Demand Estimation Technical Work Group

Gas Demand EUC Modelling Results
Analysis Year 2021/22
(2 of 3) Results – Small NDM

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RESULTS: SMALL NDM - SUMMARY

Total NDM Population Counts: AQ and Supply Point

Small NDM is the main component of the overall NDM:

- Band 1 (0-73.2 MWh pa) constitutes nearly 3/4 of overall NDM (on an AQ basis)
- Bands 1 to 2 (0-293 MWh pa) constitutes nearly 4/5 of overall NDM
- Bands 1 to 4 (0-2196 MWh pa) constitutes nearly 9/10 of overall NDM

Large NDM is very much a minority component of overall NDM

EUC Bands: Range	**% of Total NDM**	
	Total AQ	Total SP Count
Band 1: 0 to 73.2 MWh p.a.	73.03%	98.90%
Bands 1 and 2: 0 to 293 MWh p.a.	79.16%	99.72%
Bands 1 to 4: 0 to 2,196 MWh p.a.	88.36%	99.97%
Bands 5 to 9: >2,196 MWh p.a.	11.64%	0.03%

Proposed EUC Bands / Consumption Ranges

End User Category (EUC) definitions are not prescribed in Uniform Network Code and are the responsibility of DESC to review and confirm. This year's Modelling Approach document did not propose any changes to the EUC definitions for Gas Year 2022/23

Band / Range	Description	Meter Point Count*
Band 1 0 to 73.2 MWh p.a.	PPM Domestic	1,844,984
	Non-PPM Domestic	22,306,868
	PPM I&C	2,886
	Non-PPM I&C	469,182
Band 2 73.2 to 293 MWh p.a.	PPM Domestic	1,487
	Non-PPM Domestic	59,322
	PPM I&C	79
	Non-PPM I&C	142,830
Band 3 293 to 732 MWh p.a.	All NDM Supply Points	43,613
Band 4 732 to 2,196 MWh p.a.	All NDM Supply Points	18,315

* Meter Point Count as at May 2022

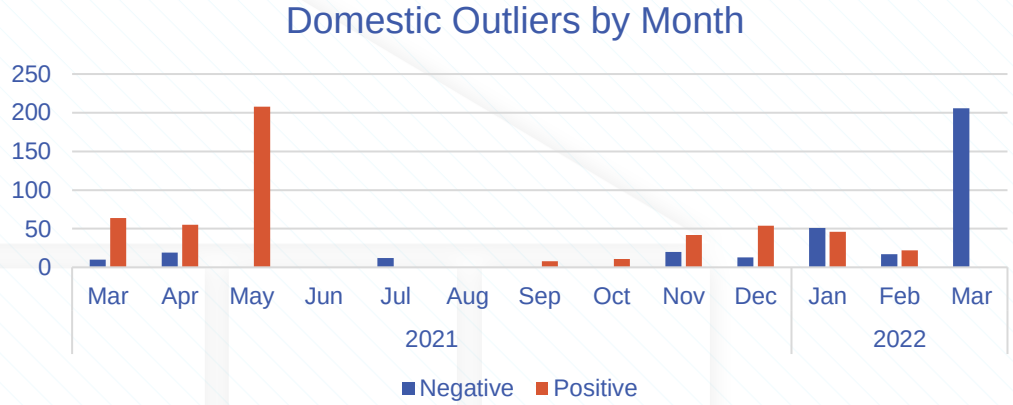
Results – Small NDM: Agreed Modelling Runs

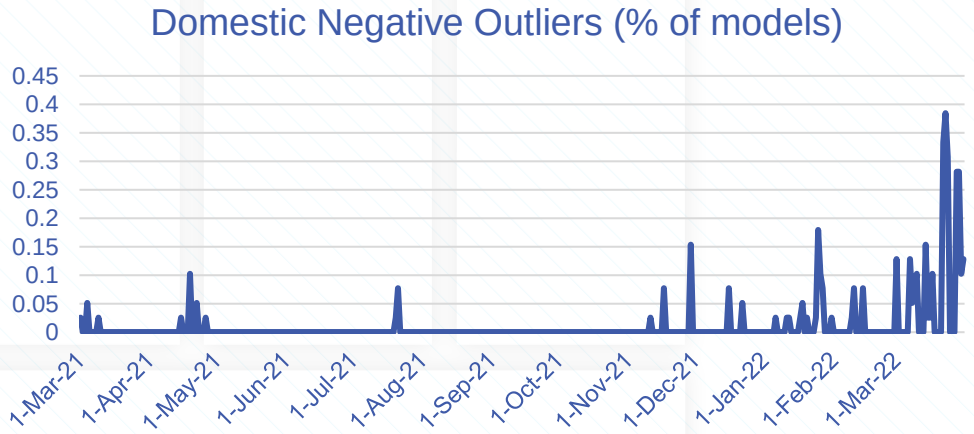
Band / Range	Description	EUC	Option 1	Option 2
Band 1 0 to 73.2 MWh p.a.	PPM Domestic	01BPD	Individual LDZ analysis with SE combined with SO	N/A
	Non-PPM Domestic	01BND	Individual LDZ analysis	N/A
	PPM I&C	01BPI	No Model Available (Lack of Data)	N/A
	Non-PPM I&C	01BNI	Individual LDZ analysis	N/A
Band 2 73.2 to 293 MWh p.a.	PPM Domestic	02BPD	No Model Available (Lack of Data)	N/A
	Non-PPM Domestic	02BND	2 LDZ groups (North / South Split)	National
	PPM I&C	02BPI	No Model Available (Lack of Data)	N/A
	Non-PPM I&C	02BNI	Individual LDZ analysis	N/A
Band 3 293 to 732 MWh p.a.	Non-PPM I&C	03B	Individual LDZ analysis	N/A
Band 4 732 to 2,196 MWh p.a.	Non-PPM I&C	04B	Individual LDZ analysis	N/A

RESULTS: SMALL NDM DOMESTIC EUCS

Results: Small NDM Domestic Outliers

- The chart on the right shows the frequency of outliers by month
  - Negative outliers are where consumption was much lower than expected
  - Positive outliers are where consumption was much higher than expected
- In many LDZs we have seen an increase in negative outliers towards the end of the analysis period – the second chart shows the frequency of negative outliers by day
- This is likely due to customer behaviour related to the increased price of gas
- There is also an increase in positive outliers in May 2021, due to abnormal weather conditions
- Due to ongoing high gas prices and the length of the abnormal weather period, the recommendation is to leave all outliers in the data





Results – Small NDM: 01BPD Summary

- This is the first set of results using class 3 data for 01BPD
- R^2 values are between 95.6% and 98.5%
- For LDZ SE only, due to low sample count (18) TWG agreed to merge with LDZ SO for this EUC model
- ILF commentary on following slide

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	97.4%	73	36.7
NO	96.9%	301	38.3
NW	96.3%	384	35.5
NE	96.5%	310	35.9
EM	98.3%	292	33.2
WM	97.8%	266	33.0
WN	95.4%	130	35.0
WS	97.3%	126	33.2
EA	97.3%	126	33.1
NT	98.4%	149	34.0
SE	98.1%	94 (includes SO)	31.7
SO	97.4%	76	29.7
SW	97.5%	77	29.1

Results – Small NDM: 01BPD Summary

- ILF values are similar to MOD451AV (2012/13), however for 1 area (highlighted - SW) the value has decreased and is now lower than 01BND PLF (2021/22)

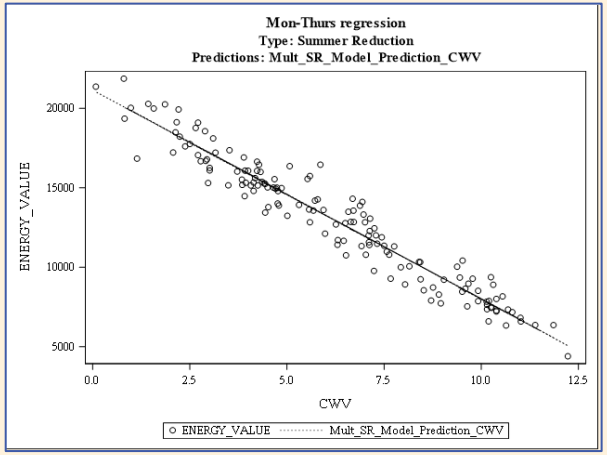
- This could result in a prepayment customer being charged more for gas network capacity charges for the same gas use as a non-prepayment customer in the same area

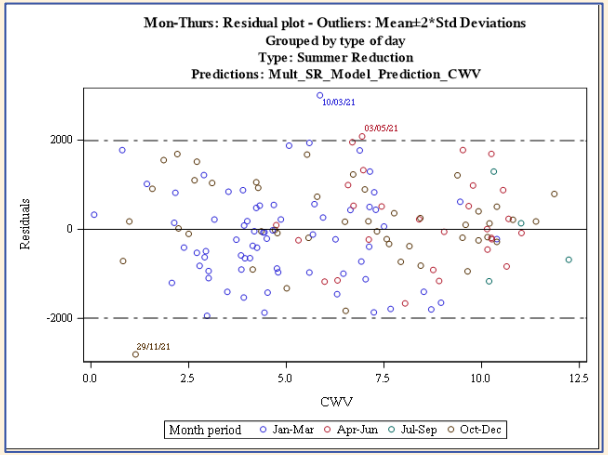
Thoughts are welcome from TWG on what, if any, action should be taken if the results are the same once the formal Load Factor calculations have been completed

LDZ	Load Factor		
	01BPD (ILF)	01BND (PLF)	Ratio
SC	36.7	34.4	106%
NO	38.3	34.5	108%
NW	35.5	31.2	112%
NE	35.9	32.6	108%
EM	33.2	30.8	107%
WM	33.0	29.8	109%
WN	35.0	30.5	113%
WS	33.2	29.9	106%
EA	33.1	31.3	104%
NT	34.0	31.2	108%
SE	31.7	29.6	107%
SO	29.7	27.6	108%
SW	**29.1**	**29.5**	**99%**

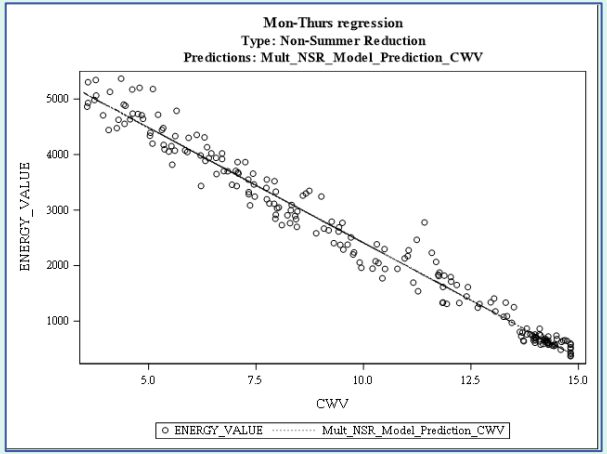
Results – Small NDM: 01BPD – NO and SW

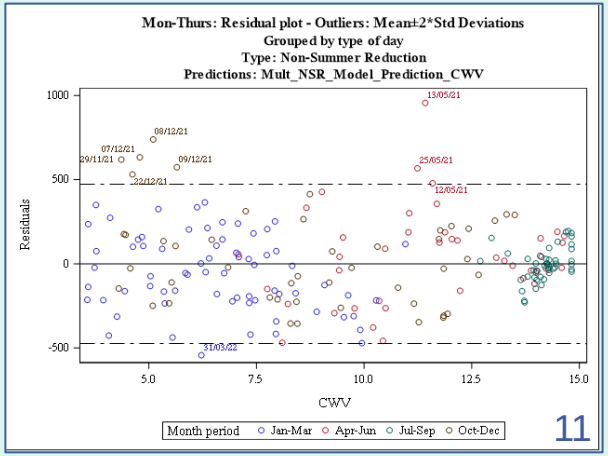
01BPD Scenario with **Highest** ILF
Model: Summer Reduction
EUC: 01BPD
LDZ: NO
Demand: NO
R^2: 96.9%
ILF: 38.3
Sample Points: 301



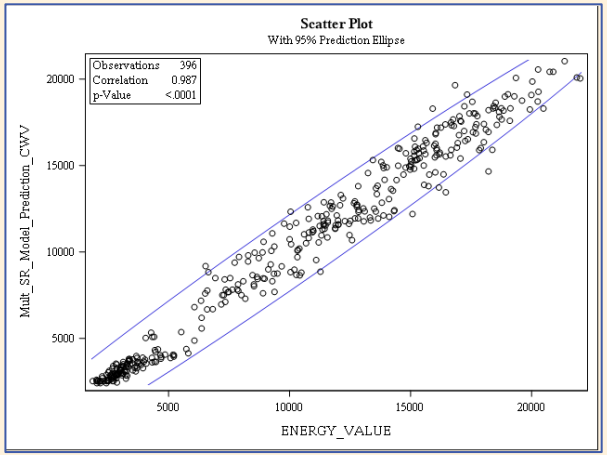


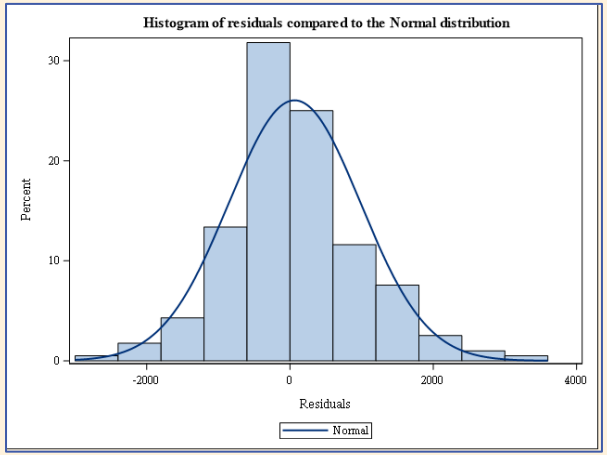
01BPD Scenario with **Lowest** ILF
Model: No Summer Reduction
EUC: 01BPD
LDZ: SW
Demand: SW
R^2: 97.5%
ILF: 29.1
Sample Points: 77

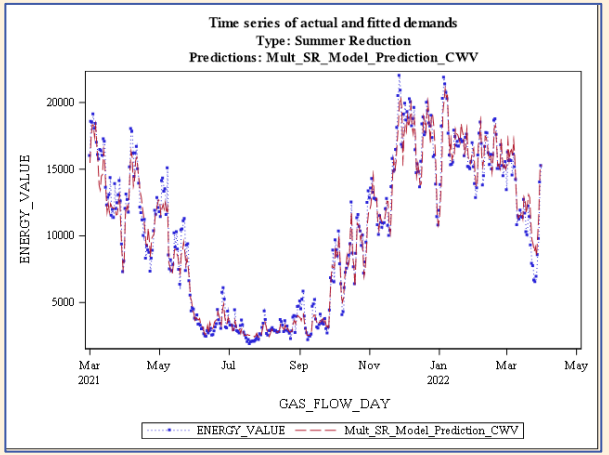


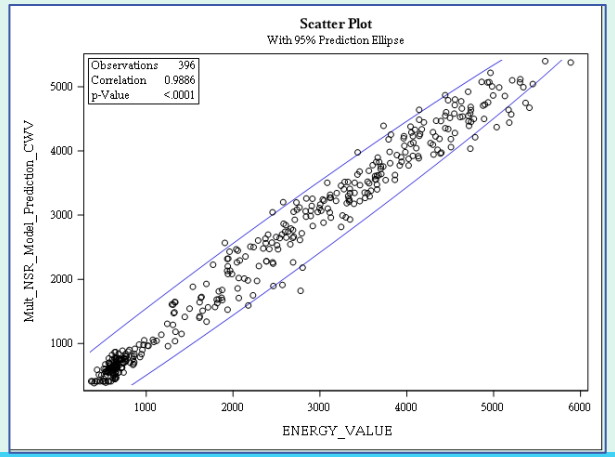


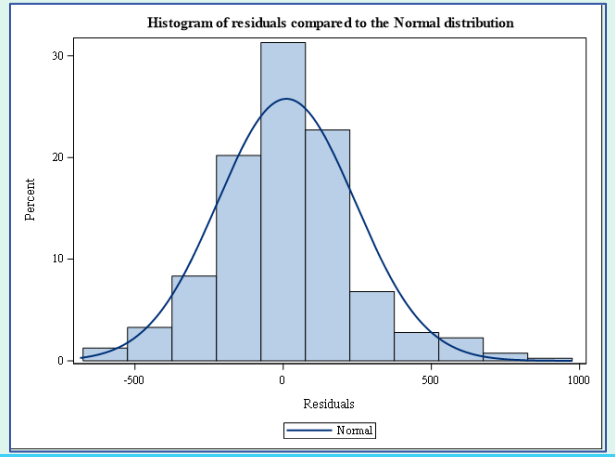
Results – Small NDM: 01BPD – NO and SW

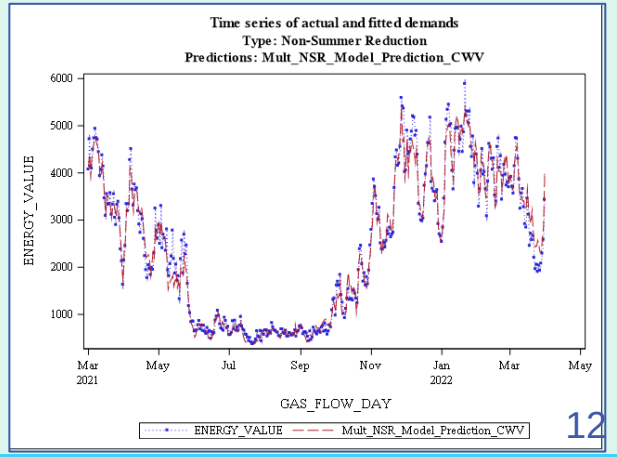












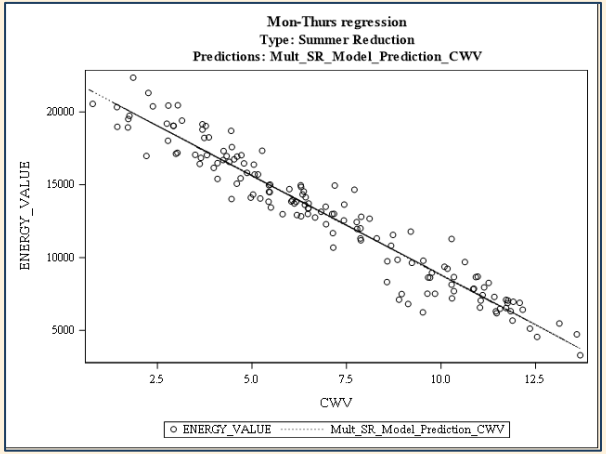
Results – Small NDM: 01BND Summary

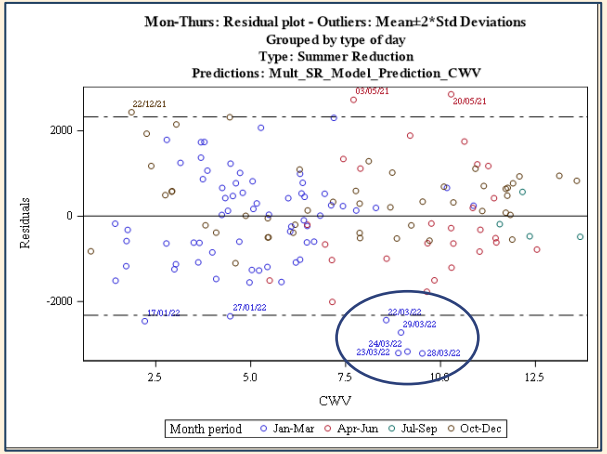
- R^2 values are between 97.0% and 98.6% (previous range was 97.6% to 99.0%)
- Outliers related to the reduced consumption in March (see following slide) are likely to be a driver in the slight reduction in R^2.
- ILF values are similar to previous years (within 1 percentage point)
- Model performance is strong and no alternatives were needed
  - Option 1

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	98.3%	385	35.6
NO	98.0%	385	36.1
NW	97.7%	385	32.4
NE	97.4%	385	33.8
EM	98.2%	385	32.7
WM	98.4%	385	30.5
WN	97.0%	298	32.7
WS	97.3%	385	31.9
EA	98.4%	385	32.5
NT	98.6%	385	32.6
SE	98.4%	385	30.3
SO	98.0%	385	29.2
SW	97.4%	385	30.5

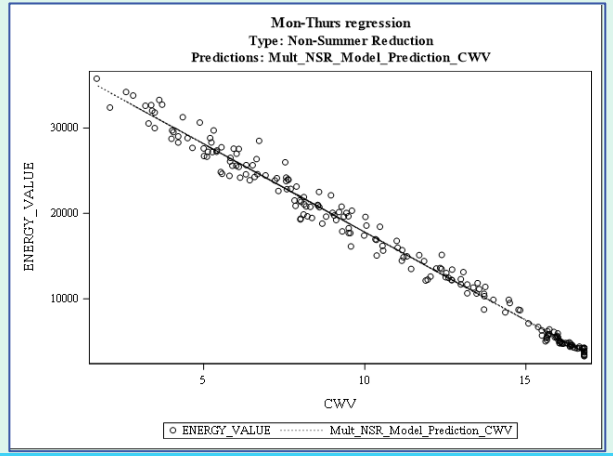
Results – Small NDM: 01BND – (WN and NT)

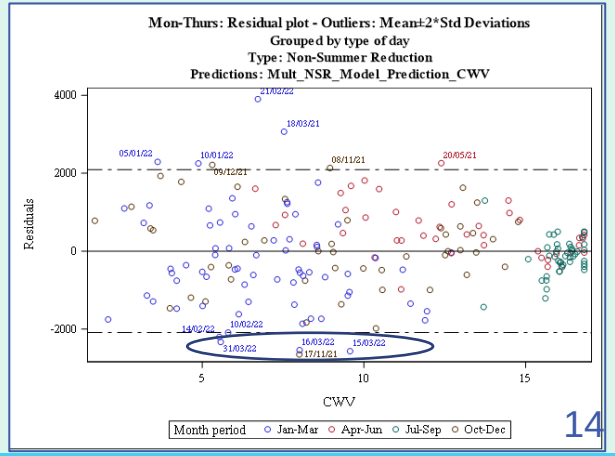
01BND Scenario with **lowest** R^2
Model: No Summer Reduction
EUC: 01BND
LDZ: WN
Demand: WN
R^2: 97.0%
ILF: 32.7
Sample Points: 298



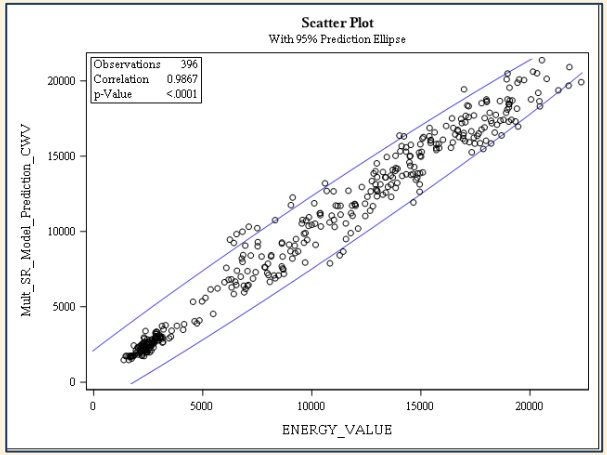


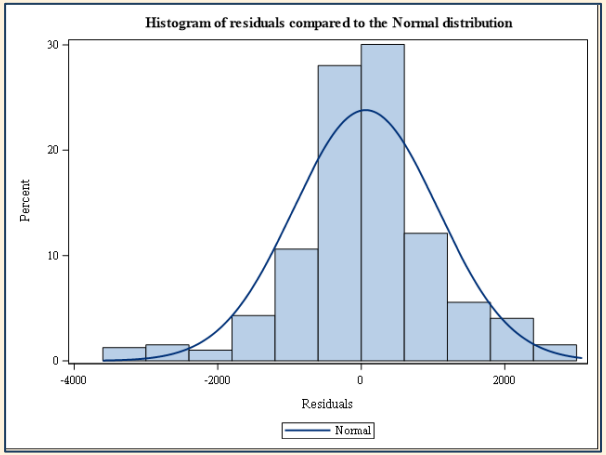
01BND Scenario with **highest** R^2
Model: No Summer Reduction
EUC: 01BND
LDZ: NT
Demand: NT
R^2: 98.6%
ILF: 32.6
Sample Points: 385

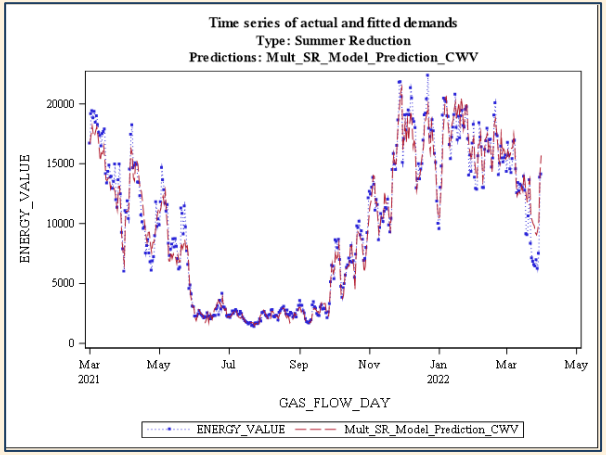


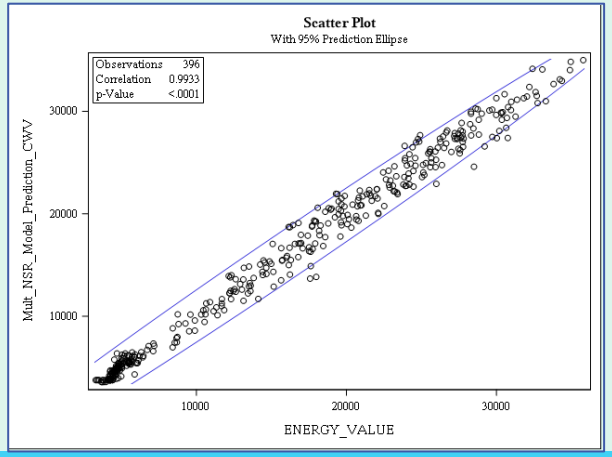


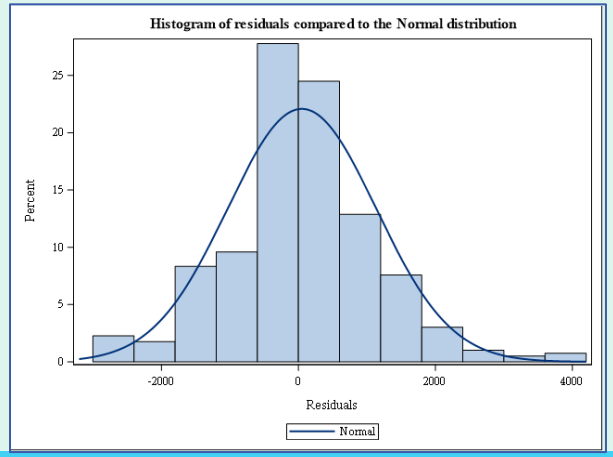
Results – Small NDM: 01BND – (WN and NT)

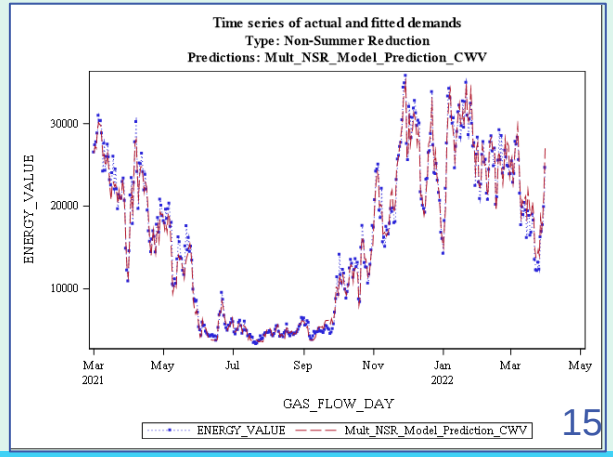












Results – Small NDM: 02BND Summary

Option 1 - North South split

- R^2 values are between 93.1% and 96.5%
- ILF values are around 3 percentage points lower for the Northern LDZs and around 4 percentage points higher for the Southern LDZs

Option 2 – National

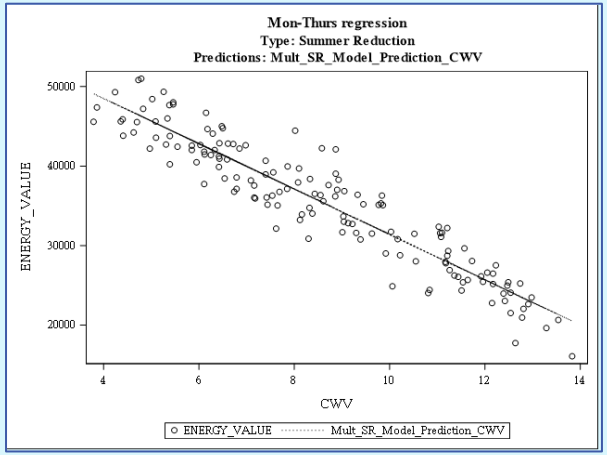
- R^2 values are between 93.1% and 96.7%
- ILF Values are similar to previous years (+/- 1.5 percentage points)

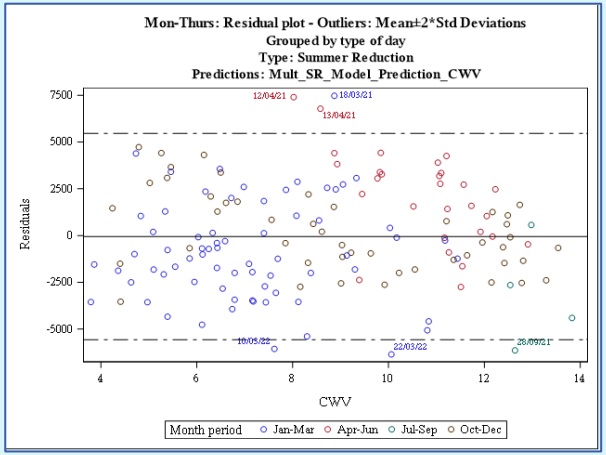
- North South grouping has been the selected option in recent years.
- The R^2 values are similar for both options, however the ILF for option 1 is quite different to currently, therefore we would welcome TWG thoughts on the Option selection.

LDZ	R^2 (All Days)		Sample Size		Indicative Load Factor (ILF)	
	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2
SC	**93.9%**	93.1%	91	187	36.4	39.4
NO	**95.8%**	95.2%			38.0	41.0
NW	**96.5%**	96.4%			35.4	38.3
NE	**96.4%**	96.4%			36.7	39.7
EM	**96.2%**	96.2%			36.4	39.4
WM	96.3%	**96.6%**			34.9	37.7
WN	**96.1%**	96.0%			36.2	39.2
WS	93.1%	**94.7%**	96		41.3	38.0
EA	95.7%	**96.5%**			41.2	38.0
NT	96.0%	**96.7%**			40.9	37.8
SE	95.7%	**96.5%**			40.3	37.1
SO	94.3%	**95.3%**			38.8	35.7
SW	93.7%	**94.9%**			39.8	36.6

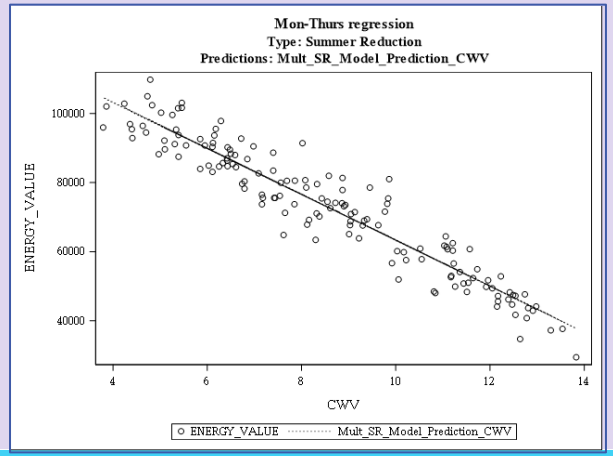
Results – Small NDM: 02BND – WS Options 1 and 2 (a)

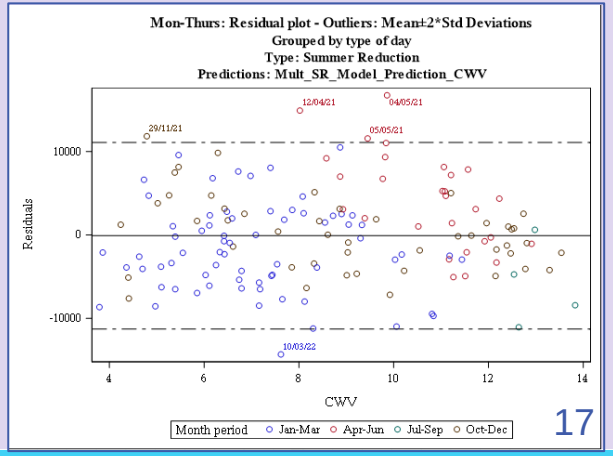
Model: Summer Reduction
EUC: 02BND
LDZ: WS
Demand: Southern LDZs
R^2: 93.1% (Lowest for 02BND)
ILF: 41.3
Sample Points: 96
Option: 1



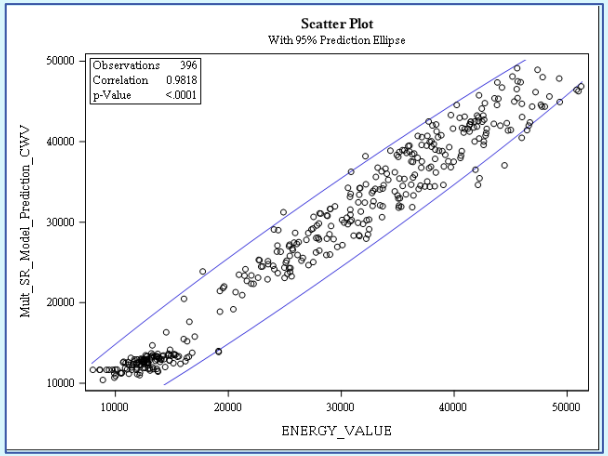


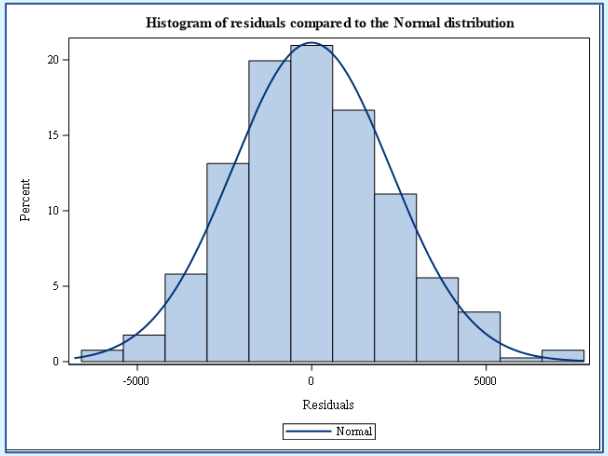
Model: Summer Reduction
EUC: 02BND
LDZ: WS
Demand: National
R^2: 94.7%
ILF: 38.0
Sample Points: 187
Option: 2

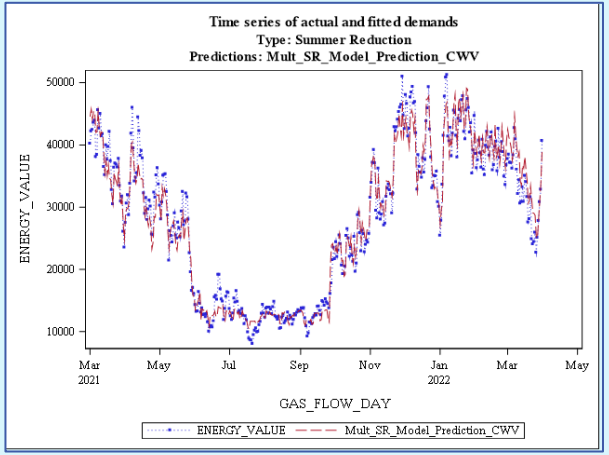


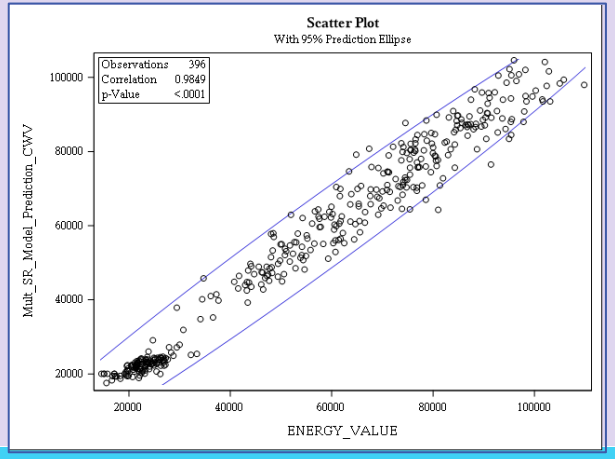


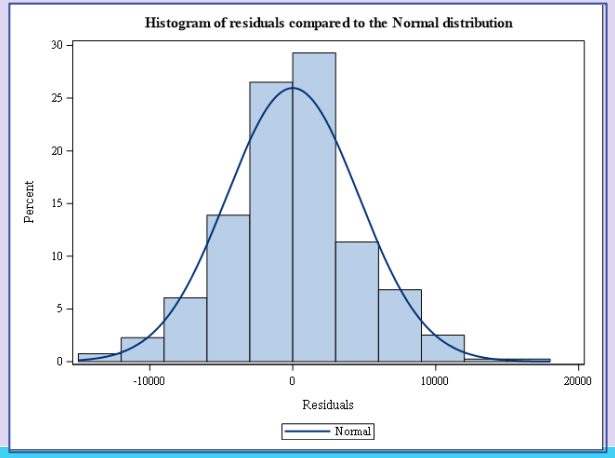
Results – Small NDM: 02BND – WS Options 1 and 2 (b)

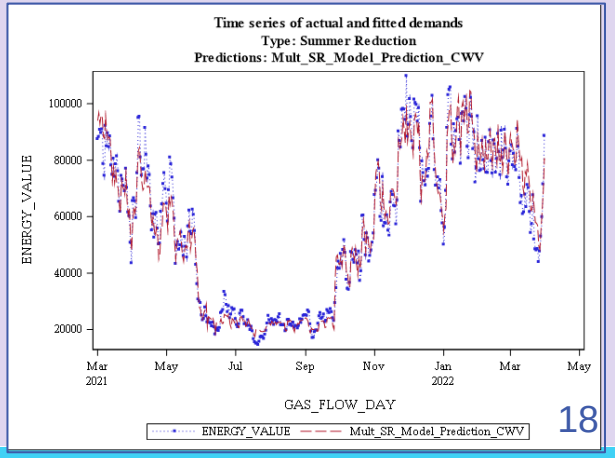






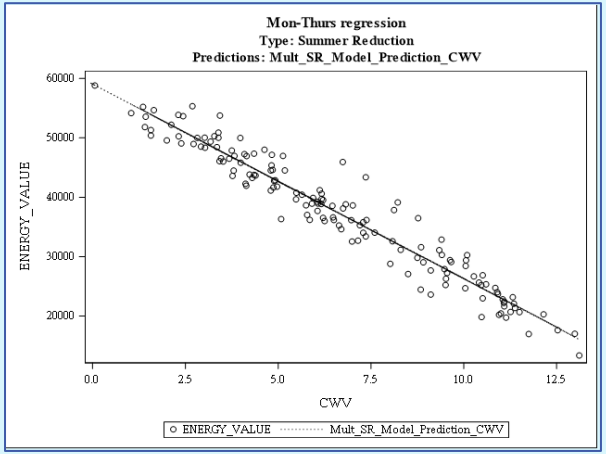


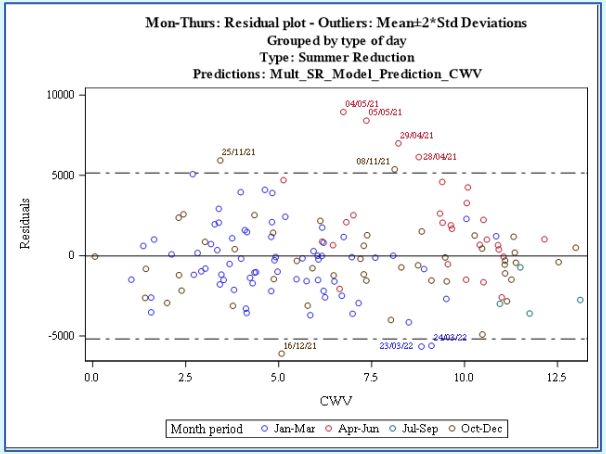




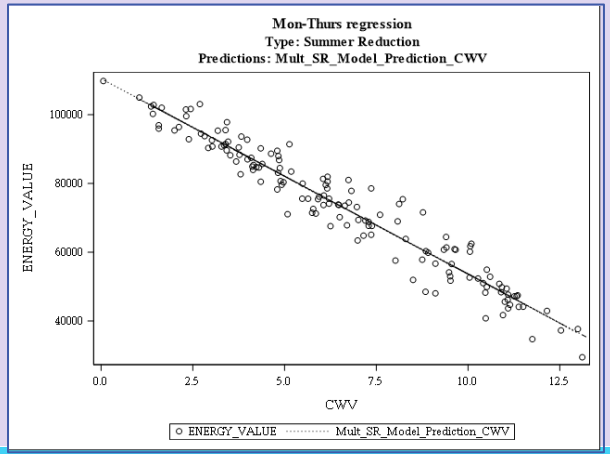
Results – Small NDM: 02BND – NW Options 1 and 2 (a)

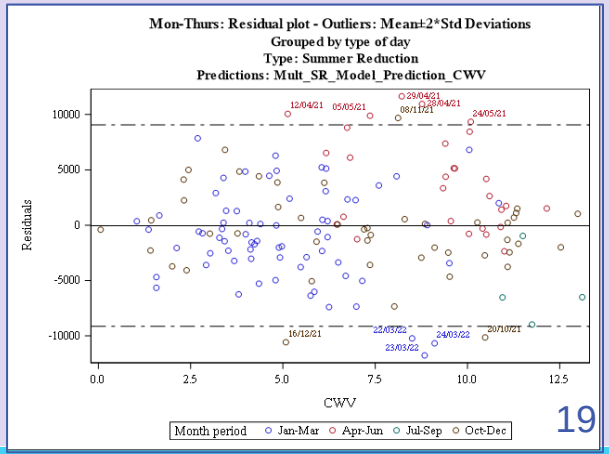
Model: Summer Reduction
EUC: 02BND
LDZ: NW
Demand: Northern LDZs (inc. SC)
R^2: 96.5% (Highest for 01BND)
ILF: 35.4
Sample Points: 91
Option: 1



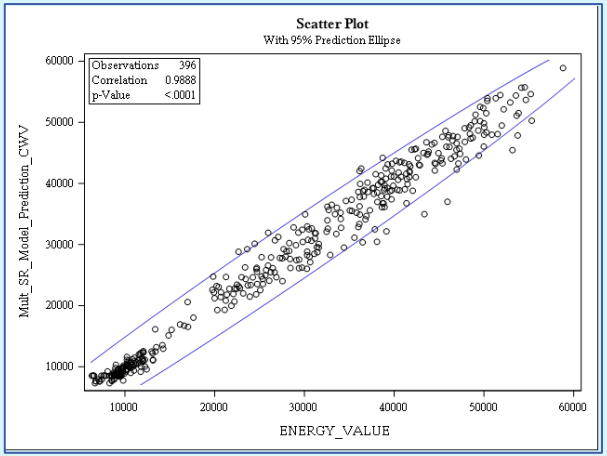


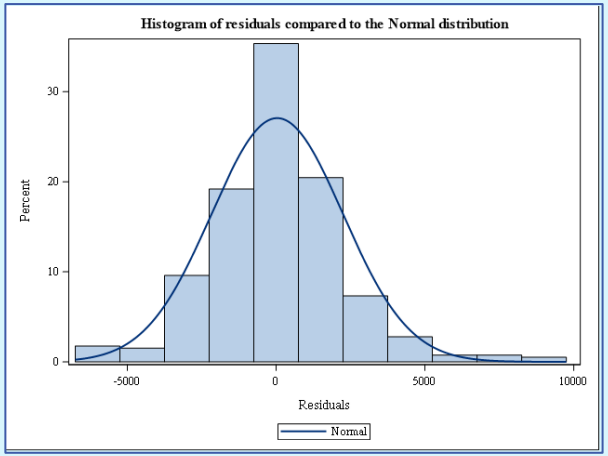
Model: Summer Reduction
EUC: 02BND
LDZ: NW
Demand: National
R^2: 96.4%
ILF: 38.3
Sample Points: 187
Option: 2

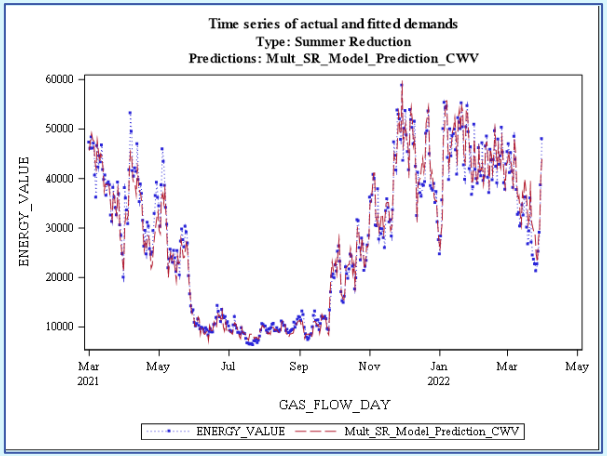


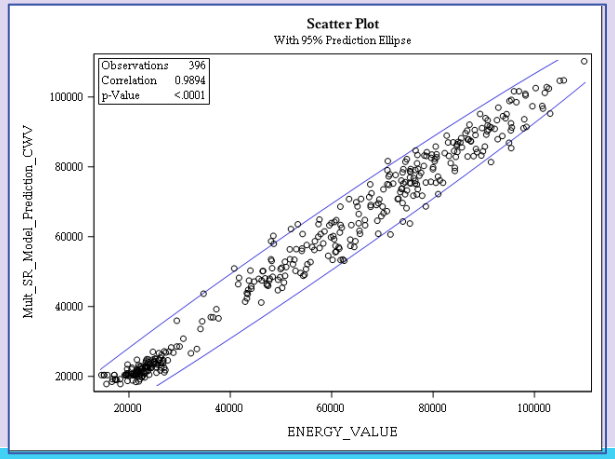


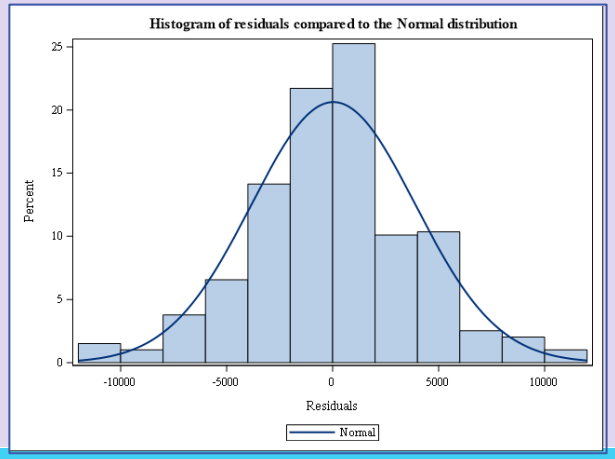
Results – Small NDM: 02BND – NW Options 1 and 2 (b)

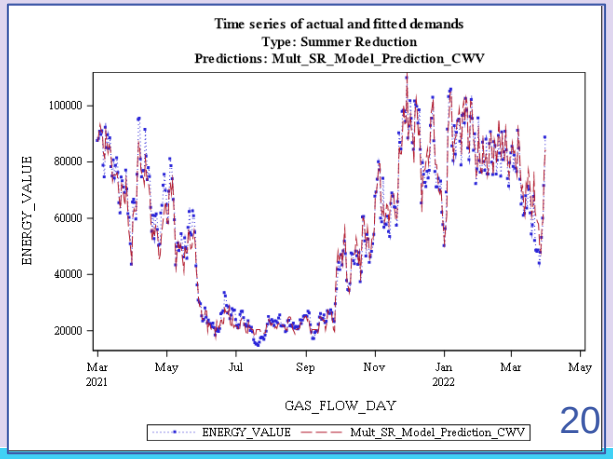












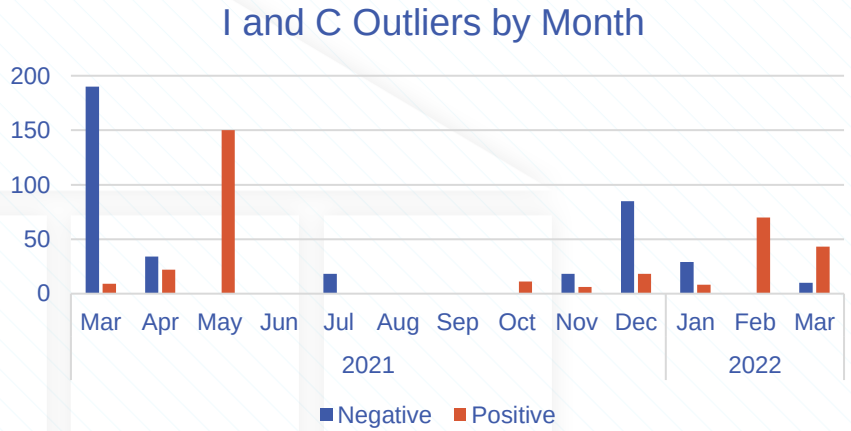
Results – Small NDM Domestic Conclusions

- Sample numbers are good with most models having similar or better overall numbers than previous years
- 01BPD models have used Class 3 data, enabling an LDZ level analysis for the first time
- Good R^2 coefficients for the majority of small NDM Domestic Models
- Consumer behaviour changes due to increased gas prices are likely to continue, and therefore no data has been removed despite an increase in outliers
- Are TWG happy to move to Demand Model Smoothing phase with the Small NDM Domestic modelling results presented today?

RESULTS: SMALL NDM I&C CONSUMPTION BAND EUCS

Results: I and C Sample Data

- Sample data collected for all EUCs was 1st March 2021 to 31st March 2021
- This is 13 months in order to get a full Easter holiday period in the sample data
- Initial modelling results showed a significant number of outliers in March 2021
- DESC made the decision in 2021 not to use the sample data for 1st April 2020 to 31st March 2021
- In order to retain the full easter period but remove the outliers, the Analysis Period for I and C was changed to 31st March 21 to 31st March 22



Outliers for 01BNI, 02BNI, 03B, 04B are shown on the chart

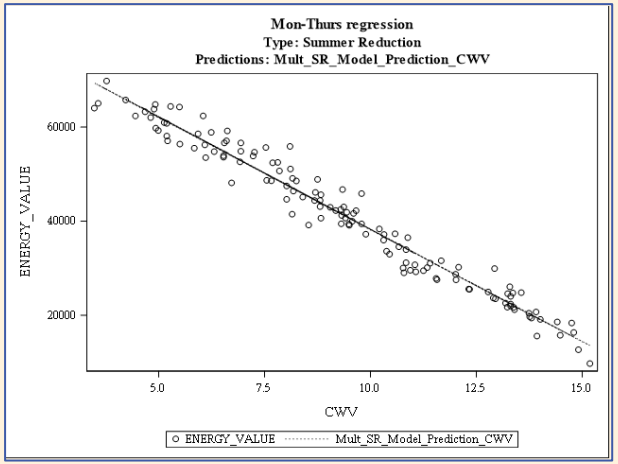
Results – Small NDM: 01BNI Summary

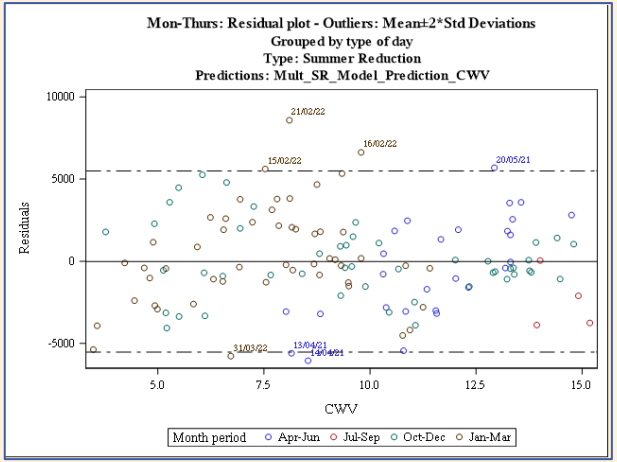
- R^2 values are between 94.1% and 98.0% (previously between 94.4% and 98.4%)
- ILF values are similar to previous years (within 3 percentage points)
- Model performance is strong and no alternatives were needed
  – Option 1

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	96.8%	381	34.3
NO	97.9%	379	32.3
NW	97.4%	382	31.0
NE	97.4%	380	31.8
EM	97.1%	382	31.3
WM	96.9%	381	29.0
WN	94.1%	54	31.4
WS	98.0%	213	30.3
EA	98.0%	381	32.7
NT	97.4%	382	33.7
SE	97.6%	382	28.5
SO	97.2%	314	26.6
SW	97.6%	381	28.5

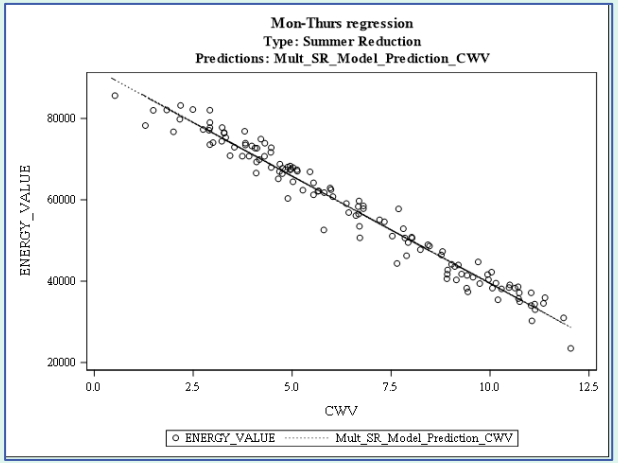
Results – Small NDM: 01BNI – (SO and SC)

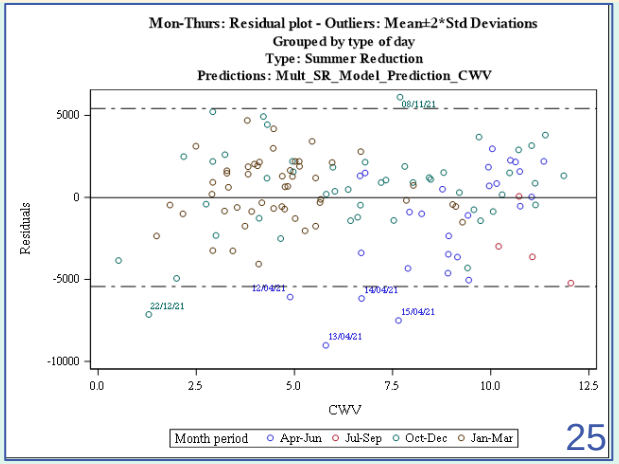
01BNI Scenario with **lowest** ILF
Model: Summer Reduction
EUC: 01BNI
LDZ: SO
Demand: SO
R^2: 97.2%
ILF: 26.6
Sample Points: 314



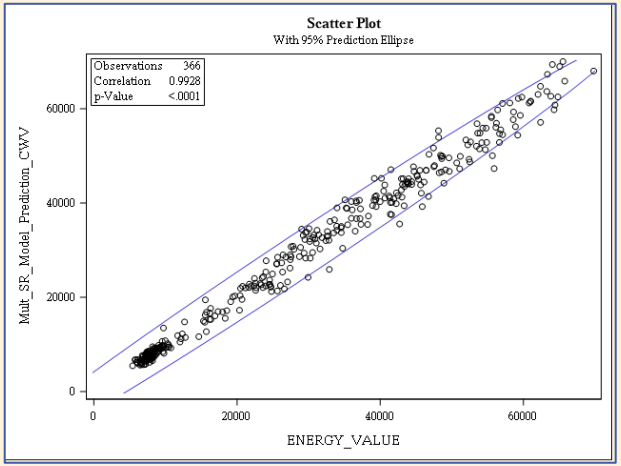


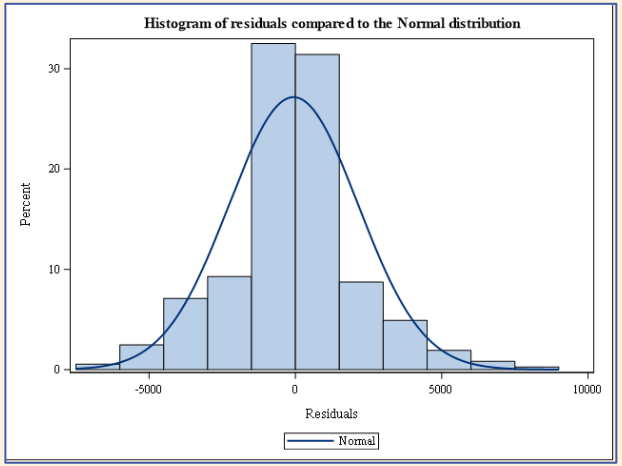
01BNI Scenario with **highest** ILF
Model: Summer Reduction
EUC: 01BNI
LDZ: SC
Demand: SC
R^2: 96.8%
ILF: 34.3
Sample Points: 381

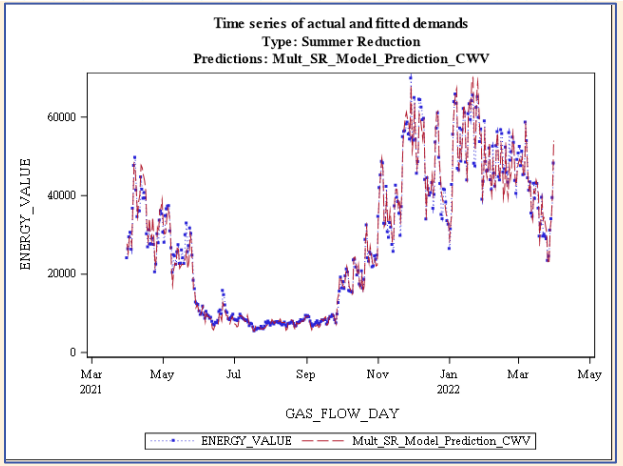


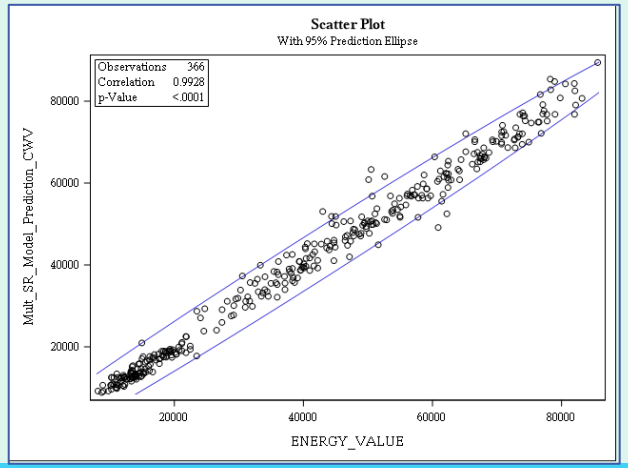


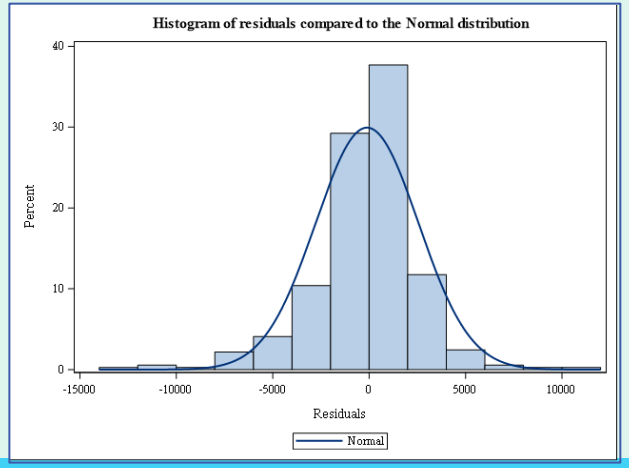
Results – Small NDM: 01BNI – (SO and SC)

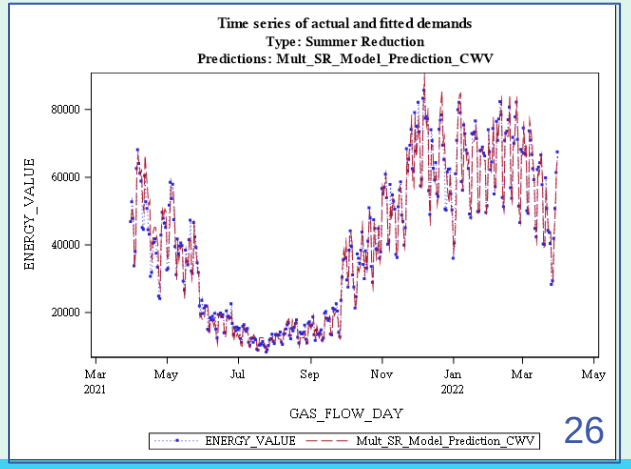












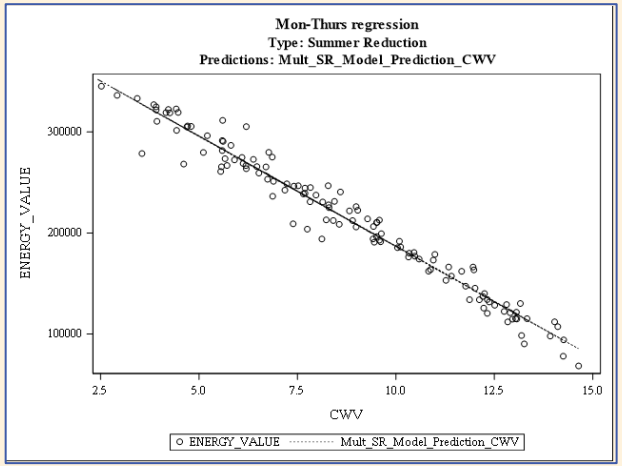
Results – Small NDM: 02BNI Summary

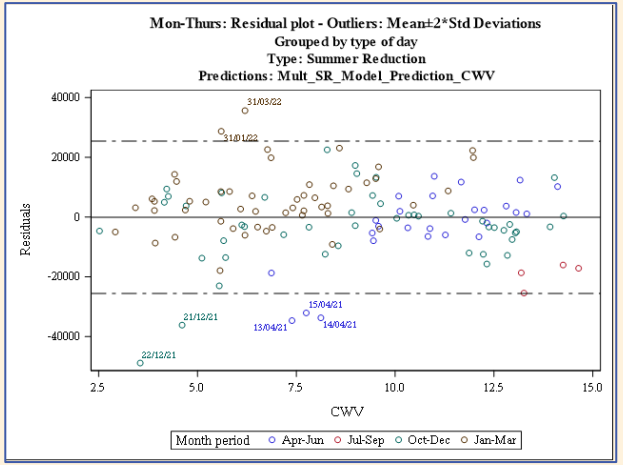
- R^2 values are between 94.5% and 97.9%
- Most ILF values are similar to previous years (within 3 percentage points)
- 3 LDZ have seen the ILF Change by greater than 3 percentage points (but all less than 3.5)

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	96.9%	373	36.4
NO	97.9%	365	37.5
NW	96.6%	376	34.5
NE	96.9%	369	36.0
EM	96.7%	375	32.8
WM	95.4%	374	31.7
WN	94.5%	70	36.6
WS	97.1%	210	36.9
EA	95.8%	372	32.9
NT	96.3%	376	36.6
SE	95.3%	376	29.8
SO	96.8%	373	30.7
SW	96.8%	370	31.8

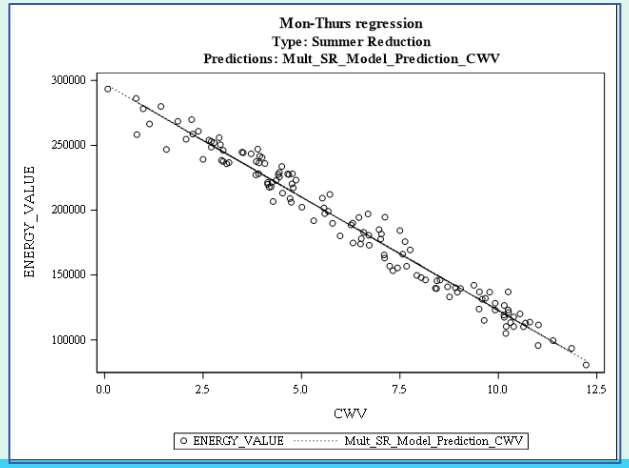
Results – Small NDM: 02BNI – (SE and NO)

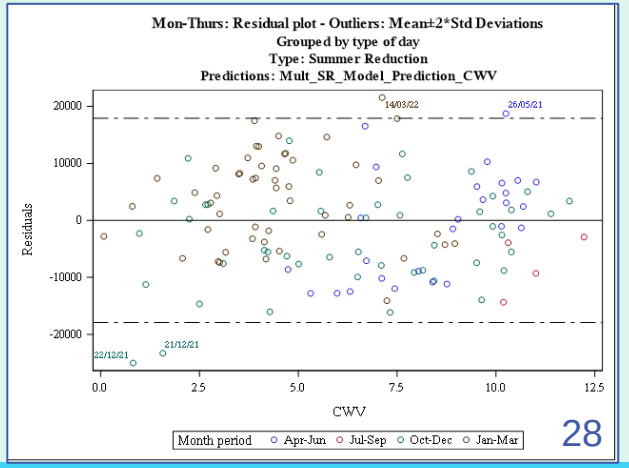
02BNI Scenario with **lowest** ILF
Model: Summer Reduction
EUC: 02BNI
LDZ: SE
Demand: SE
R^2: 95.3%
ILF: 29.8
Sample Points: 376



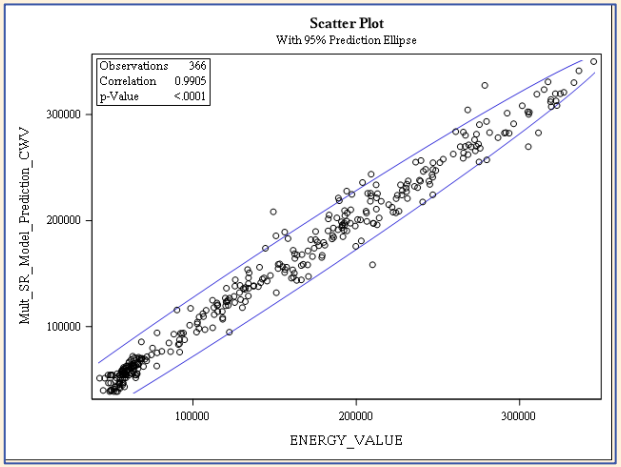


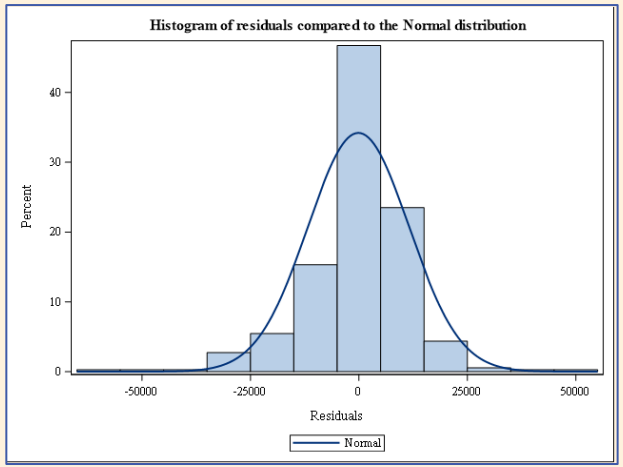
02BNI Scenario with **highest** ILF
Model: Summer Reduction
EUC: 02BNI
LDZ: NO
Demand: NO
R^2: 97.9%
ILF: 37.5
Sample Points: 365

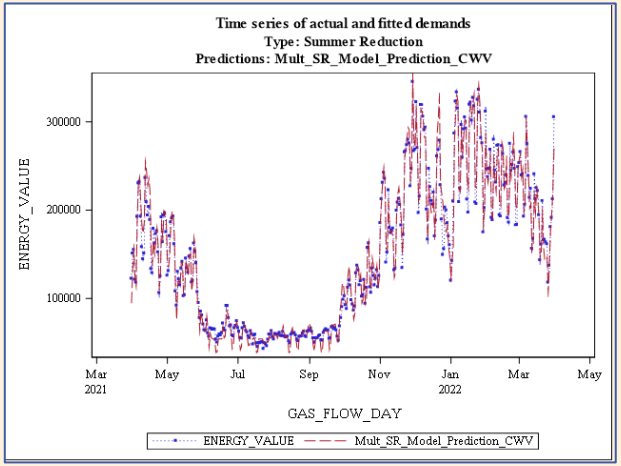


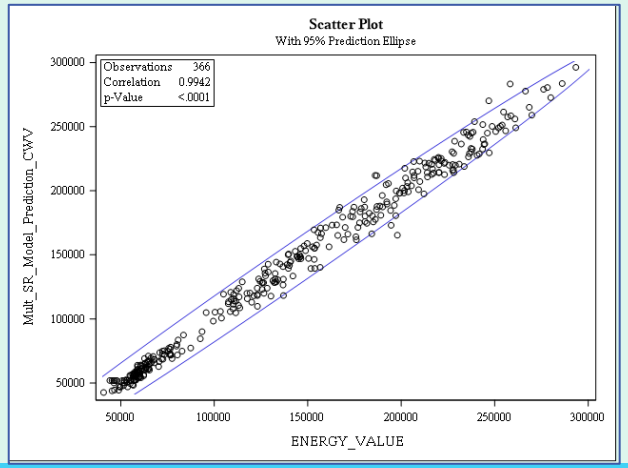


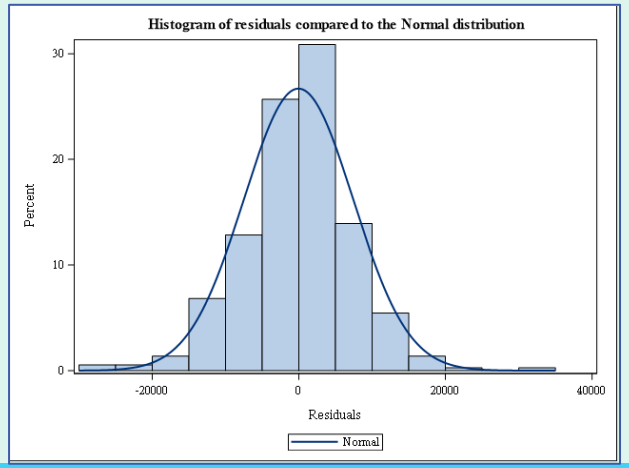
Results – Small NDM: 02BNI – (SE and NO)

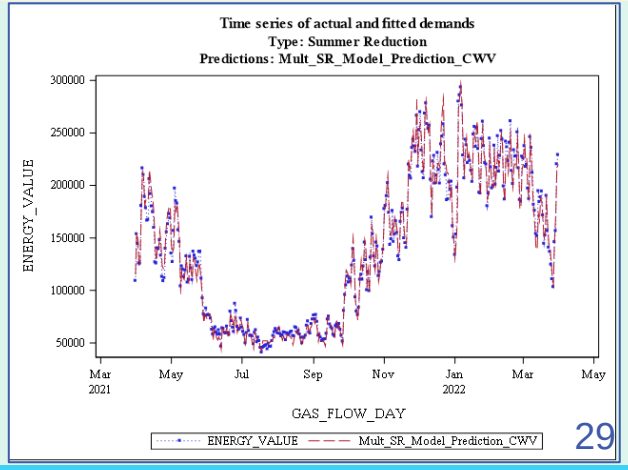












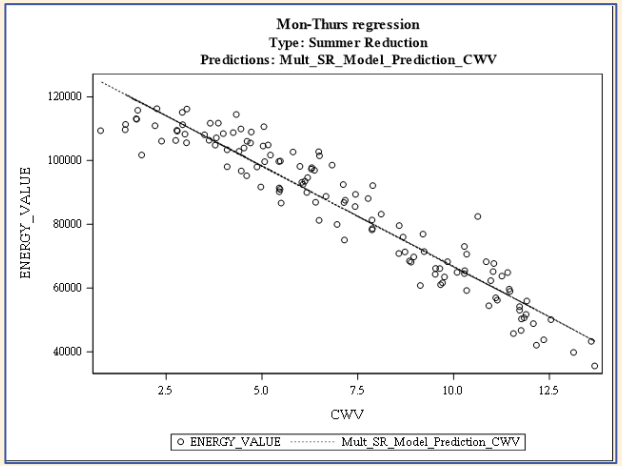
Results – Small NDM: 03B Summary

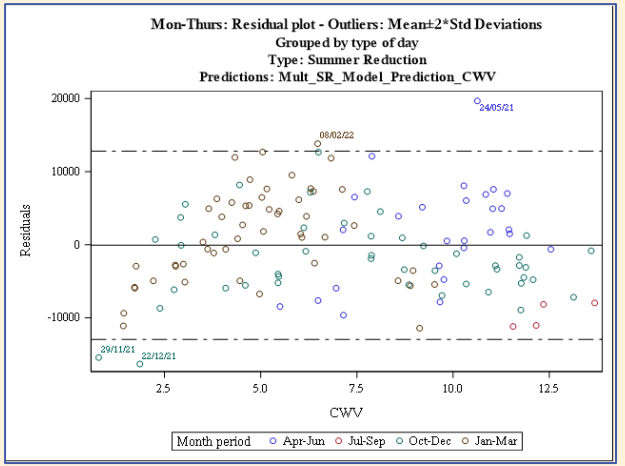
- R^2 values are between 92.9% and 97.5%
- Most ILF values are similar to previous years (within 2 percentage points)
- 2 LDZs have seen the ILF change by more than 3 percentage points (but within 4), the R^2 in both LDZs has improved this year
- Model performance is strong

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	95.4%	354	35.9
NO	96.9%	205	37.8
NW	96.7%	335	35.5
NE	97.4%	198	35.1
EM	96.6%	297	34.7
WM	96.7%	268	33.8
WN	92.9%	44	35.5
WS	96.8%	96	37.3
EA	97.0%	294	33.4
NT	97.1%	336	35.9
SE	97.1%	349	33.8
SO	96.2%	271	32.0
SW	97.5%	233	33.4

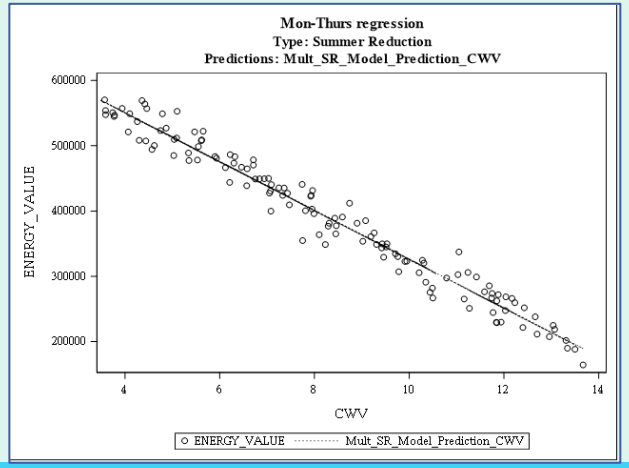
Results – Small NDM: 03B – (WN and SW)

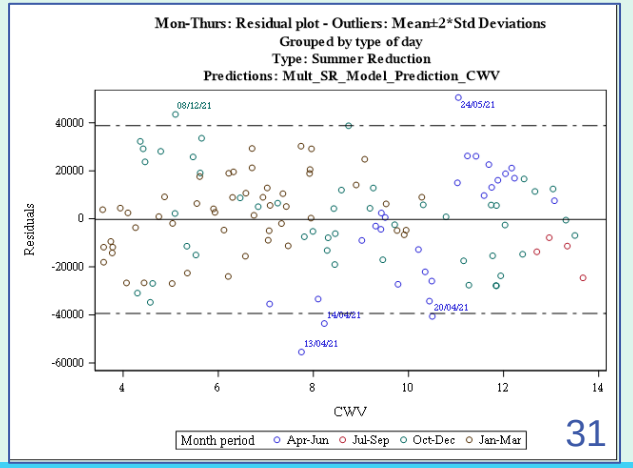
03B Scenario with **lowest** R^2
Model: Summer Reduction
EUC: 03B
LDZ: WN
Demand: WN
R^2: 92.9%
ILF: 35.5
Sample Points: 44



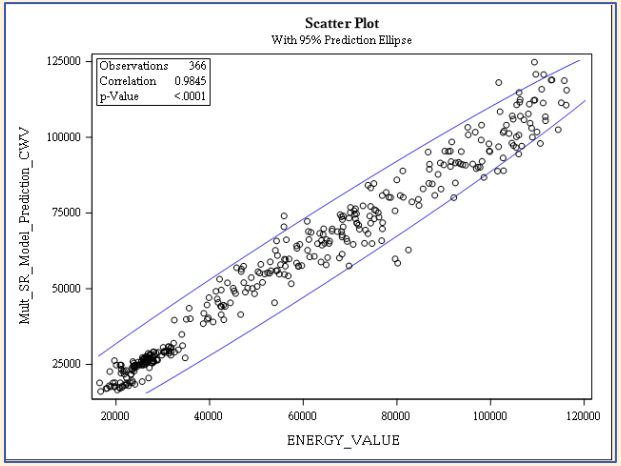


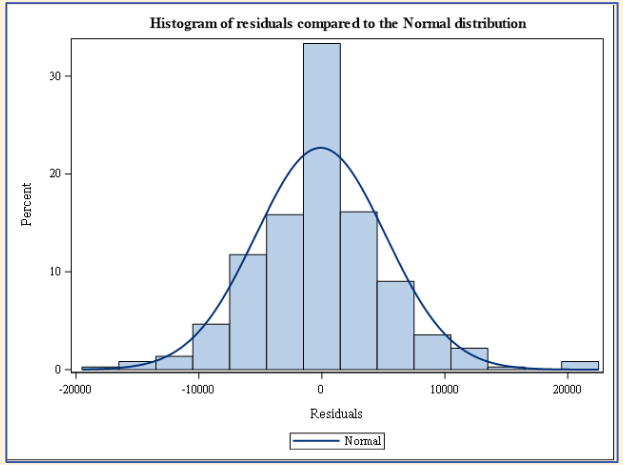
03B Scenario with **highest** R^2
Model: Summer Reduction
EUC: 03B
LDZ: SW
Demand: SW
R^2: 97.5%
ILF: 33.4
Sample Points: 233

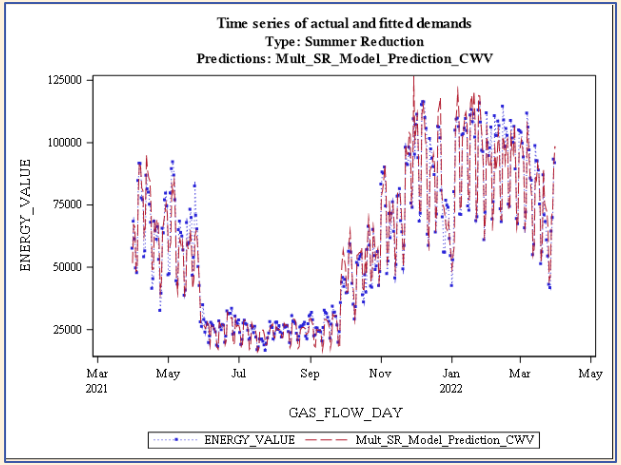


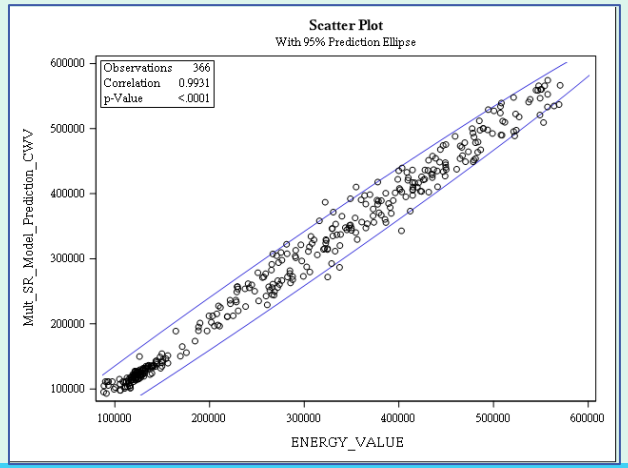


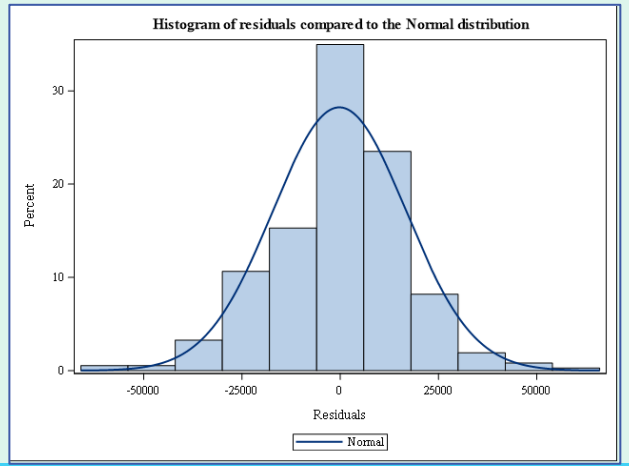
Results – Small NDM: 03B – (WN and SW)

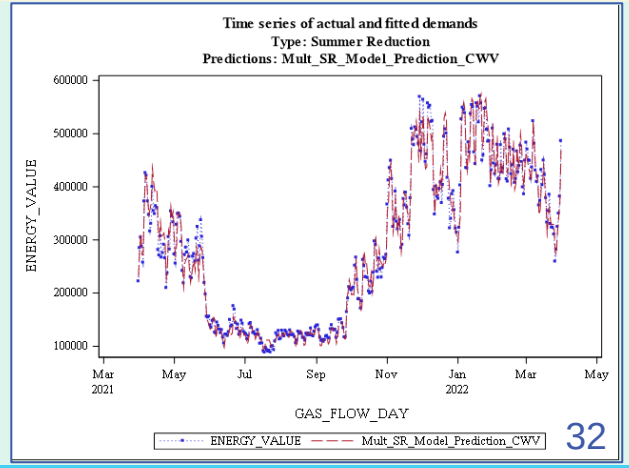












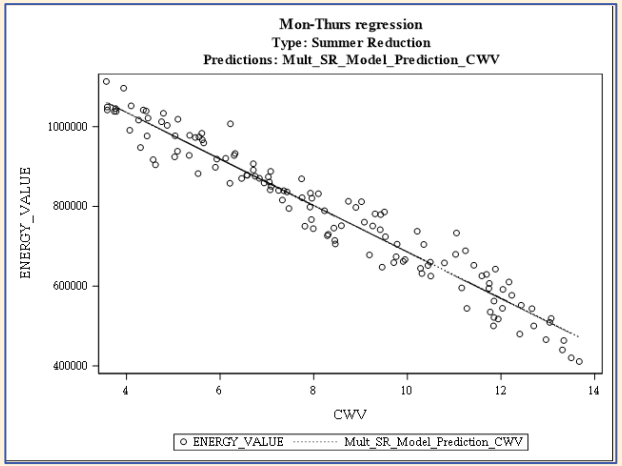
Results – Small NDM: 04B Summary

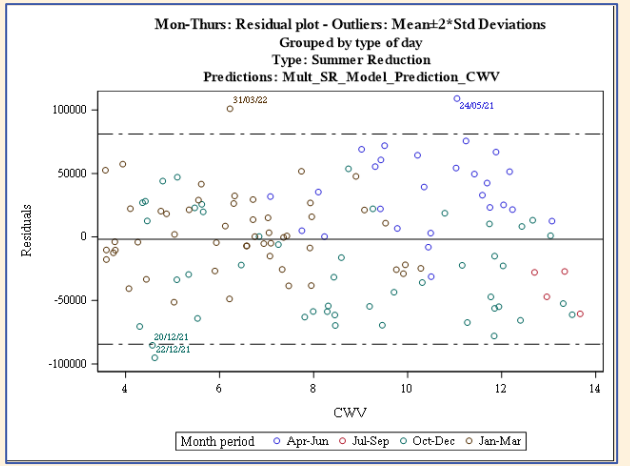
- R^2 values are between 95.3% and 98.0%
- All ILF values are similar to previous years (within 3 percentage points)
- Model performance is strong

LDZ	R^2 (All Days)	Sample Size	Indicative Load Factor (ILF)
SC	97.1%	318	36.7
NO	97.6%	178	38.3
NW	96.9%	264	38.9
NE	96.9%	257	36.1
EM	97.3%	210	37.8
WM	97.0%	253	33.7
WN	95.4%	38	35.9
WS	96.0%	99	36.6
EA	96.8%	232	38.4
NT	98.0%	274	38.8
SE	97.8%	310	37.4
SO	97.5%	267	32.6
SW	95.3%	176	39.2

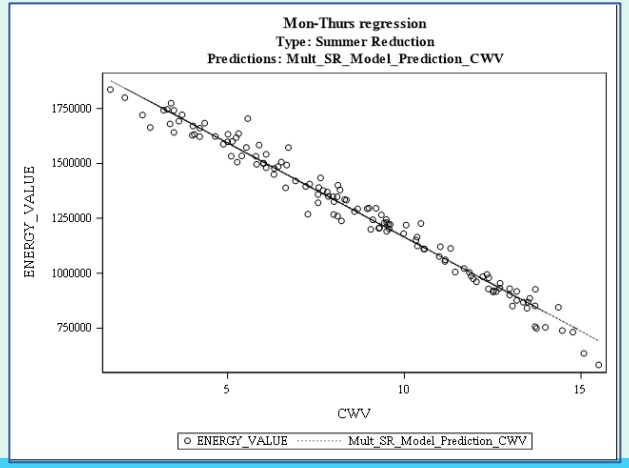
Results – Small NDM: 04B – (SW and NT)

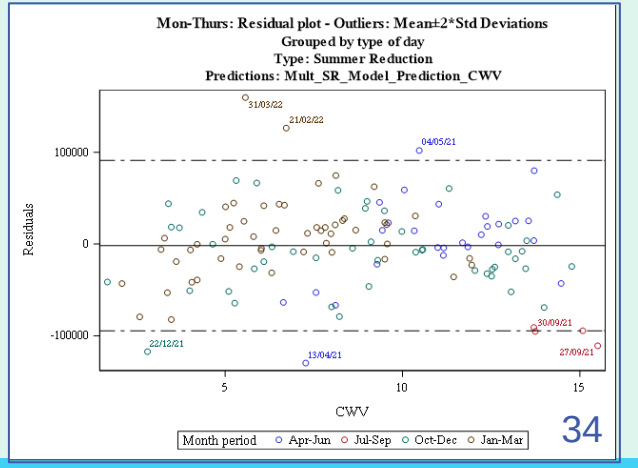
04B Scenario with **lowest** R^2
Model: Summer Reduction
EUC: 04B
LDZ: SW
Demand: SW
R^2: 95.3%
ILF: 39.2
Sample Points: 176



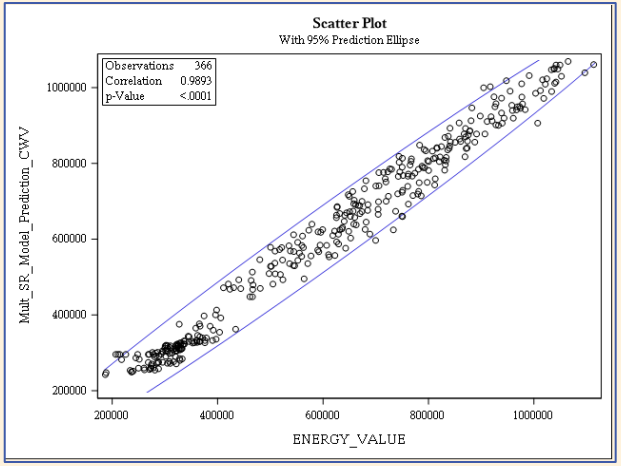


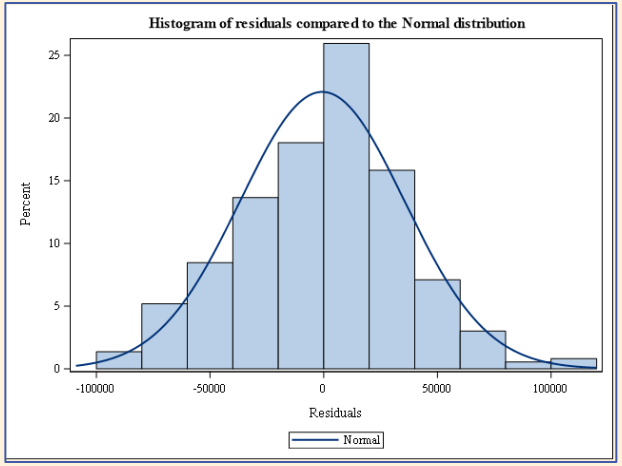
04B Scenario with **highest** R^2
Model: Summer Reduction
EUC: 04B
LDZ: NT
Demand: NT
R^2: 98.0%
ILF: 38.8
Sample Points: 274

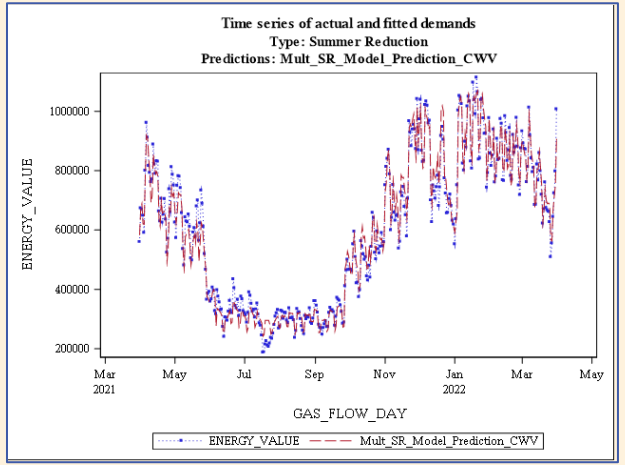


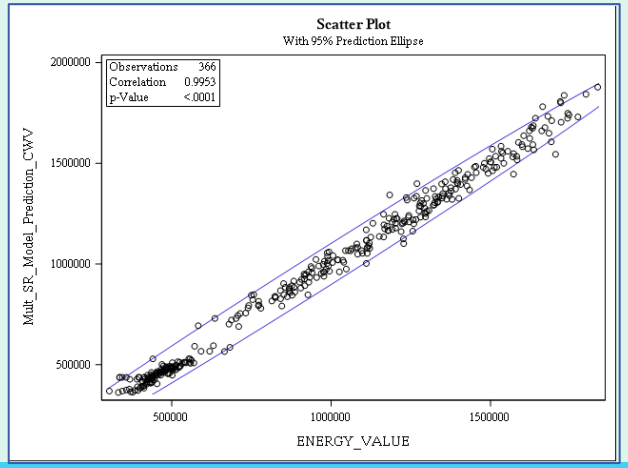


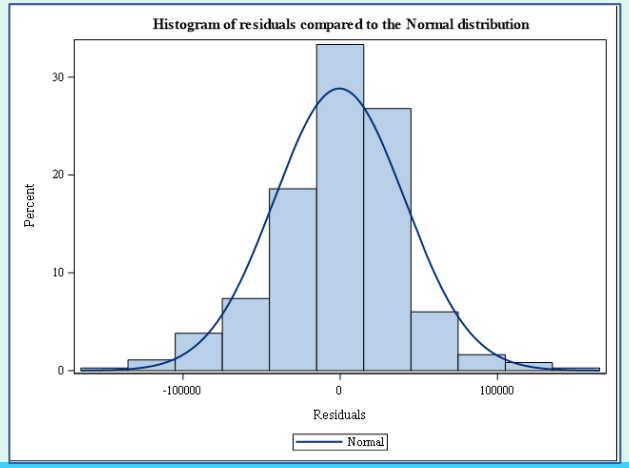
Results – Small NDM: 04B – (SW and NT)

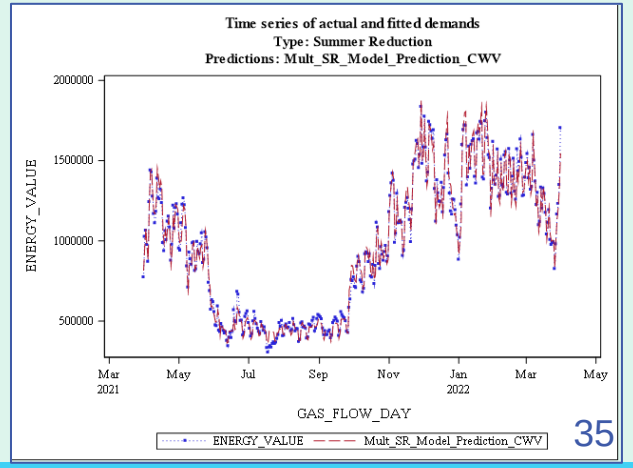












RESULTS: SMALL NDM WAR BANDS

Results – Small NDM WAR Bands: Agreed Modelling Runs

Band / Range	Description	EUCs	Option 1	Option 2
Band 1 0 to 73.2 MWh p.a.	PPM Domestic, Non-PPM Domestic, PPM I&C, Non-PPM I&C	01BPD, 01BND, 01BPI, 01BNI	N/A No WAR Bands	
Band 2 73.2 to 293 MWh p.a.		02BPD, 02BND, 02BPI, 02BNI		
Band 3 293 to 732 MWh p.a.	Non-PPM I&C	03W01-04, 04W01-04	Individual LDZ Analysis.	Individual LDZ Analysis, With WS using WS and SW
Band 4 732 to 2,196MWh p.a.				

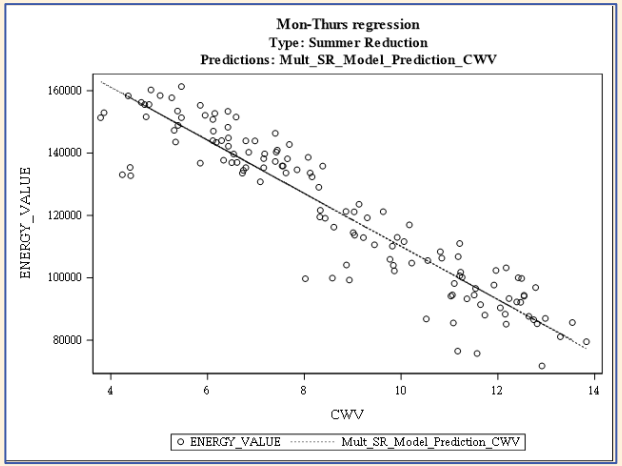
- Bands 3 and 4 are combined for WAR Band analysis purposes only

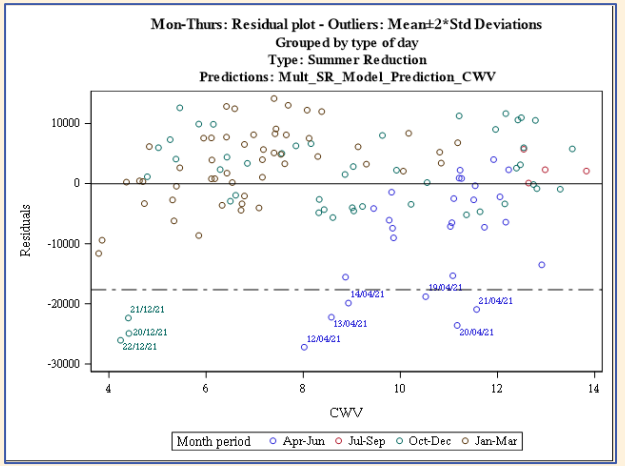
Results – 03W01-04 and 04W01-04 WAR Band Summary

Option 1	W01 (0 to 0.442)			W02 (0.443 to 0.477)			W03 (0.478 to 0.553)			W04 (0.554 to 1.000)		
LDZ	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF
SC	95.7%	207	54.1	95.1%	119	40.9	95.6%	257	31.6	91.6%	89	24.3
NO	95.3%	151	55.7	96.7%	77	39.5	96.9%	104	31.8	92.7%	51	24.2
NW	91.7%	201	56.4	95.6%	114	42.9	96.9%	160	33.7	93.4%	124	23.6
NE	94.3%	130	57.5	97.3%	84	43.8	96.1%	123	32.9	93.6%	118	23.2
EM	88.4%	164	54.9	96.4%	84	44.7	97.2%	156	33.6	95.1%	103	22.1
WM	93.8%	147	53.3	96.9%	103	40.4	96.0%	158	29.8	93.9%	113	22.2
WN	91.1%	225	57.4	95.9%	134	43.5	96.6%	176	34.3	94.1%	146	24.0
WS	**86.8%**	84	53.1	90.2%	37	43.2	94.8%	50	30.2	92.1%	24	20.1
EA	88.5%	131	55.8	95.1%	122	44.1	96.6%	152	33.7	94.7%	121	22.9
NT	93.9%	172	56.6	97.1%	133	44.9	97.3%	187	33.7	95.3%	118	24.9
SE	90.7%	176	56.7	96.6%	128	43.2	96.6%	224	32.8	96.6%	131	23.7
SO	87.7%	160	54.6	95.5%	93	39.4	97.1%	153	30.5	93.0%	132	20.9
SW	79.7%	141	59.5	93.1%	72	43.7	96.2%	108	31.4	95.3%	88	21.9
Option 2	W01 (0 to 0.442)			W02 (0.443 to 0.477)			W03 (0.478 to 0.553)			W04 (0.554 to 1.000)		
LDZ	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF	R^2 (All Days)	Sample Size	ILF
WS	83.9%	225	57.4	**94.3%**	109	44.2	**95.8%**	158	31.8	**95.1%**	112	22.1

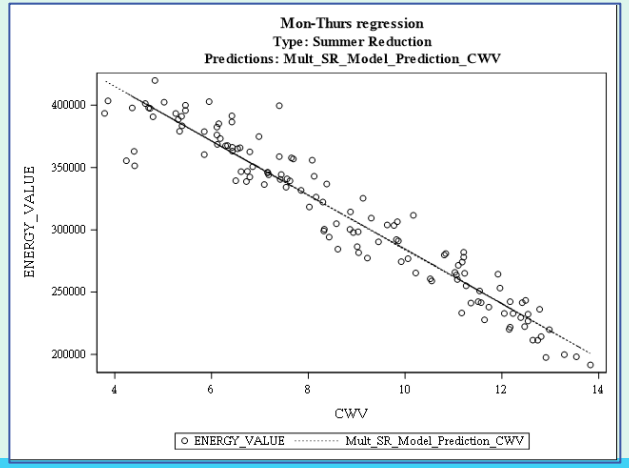
Results – Small NDM: 03/04W02 – WS

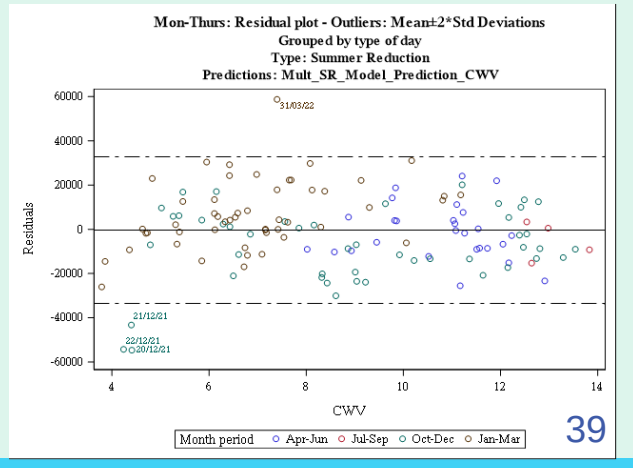
03/04W02 WS Option 1
Model: Summer Reduction
EUC: 03/04W02
LDZ: WS
Demand: WS
R^2: 90.2%
ILF: 43.2
Sample Points: 37



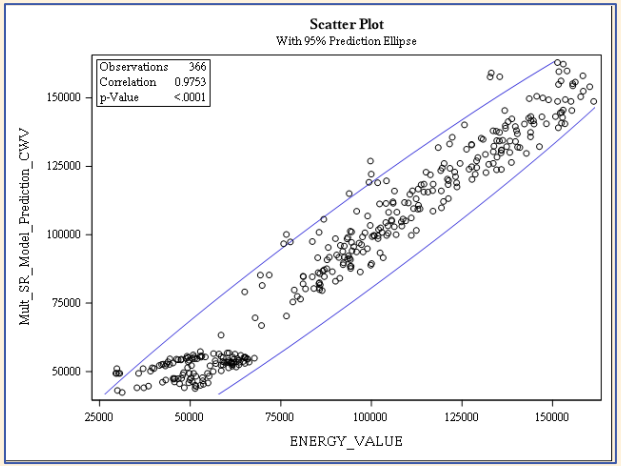


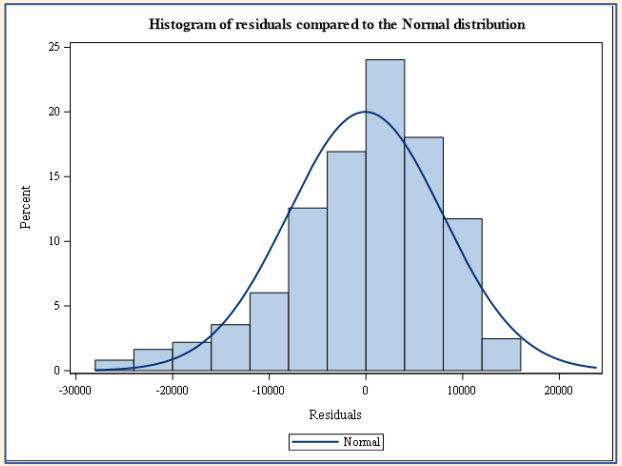
03/04W02 WS Option 2
Model: Summer Reduction
EUC: 03/04W02
LDZ: WS
Demand: WS and SW
R^2: 94.3%
ILF: 44.2
Sample Points: 109

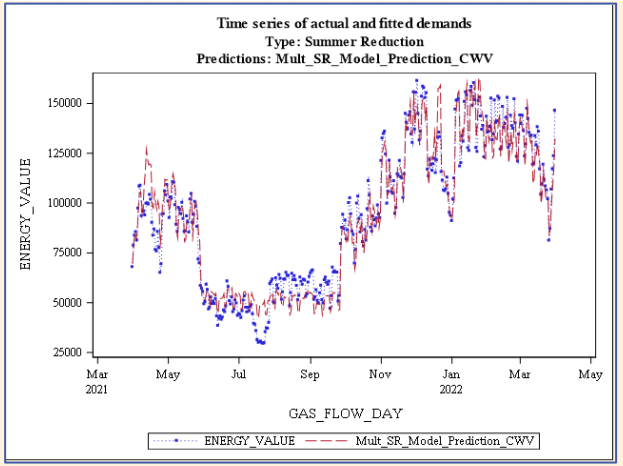


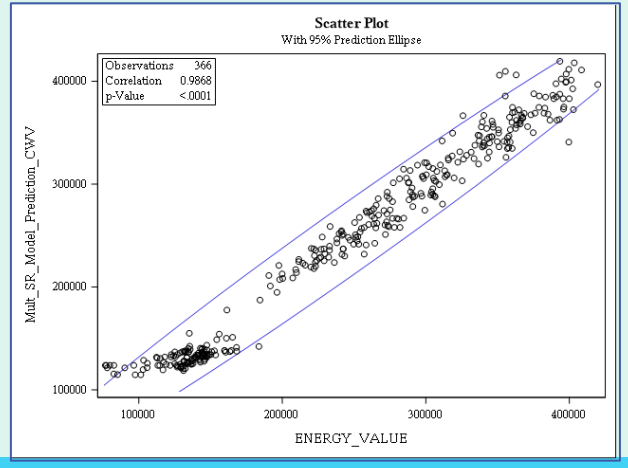


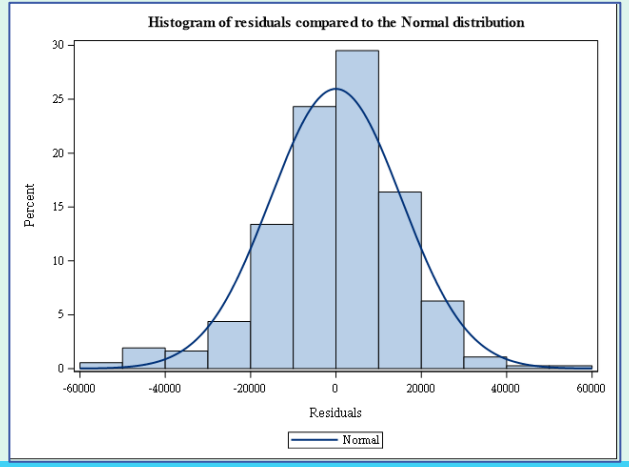
Results – Small NDM: 03/04W02 – WS

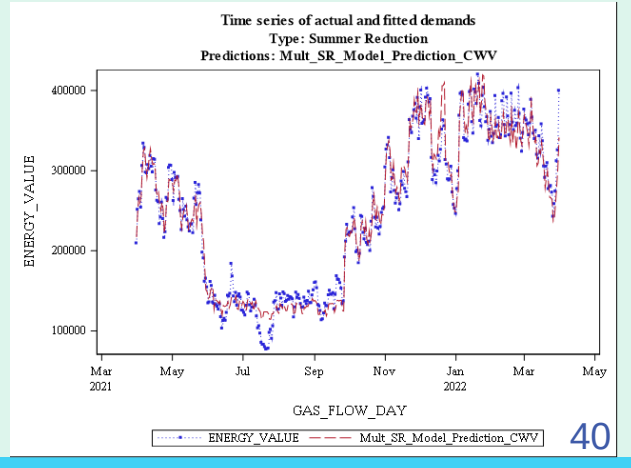












Results – 03W01-04 and 04W01-04 WAR Band Summary

Option 1

- R^2 values are between 79.7% and 97.3% (in line with previous results)
- Most ILF values are similar to previous years (within 3 percentage points)
- W01 has seen the biggest ILF changes with all LDZs reducing between 3.9 and 11.1 percentage points

Option 2

- Applies to WS only – combining sample data for WS and SW due to WAR Band 4 sample containing less than 30 sample points (24)
- R^2 values are between 83.9% and 95.8% similar to option 1 (86.8% to 94.8%)
- Recommendation is option 1 as R^2 values are similar and this retains regional integrity

Results – Small NDM I and C Conclusions

- Sample numbers are good with most models having similar or better overall numbers than previous years
- Good R^2 coefficients for the majority of Small NDM I and C Models
- Unusually cold weather has increased the number of outliers for May 21, however as this was a genuine weather:demand reaction the data points have been left in the modelling to avoid loss of key usage information
- March 21, (up to the 30th) was excluded from modelling due to COVID-19 impacts (in line with last year's approach). The dataset still has 12 months and a full set of holiday codes
- Are TWG happy to move to Demand Model Smoothing phase with the Small NDM I and C modelling results presented today?