what we would expect for a non domestic profile. This reduction ranges anywhere between 4-35%.

# Analysis of weekend effects – Band 2

LDZ	02 Domestic (All LDZs)			02 Domestic (2 Groups)			02 Non Domestic		
	Fri	Sat	Sun	Fri	Sat	Sun	Fri	Sat	Sun
SC	not sig. +	not sig. -	0.959	not sig. +	not sig. -	not sig. -	0.937	0.712	0.762
NO	not sig. +	not sig. -	0.961	not sig. -	not sig. -	not sig. -	not sig. -	0.870	0.839
NW	not sig. +	not sig. -	0.965	not sig. -	not sig. -	not sig. -	not sig. -	0.917	0.883
NE	not sig. +	0.983	0.962	not sig. -	not sig. -	not sig. -	not sig. -	0.882	0.867
EM	not sig. +	not sig. -	0.962	not sig. -	not sig. -	not sig. -	0.957	0.767	0.767
WM	not sig. +	not sig. -	0.965	not sig. -	not sig. -	not sig. -	0.971	0.794	0.788
WN	not sig. +	not sig. -	0.965	not sig. -	not sig. -	not sig. -	not sig. -	0.917	0.883
WS	not sig. +	not sig. -	0.963	not sig. +	not sig. -	0.944	not sig. -	0.953	0.880
EA	not sig. +	not sig. -	0.971	1.028	not sig. -	0.953	0.949	0.654	0.714
NT	not sig. +	not sig. -	0.972	1.028	not sig. -	0.953	not sig. -	0.858	0.856
SE	not sig. +	not sig. -	0.973	1.029	not sig. -	0.955	not sig.	0.990	0.876
SO	not sig. +	not sig. -	not sig. -	1.025	not sig. -	0.960	not sig. -	0.927	0.906
SW	not sig. +	not sig. -	0.973	not sig. +	not sig. -	0.955	not sig. -	0.880	0.848

Updated post meeting

## Small NDM Modelling Results: EUC Band 2 – Non Domestic Sites

73.2 to 293 MWh pa	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	36%	97%	904
NO	43%	98%	236
NW / WN	40%	98%	518
NE	39%	98%	293
EM	36%	97%	560
WM	35%	98%	519
WS	39%	97%	123
EA	32%	96%	657
NT	40%	98%	497
SE	37%	98%	448
SO	37%	99%	413
SW	38%	97%	382

- The majority of LDZs had more than the suggested sample size
- The average R<sup>2</sup> is 97.49%
- There is no direct comparable model as this is the first time EUC Band 2 Non Domestic sites have been modelled on their own, however it is similar to the usual band 2 model used in the past as there are only a handful of domestic sites that are usually included.

## Small NDM Modelling Results: EUC Band 3

293 to 732 MWh pa	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	35%	97%	902
NO	42%	98%	160
NW / WN	40%	97%	331
NE	41%	98%	194
EM	37%	98%	316
WM	37%	98%	273
WS	38%	97%	69
EA	35%	97%	297
NT	41%	98%	281
SE	37%	97%	348
SO	34%	98%	261
SW	37%	98%	241

- ILF range appears to have increased this year:
  - **2016/17:** 27.3% to 35.2%      **2017/18:** 34.0% to 41.7%
  - The change in ILFs may be due to the change in sample composition
- R<sup>2</sup> average has increased very slightly this year
- All LDZ sample sizes have increased this year which may be the reason for the change in ILFs.

## Small NDM Modelling Results: EUC Band 4

732 to 2,196 MWh pa	Indicative Load Factor (ILF)	R <sup>2</sup> Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	37%	98%	654
NO	38%	98%	242
NW / WN	36%	98%	298
NE	39%	97%	306
EM	37%	98%	218
WM	35%	98%	250
WS	35%	97%	88
EA	37%	98%	238
NT	37%	98%	277
SE	37%	98%	392
SO	34%	98%	300
SW	38%	97%	178

- ILFs for majority of LDZs are comparable to last year
- R<sup>2</sup> average has increased very slightly this year
- The majority of LDZs have had an increase in sample sizes.

## Section 3 part 2:

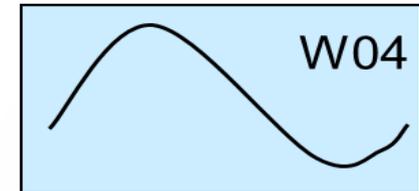
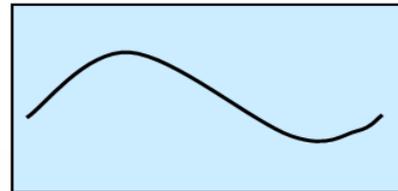
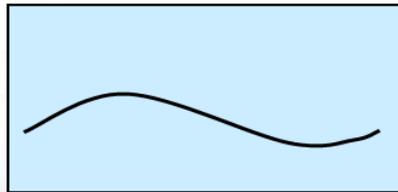
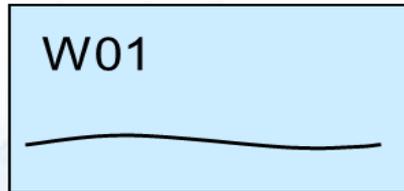
Small NDM WAR Bands: 3 to 4  
AQ Range: 293 to 2,196 MWh pa

Single Year Results for 2017/18 sample data

# Winter Annual Ratio (WAR) Bands

- Higher AQ Bands where meter points are monthly read have a consumption band EUC plus 4 differential EUCs based on ratio of winter consumption to total annual consumption. Sites with adequate read history allocated automatically to a WAR Band based on system calculation during AQ review
- WAR Band limits for Spring 2018 analysis were discussed and agreed at April TWG

Weather  
insensitive



Weather  
sensitive

# Small NDM WAR Bands: Agreed Modelling Runs

EUC Bands: Range	Comments on 2017/18 data TWG Agreed Modelling Runs
Band 1: 0 to 73.2 MWh pa	Not generally Monthly read – no WAR Bands
Band 2: 73.2 to 293 MWh pa	Not generally Monthly read – no WAR Bands
Band 3 and Band 4 (combined): 293 to 2196 MWh pa	Individual LDZ analysis (NW/WN combined)  Agreed WAR Ratios: 0.449; 0.525 and 0.627

- Modelling Runs agreed at April TWG.
- Sufficient data available to allow individual LDZ analysis except for NW/WN which are combined.

# Small NDM Modelling Results: EUC Band 3 and 4 WARs

	WAR Band: 293 to 2196 MWh pa											
	Band 1 0.00 – 0.449			Band 2 0.449 – 0.525			Band 3 0.525 – 0.627			Band 4 0.627 – 1.00		
SC	63%	94%	190	45%	98%	489	31%	97%	645	25%	97%	232
NO	64%	94%	100	46%	98%	128	33%	97%	104	25%	96%	70
NW /WN	61%	95%	148	47%	97%	194	34%	97%	164	23%	95%	123
NE	60%	96%	129	47%	97%	149	34%	96%	132	25%	95%	90
EM	60%	95%	103	45%	97%	168	34%	98%	137	24%	97%	126
WM	59%	97%	101	45%	97%	155	34%	98%	141	23%	96%	126
WS	65%	83%	35	46%	93%	56	33%	97%	30	23%	95%	36
EA	63%	92%	78	46%	95%	148	34%	97%	186	24%	96%	123
NT	68%	88%	147	45%	97%	162	34%	97%	137	24%	97%	112
SE	64%	90%	165	45%	96%	230	33%	98%	179	24%	97%	166
SO	63%	92%	114	42%	97%	143	32%	97%	177	22%	96%	127
SW	66%	90%	110	44%	95%	121	34%	96%	88	23%	96%	100

**Indicative Load Factor (ILF) : R<sup>2</sup> Multiple Correlation Coefficient (All days) : Sample Size (Supply Points)**

- ILFs show clear distinction across WAR bands for all LDZs
- No TWG decision required for these EUC Bands
- Last year WS/SW were combined.
- Majority of all LDZs across all WAR bands have seen an increase in the R<sup>2</sup> this year.

# Small NDM Modelling Results: Summary

- Good  $R^2$  Coefficients for majority of Consumption Band and WAR Band models
- Decrease in sample numbers available for modelling for EUC Band 1 Domestic sites. All of the LDZs have less than the suggested number of sample sites, however, the results indicate that we have been able to produce robust models this year by individual LDZ.
- For EUC Bands 2 to 4 there has been an overall increase in sample numbers. We have been able to continue with individual LDZs, providing good robust models for both Consumption Bands and WAR Band EUCs
- Have TWG made a decision on EUC Band 2 Domestic sites:
  - All LDZs aggregated or 2 Groups?
- Are TWG happy to move to model smoothing phase with the Small NDM modelling results presented today ?