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

15th May 2018

Section 4:

Large NDM Sector Modelling Results

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Large NDM Sector: (>2,196 MWh pa)

- Large NDM for Demand Estimation purposes >2,196 MWh

- EUC consumption ranges not prescribed in Uniform Network Code, however there are no proposed changes to EUC definitions for Gas Year 2018/19

- Current EUC Bands / Consumption Ranges for Large NDM:
    - Consumption Band 5: 2,196 to 5,860 MWh pa
    - Consumption Band 6: 5,860 to 14,650 MWh pa
    - Consumption Band 7: 14,650 to 29,300 MWh pa
    - Consumption Band 8: 29,300 to 58,600 MWh pa

        All above also include 4 x Winter Annual Ratio (WAR) Bands alongside the Consumption Band EUC
    - Consumption Band 9: >58,600 MWh pa

- Large NDM is very much a minority component of overall NDM (11% of total AQ)

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Section 4 part 1:

Large NDM Consumption Bands: 5 to 9
AQ Range: >2,196 MWh pa

Single Year Results for 2017/18 sample data

Large NDM Consumption Bands: Agreed Modelling Runs

EUC Bands: Range	Comments on 2017/18 data TWG Agreed Aggregations
Band 5: 2,196 to 5,860 MWh pa	Individual LDZ analysis (NW/WN combined)
Band 6: 5,860 to 14,650 MWh pa	Individual LDZ analysis (NW/WN combined) **AND** Individual LDZ analysis (NW/WN and WS/SW combined)
Band 7 and Band 8 (combined): 14,650 to 58,600 MWh pa	Individual LDZ analysis (NW/WN combined) **AND** Individual LDZ analysis (NW/WN,WS/SW and SE/SO combined)
Band 9: >58,600 MWh pa	National

- Modelling Runs agreed at April TWG
- Decisions to be made on models for Consumption Band 6, and Bands 7 and 8

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Large NDM Modelling Results: EUC Band 5

2,196 to 5,860 MWh pa	Indicative Load Factor (ILF)	R^2 Multiple Correlation Coefficient (All days)	Sample Size (Supply Points)
SC	43%	98%	247
NO	41%	98%	110
NW / WN	43%	98%	147
NE	44%	98%	148
EM	39%	98%	111
WM	38%	98%	134
WS	41%	96%	32
EA	40%	97%	83
NT	42%	98%	131
SE	42%	98%	157
SO	38%	98%	112
SW	44%	95%	64

- Good results overall for individual LDZs with R^2 values in the range 95%-98%
- Note: WS small sample size of 32 but produces model with R^2 of 96%

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Large NDM Modelling Results: EUC Band 6

5,860 to 14,650 MWh pa	Run1: Individual LDZ (NW/WN Combined)			Run 2: Individual LDZ (NW/WN and WS/SW Combined)		
SC	50%	97%	95	50%	97%	95
NO	50%	95%	50	50%	95%	50
NW / WN	49%	98%	71	49%	98%	71
NE	57%	96%	67	57%	96%	67
EM	53%	97%	72	53%	97%	72
WM	47%	97%	56	47%	97%	56
EA	52%	97%	42	52%	97%	42
NT	49%	98%	52	49%	98%	52
SE	46%	97%	40	46%	97%	40
SO	44%	97%	45	44%	97%	45
WS	45%	95%	21	45%	97%	62
SW	45%	96%	41			

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**
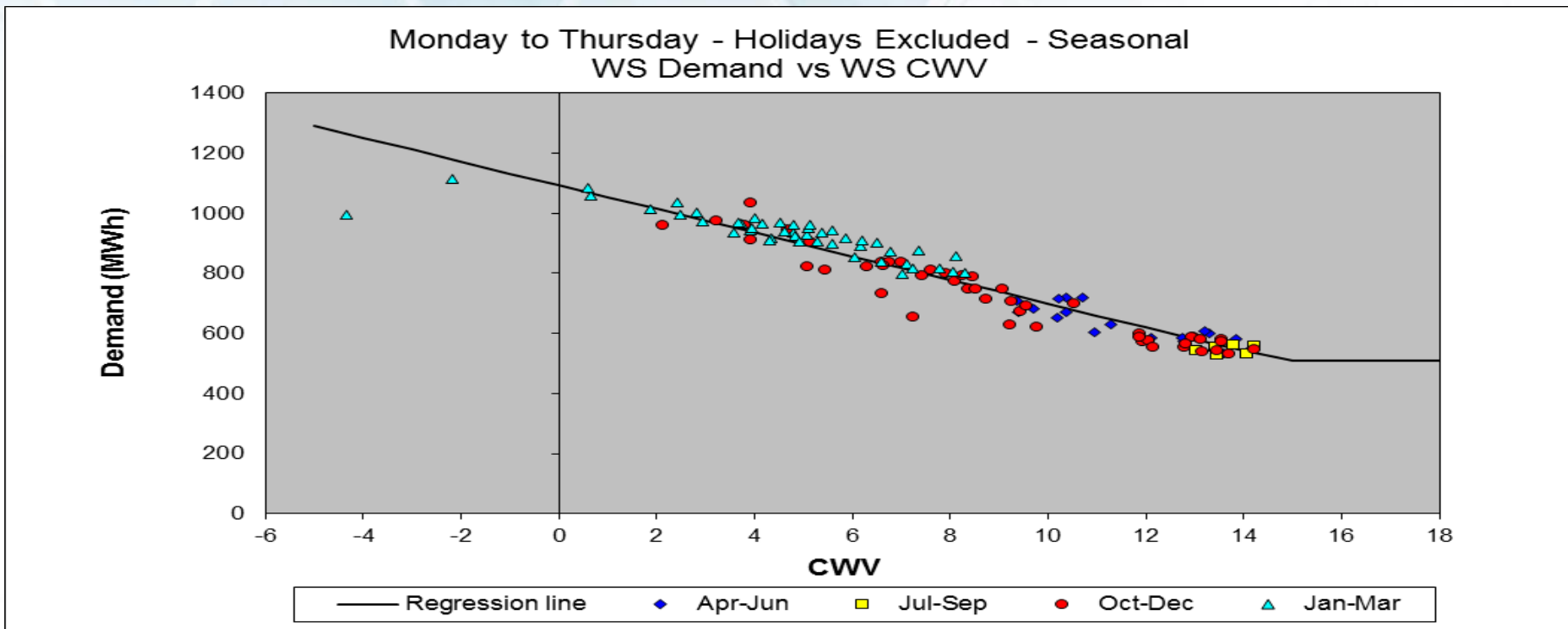
- Results above for both modelling runs including for combined WS/SW
- Good results overall for individual LDZs. Highlighted results for WS and SW models are shown in more detail on subsequent slides

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TWG Decision

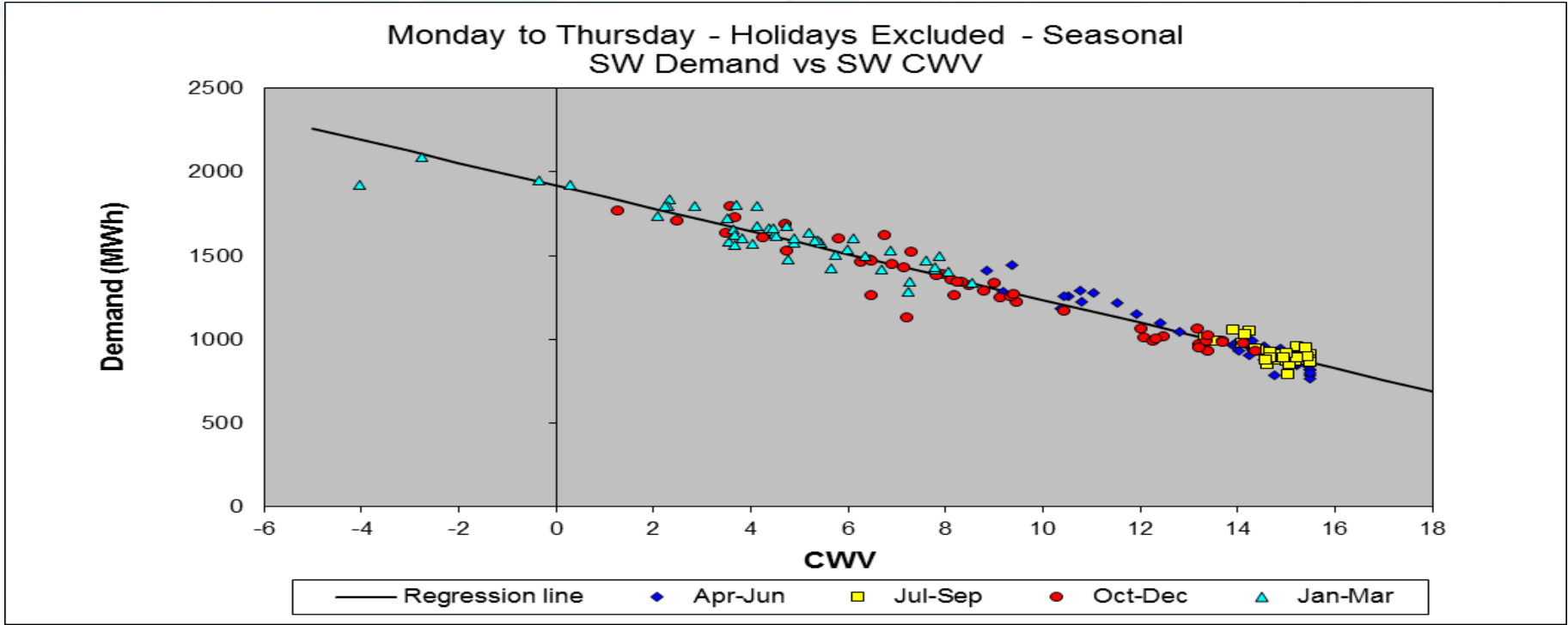Large NDM Consumption Band 6
AQ Range: 5,860 to 14,650 MWh

Run 1: Individual LDZ (NW/WN combined)

WS LDZ, EUC Band 6: 5,860 – 14,650 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
WS Demand vs WS CWV

Run		ILF	R² (All days)	Sample
WS		45%	95%	21
WS / SW		45%	97%	62

SW LDZ, EUC Band 6: 5,860 – 14,650 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SW Demand vs SW CWV

Run	ILF	R² (All days)	Sample
SW	45%	96%	41
WS / SW	45%	97%	62

TWG Decision

Large NDM Consumption Band 6
AQ Range: 5,860 to 14,650 MWh

Run 2: Individual LDZ (NW/WN and WS/SW combined)
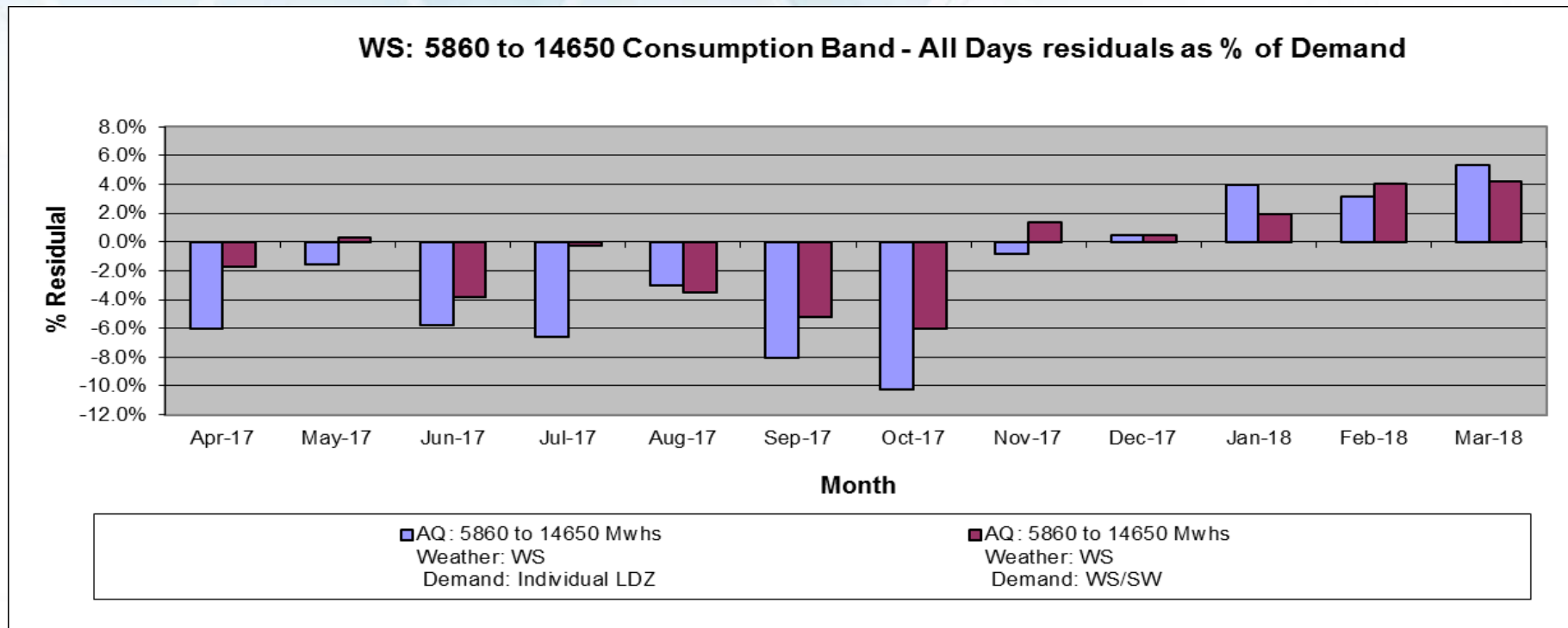
WS LDZ, EUC Band 6: 5,860 – 14,650 MWh pa
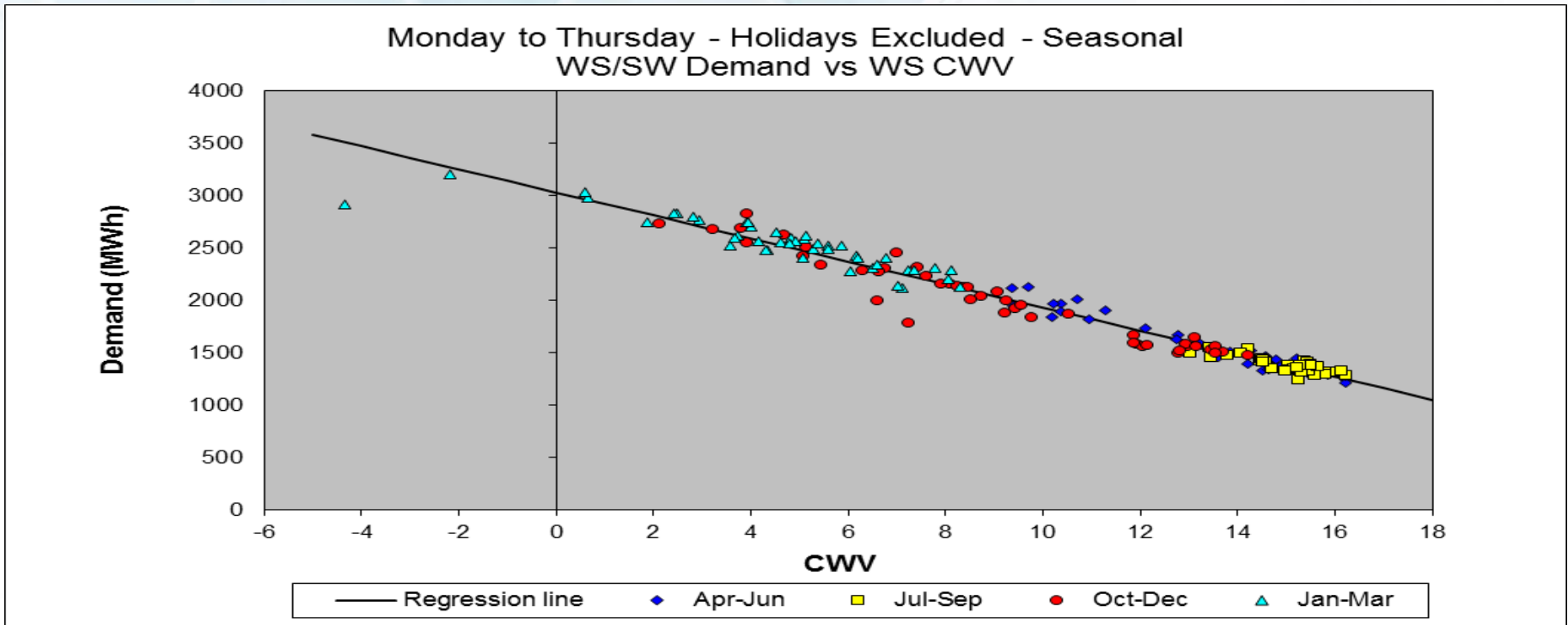
Monday to Thursday - Holidays Excluded - Seasonal WS/SW Demand vs WS CWV

Run	ILF	R² (All days)	Sample
WS	45%	95%	21
WS / SW	45%	97%	62

SW LDZ, EUC Band 6: 5,860 – 14,650 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
WS/SW Demand vs SW CWV
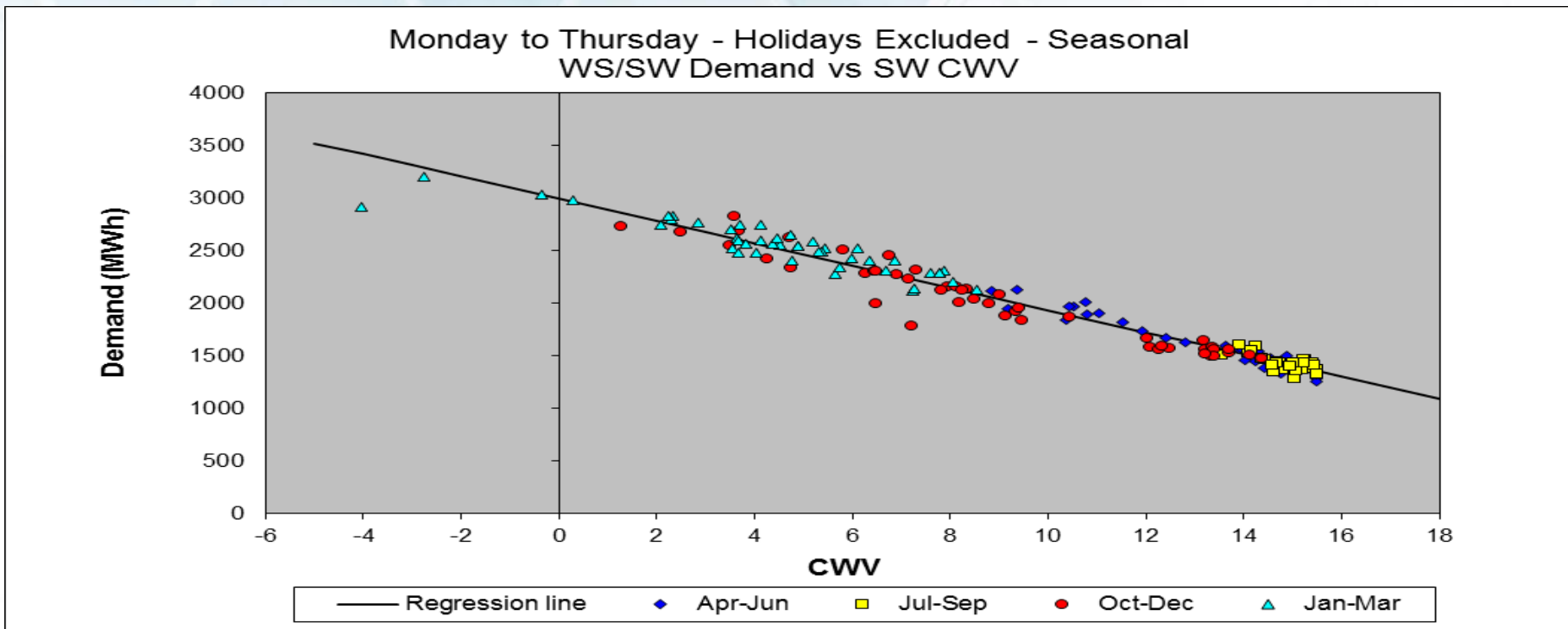
Run	ILF	R² (All days)	Sample
SW	45%	96%	41
WS / SW	45%	97%	62

WS LDZ, EUC Band 6: 5,860 – 14,650 MWh pa

WS: 5860 to 14650 Consumption Band - All Days residuals as % of Demand

- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Aggregation mostly reduces residuals (benefit from characteristics of LDZ SW)
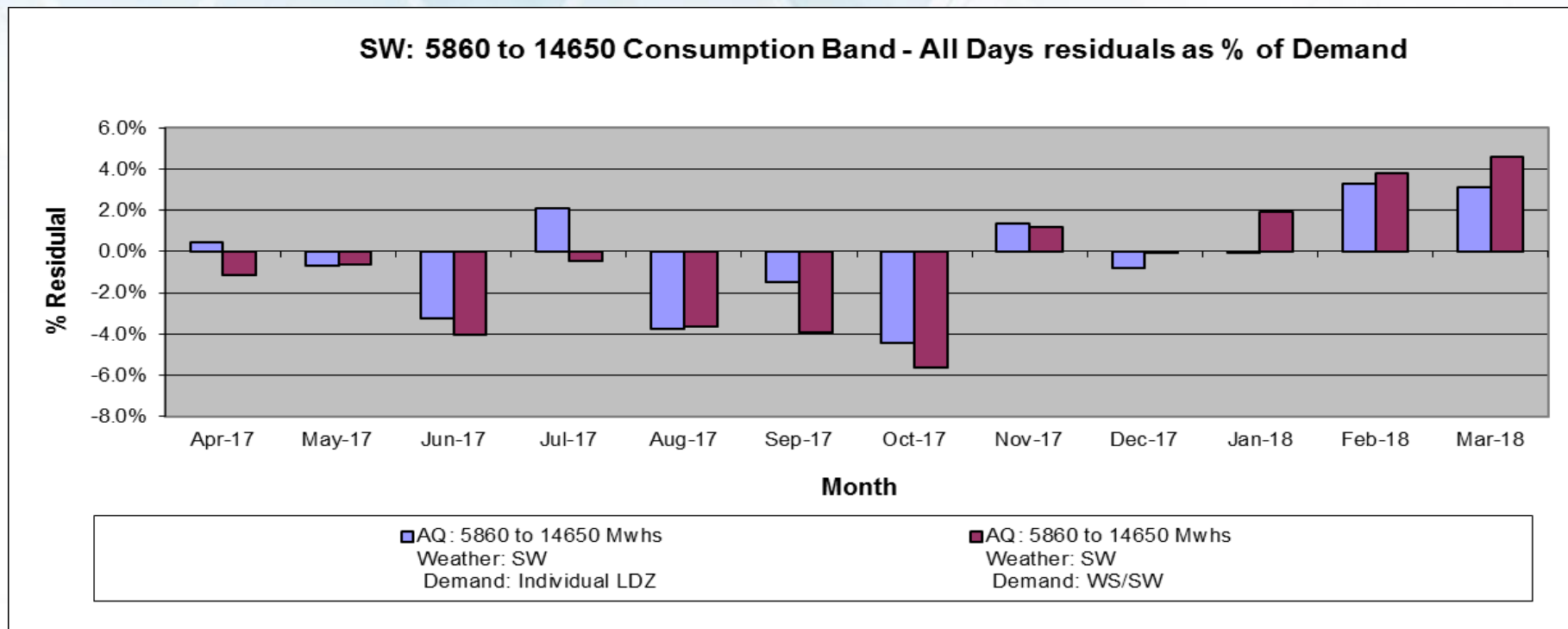
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SW LDZ, EUC Band 6: 5,860 – 14,650 MWh pa

SW: 5860 to 14650 Consumption Band - All Days residuals as % of Demand

- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Residuals not as good following aggregation due to poorer characteristics of LDZ WS
- **TWG to decide on preferred model**

Large NDM Modelling Results: EUC Band 7 and 8

14,650 to 58,600 MWh pa	Run1: Individual LDZ (NW/WN Combined)			Run 2: Individual LDZ (NW/WN, WS/SW and SE/SO Combined)		
SC	62%	86%	42	62%	86%	42
NO	63%	93%	36	63%	93%	36
NW / WN	65%	94%	70	65%	94%	70
NE	69%	92%	64	69%	92%	64
EM	61%	94%	71	61%	94%	71
WM	59%	92%	61	59%	92%	61
EA	64%	86%	30	64%	86%	30
NT	49%	95%	27	49%	95%	27
SE	52%	88%	19	51%	95%	36
SO	50%	93%	17			
WS	55%	81%	19	59%	89%	51
SW	61%	82%	32			

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**
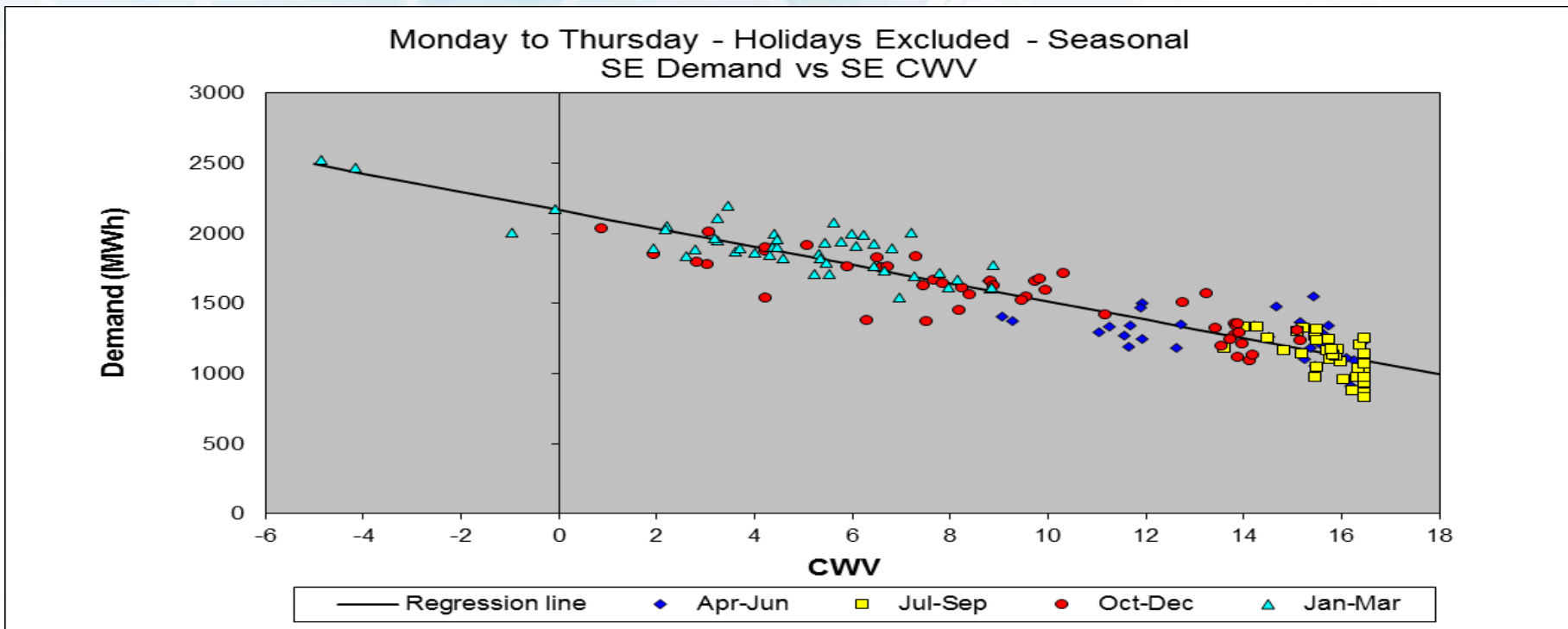
- Good results overall for majority of individual LDZs.
- Highlighted results for SE / SO and WS / SW models are shown in more detail on subsequent slides

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TWG Decision

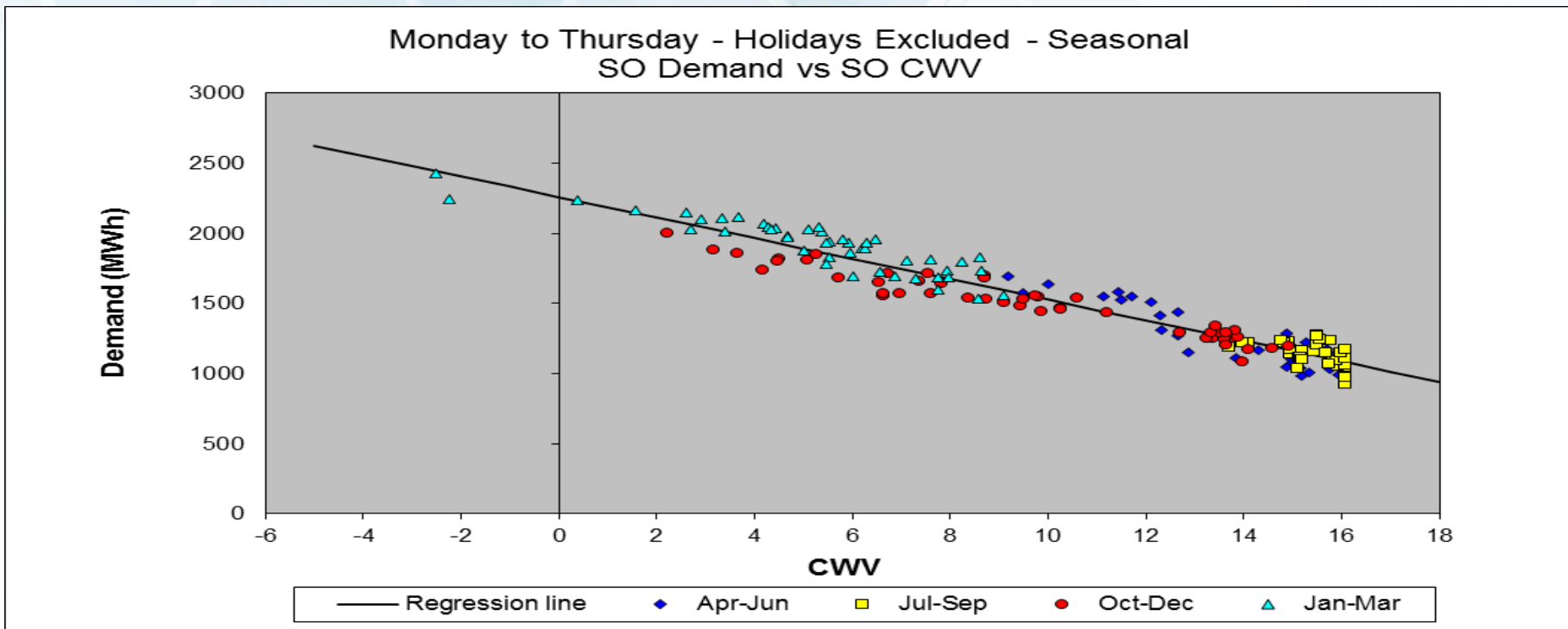Large NDM Consumption Band 7 and 8
AQ Range: 14,650 to 58,600MWh

Run 1: Individual LDZ (NW/WN combined)
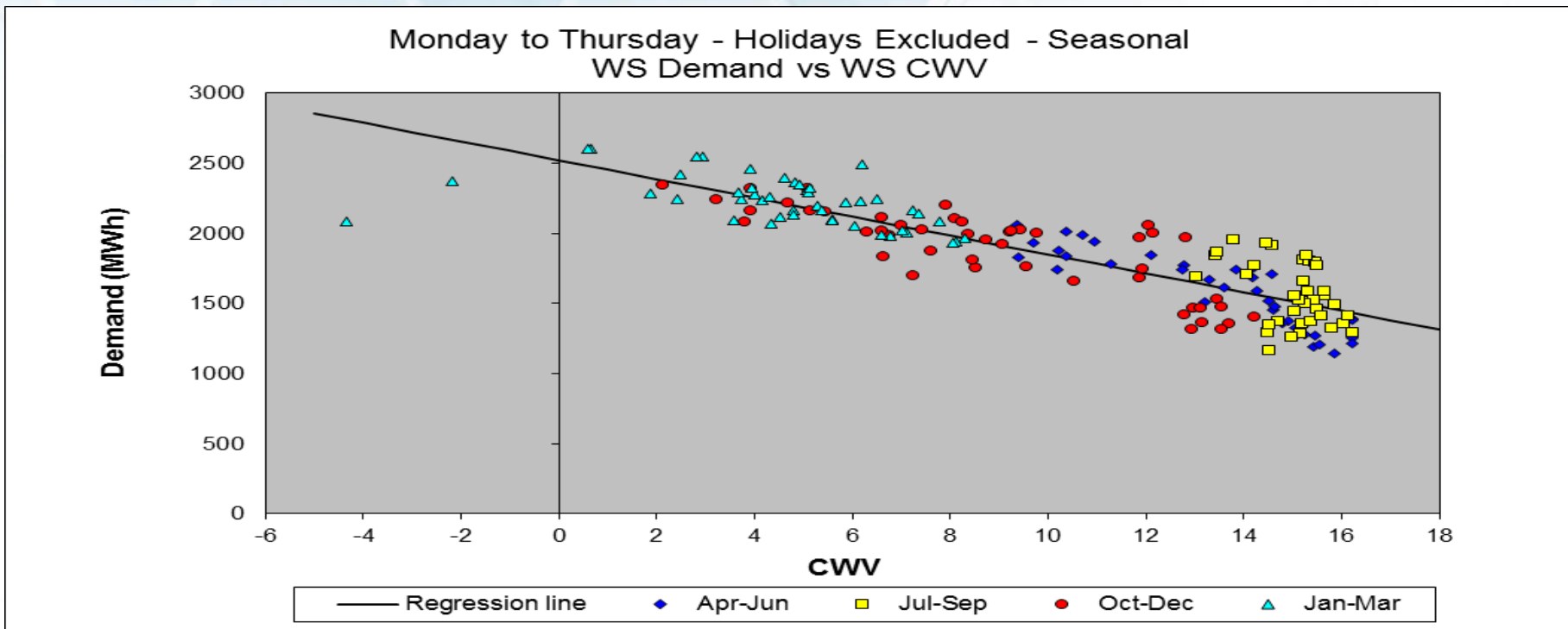
SE LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SE Demand vs SE CWV

Run	ILF	R² (All days)	Sample
SE	52%	88%	19
SE / SO	51%	95%	36

SO LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SO Demand vs SO CWV

Run	ILF	R² (All days)	Sample
SO	50%	93%	17
SE / SO	51%	95%	36

WS LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
WS Demand vs WS CWV

Run	ILF	R² (All days)	Sample
WS	55%	81%	19
WS / SW	59%	89%	51

SW LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SW Demand vs SW CWV

Run	ILF	R² (All days)	Sample
SW	61%	82%	32
WS / SW	59%	89%	51

TWG Decision

Large NDM Consumption Band 7 and 8
AQ Range: 14,650 to 58,600MWh

Run 2: Individual LDZ (NW/WN, WS/SW and SE/SO combined)
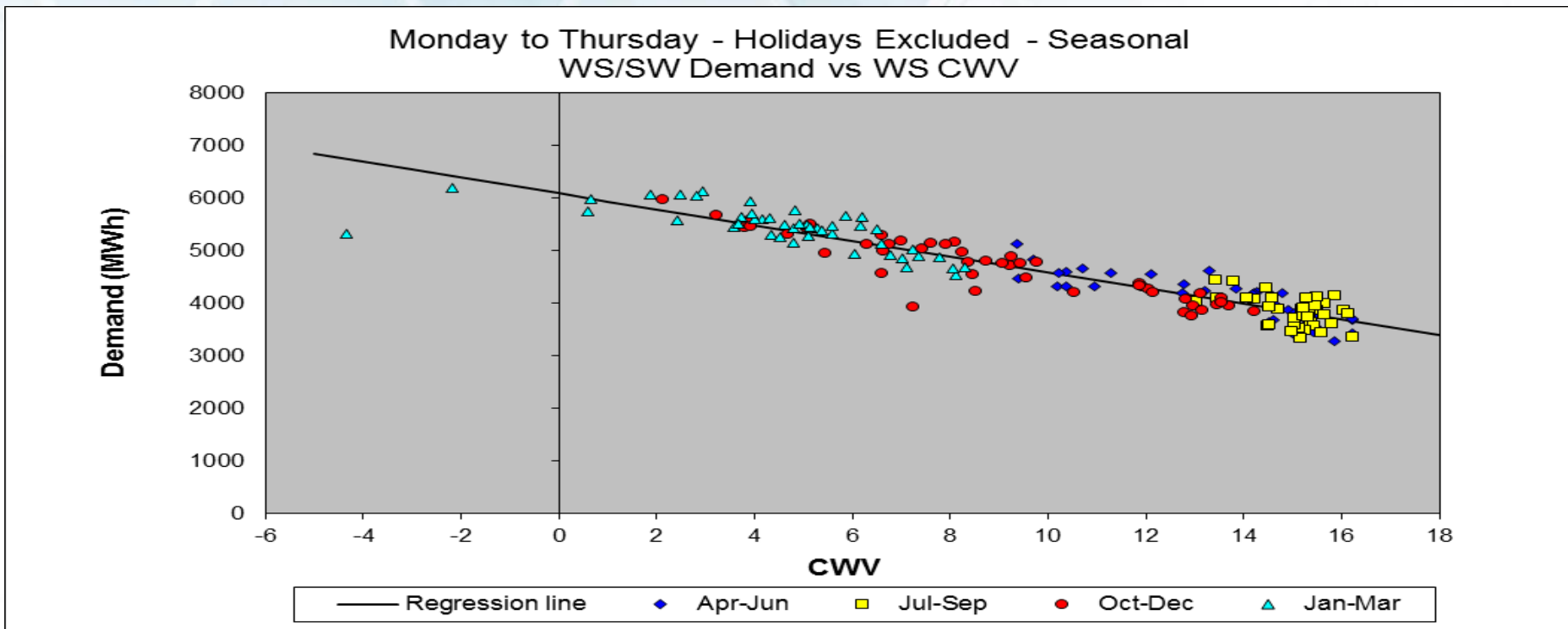
SE LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SE / SO Demand vs SE CWV

Run	ILF	R² (All days)	Sample
SE	52%	88%	19
SE / SO	51%	95%	36

SO LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SE / SO Demand vs SO CWV

Run	ILF	R² (All days)	Sample
SO	50%	93%	17
SE / SO	51%	95%	36

WS LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal WS/SW Demand vs WS CWV

Run	ILF	R² (All days)	Sample
WS	55%	81%	19
WS / SW	59%	89%	51

SW LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal WS/SW Demand vs SW CWV

Run	ILF	R² (All days)	Sample
SW	61%	82%	32
WS / SW	59%	89%	51

SE LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

SE: 14650 to 29300 Consumption Band - All Days residuals as % of Demand
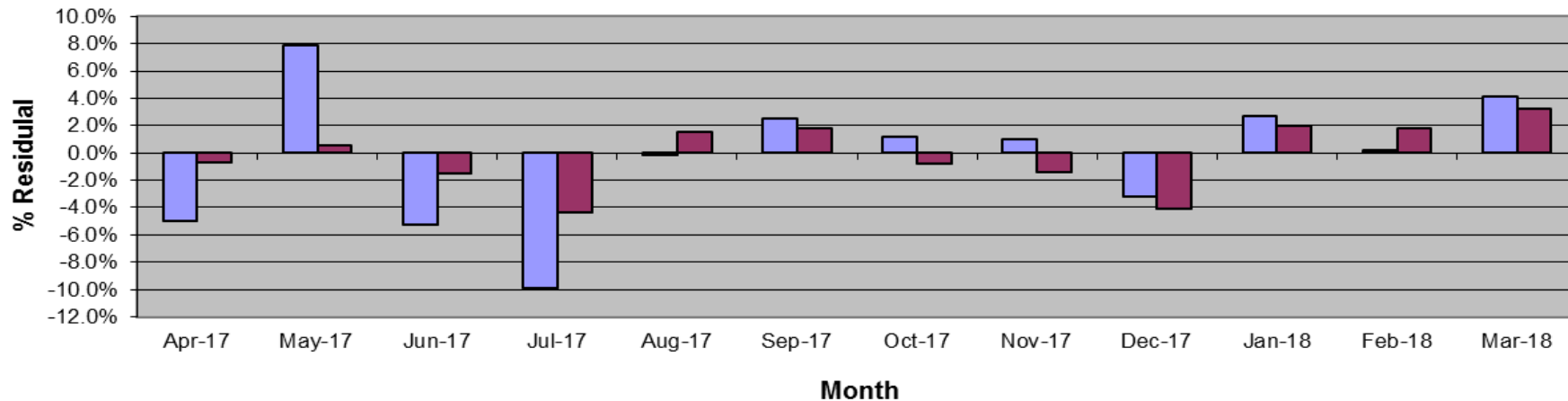
- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Residuals mostly improve following aggregation with LDZ SO

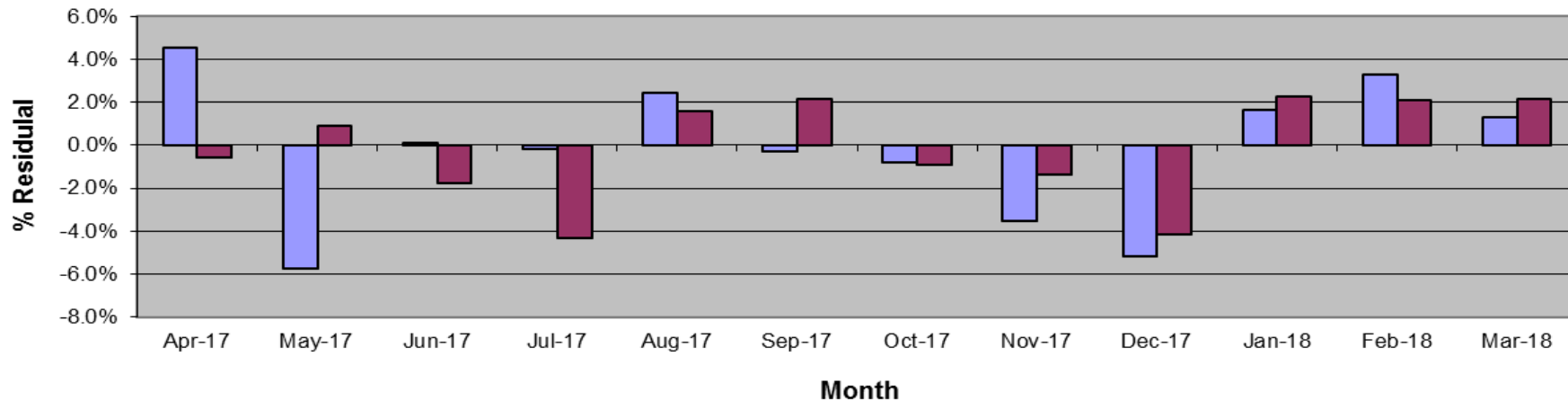# SO LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

SO: 14650 to 29300 Consumption Band - All Days residuals as % of Demand

- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Residuals improve for some months but noticeably worse June, July and September

WS LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

WS: 14650 to 29300 Consumption Band - All Days residuals as % of Demand

- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Residuals mostly better following aggregation due to poorer characteristics of LDZ WS
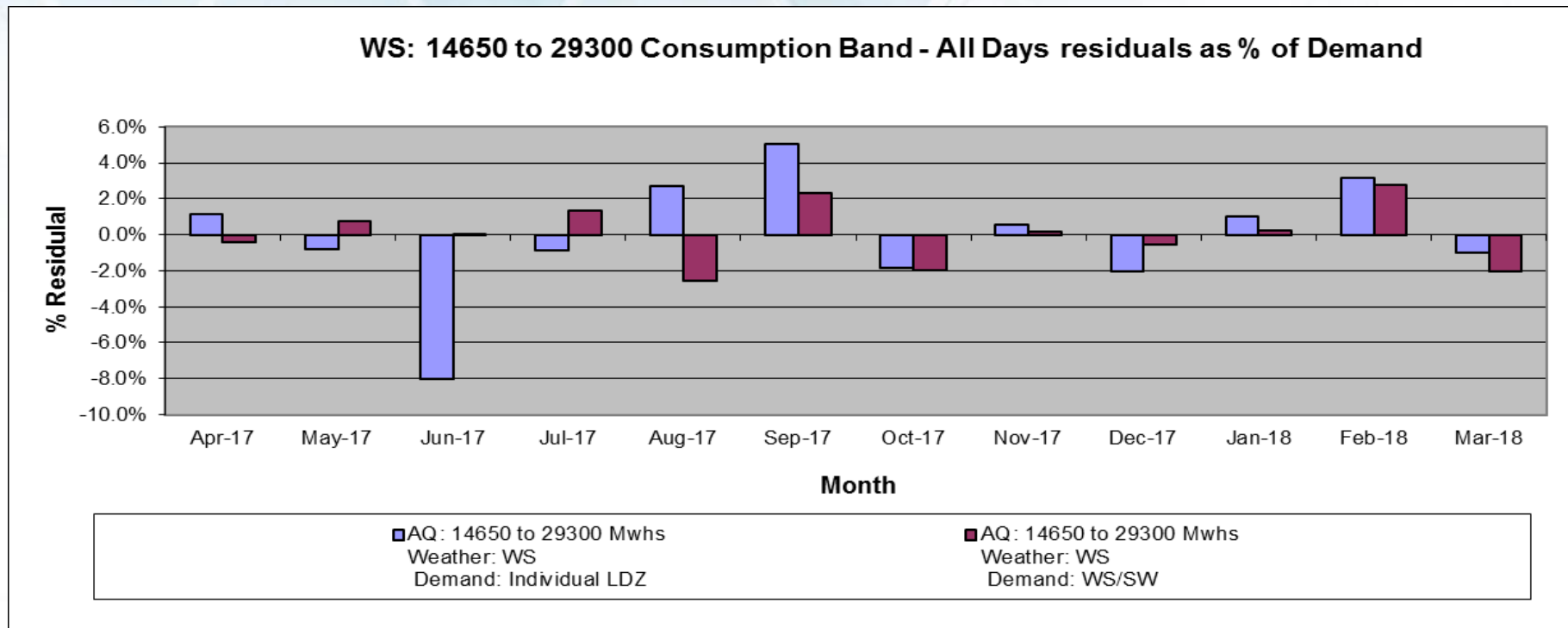
SW LDZ, EUC Band 7 & 8: 14,650 – 58,600 MWh pa

SW: 14650 to 29300 Consumption Band - All Days residuals as % of Demand

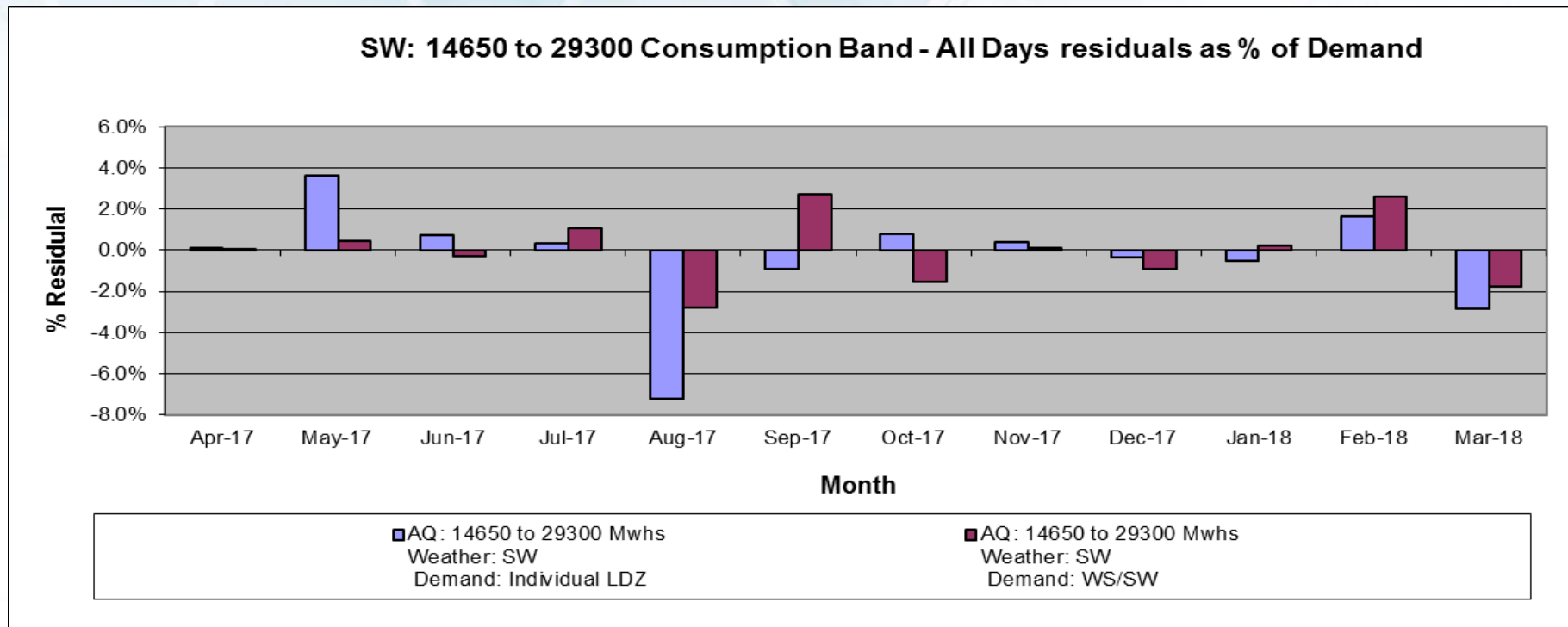- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested
- Residuals mixed – some large improvement from aggregation but several months, July, September, October and February poorer.
- **TWG to decide on preferred model**

Large NDM Modelling Results: EUC Band 9

>58,600 MWh pa	NATIONAL GROUPINGS		
SC			
NO			
NW / WN			
NE			
EM			
WM	**70%**	**80%**	**216**
WS			
EA			
NT			
SE			
SO			
SW			

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

- As with previous years, this band is a national aggregation model
- No TWG decision required for this EUC Band

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Section 4 part 2:

Large NDM WAR Bands: 5 to 8

AQ Range: 2,196 to 58,600 MWh pa

Single Year Results for 2017/18 sample data

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Large NDM WAR Bands: Agreed Modelling Runs

EUC Bands: Range	Comments on 2017/18 data TWG Agreed Aggregations
Band 5: 2,196 to 5,860 MWh pa	**5 LDZ Group** (SC, NO/NW/WN, NE/EM/WM, EA/NT/SE and WS/SO/SW) **Agreed WAR Ratios**: 0.406; 0.493 and 0.580
Band 6: 5,860 to 14,650 MWh pa	**3 LDZ Group** (SC/NO/NW/WN, NE/EM/WM, EA/NT/SE/WS/SO/SW) **Agreed WAR Ratios:** 0.344; 0.425 and 0.533
Band 7 and Band 8 (combined): **14,650 to 58,600 MWh pa**	**3 LDZ Group** (SC/NO/NW/WN, NE/EM/WM, EA/NT/SE/WS/SO/SW) **AND** **2 LDZ Group** (SC/NO/NW/WN/NE/EM/WM, EA/NT/SE/WS/SO/SW) **Agreed WAR Ratios:** 0.339; 0.374 and 0.455

- Aggregations as agreed at April TWG.
- Decision to be made on models for Band 7 and 8

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Large NDM Modelling Results: EUC Band 5 WARs

2,196 to 5,860 MWh pa	WAR Banding											
	Band 1 0.00 – 0.406			Band 2 0.406 – 0.493			Band 3 0.493 – 0.580			Band 4 0.580 – 1.000		
SC	68%	94%	33	51%	98%	85	39%	98%	92	28%	98%	37
NO / NW / WN	68%	94%	57	50%	97%	91	39%	98%	53	26%	96%	56
NE / EM / WM	65%	98%	92	47%	97%	101	39%	98%	109	27%	97%	91
EA / NT / SE	71%	94%	57	51%	96%	119	39%	97%	132	26%	97%	63
WS / SO / SW	69%	91%	55	50%	94%	51	37%	97%	55	26%	97%	47

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

- The results show R^2 values above 90%. The lowest R^2 is 91% in WS / SO / SW WAR Band 1
- ILFs demonstrate distinct levels between WAR bands

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Large NDM Modelling Results: EUC Band 6 WARs

5,860 to 14,650 MWh pa	WAR Banding											
	Band 1 0.00 – 0.344			Band 2 0.344 – 0.425			Band 3 0.425 – 0.533			Band 4 0.533 – 1.000		
SC/NO/NW/WN	81%	93%	35	61%	95%	73	47%	97%	66	31%	98%	42
NE/EM/WM	81%	94%	54	61%	97%	63	44%	95%	45	30%	98%	33
WS/EA/NT/SE/SO/SW	80%	95%	42	63%	96%	58	44%	98%	84	31%	98%	57

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

- The results showed reasonably good R^2 values with the lowest of 93% for the SC / NO / NW / WN WAR band 1 group.
- ILFs demonstrate distinct levels between WAR bands.

Large NDM Modelling Results: Band 7 & 8 WARs Run 1

14,650 to 58,600 MWh pa	WAR Banding											
	Band 1 0.00 – 0.339			Band 2 0.339 – 0.374			Band 3 0.374 – 0.455			Band 4 0.455 – 1.000		
SC/NO/NW/WN	86%	72%	31	76%	86%	36	60%	94%	54	42%	96%	27
NE/EM/WM	90%	82%	42	73%	95%	71	61%	93%	54	35%	94%	29
WS/EA/NT/SE/SO/SW	92%	40%	25	73%	90%	39	58%	90%	39	35%	98%	41

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

- Decision required on keeping the two most northern groups separate or to merge due to low sample numbers in WAR band 4.

- Individual run shows these WAR band 4 groups as having strong R^2 values of 96% and 94%

- Southern group, WAR band 1 has sample size of 25 and R^2 of 40%. A chart will follow that demonstrates this is a flat profile and the R^2 value is reflective of being non weather sensitive.
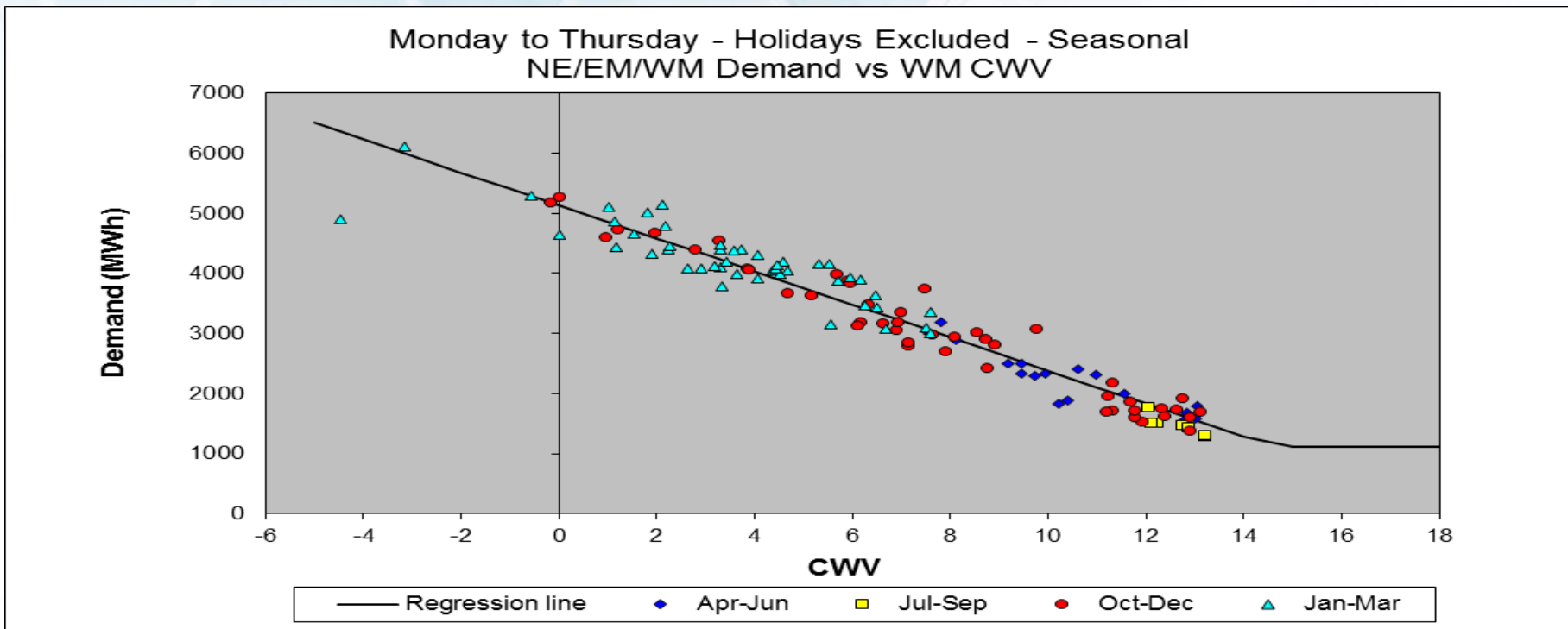
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Large NDM Modelling Results: Band 7 & 8 WARs Run 2

14,650 to 58,600 MWh pa	WAR Banding											
	Band 1 0.00 – 0.339			Band 2 0.339 – 0.374			Band 3 0.374 – 0.455			Band 4 0.455 – 1.000		
SC/NO/NW/WN NE/EM/WM	88%	83%	73	74%	95%	107	61%	95%	108	38%	95%	56
WS/EA/NT/SE/SO/SW	92%	40%	25	73%	90%	39	58%	90%	39	35%	98%	41

Indicative Load Factor (ILF) : **R^2 Multiple Correlation Coefficient (All days)** : **Sample Size (Supply Points)**

- Aggregating the two most northern groups produces a model R^2 of 95% for War band 4 (96% and 94% individually)

- Secondary consequence for other WAR bands with R^2 of WB1 83% (72%,82%), WB2 95%(86%,95%) and WB3 95%(94%,93%)

- Charts to follow

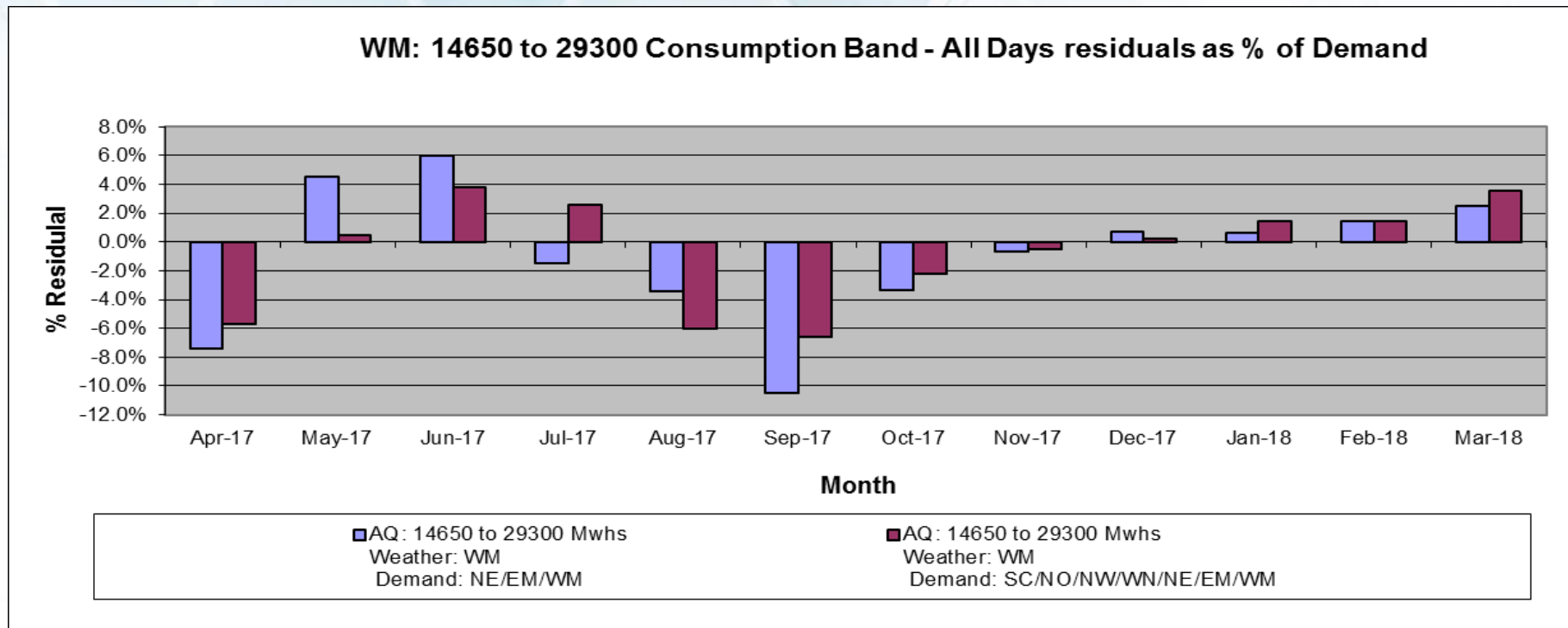XOserve

WM LDZ, WAR Band 4: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
NE/EM/WM Demand vs WM CWV

Run	ILF	R² (All days)	Sample
NE/EM/WM	35%	94%	29
SC/NO/NW/WN/NE/EM/WM	38%	95%	56

WM LDZ, WAR Band 4: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
SC/NO/NW/WN/NE/EM/WM Demand vs WM CWV

Run	ILF	R² (All days)	Sample
NE/EM/WM	35%	94%	29
SC/NO/NW/WN/NE/EM/WM	38%	95%	56

WM LDZ, WAR Band 4: 14,650 – 58,600 MWh pa

WM: 14650 to 29300 Consumption Band - All Days residuals as % of Demand
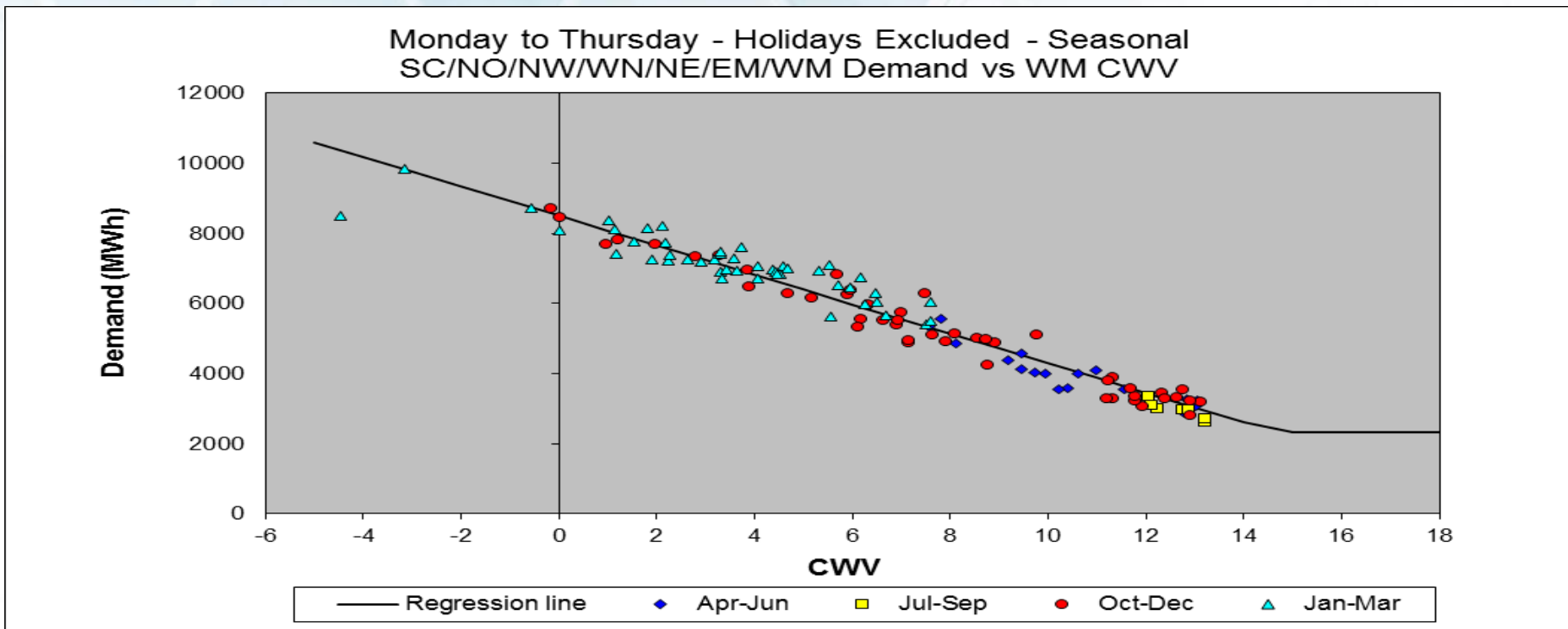
- Comparison of monthly residuals (all days) for the specific LDZ for the two models tested.
- This LDZ benefits from the aggregation by having lower residuals
- **TWG to decide on preferred model**

NT LDZ, WAR Band 1: 14,650 – 58,600 MWh pa

Monday to Thursday - Holidays Excluded - Seasonal
WS/EA/NT/SE/SO/SW Demand vs NT CWV
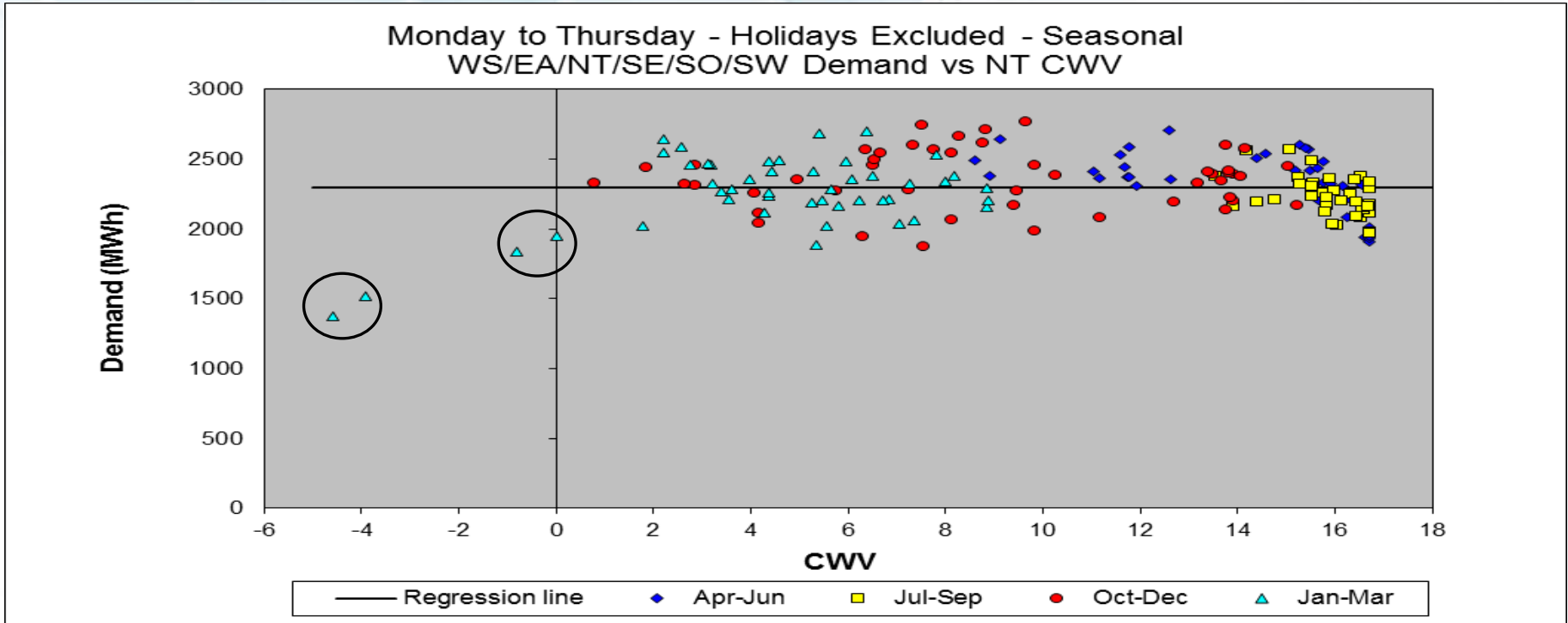
- The variability in the data points across the different seasons is consistent with a weather insensitive model. The highlighted data points are from the 26,27,28th Feb and 1st Mar which were the coldest and snowy days this winter
- WAR Band 1 more prevalent to scatter as less weather sensitive.

Large NDM Modelling Results: Summary

- Good R^2 Coefficients for majority of models, including WAR Bands, some lower values in WAR Band 1

- Merging sample data for Bands 7 and 8 for modelling purposes has helped results remain acceptable

- Recap on decisions made:

  - *Consumption Band 6: Individual or Individual with WS / SW combined*
  - *Consumption Band 7&8: Individual or Individual with WS / SW, SE / SO combined*

  - *Consumption Band 7&8 WAR: 3 group LDZ or 2 group LDZ*

- Are TWG happy to move to model smoothing phase with the Large NDM modelling results presented today ?

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Section 5:

Next Steps

Demand Estimation: Next Steps

- Once all single year models have been approved the "Model Application" phase commences. This begins with model smoothing i.e. the process of 'averaging the effects' from the 3 latest analysis years. During this phase it is possible the CDSP may need to contact TWG for further prompt decisions on modelling analysis (probably by email)

- The CDSP then use the output from the smoothed models as the basis for producing the annual Derived Factors which consist of Annual Load Profiles (ALPs), Daily Adjustment Factors (DAFs) and Peak Load Factors (PLFs)

- w/c 4th June Xoserve to publish the draft Derived Factors for DESC and TWG to review and provide feedback

- TWG and DESC have 3 weeks to review draft Demand Estimation parameter values and provide feedback (by no later than Friday 22rd June)

- Combined TWG and DESC meeting planned for 9th July to review feedback received and seek approval to publish to wider industry participants

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