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DESC Technical Workgroup

CWV Optimisation
Production Phase Results

17th November 2014

Contents

CWV Optimisation

Introduction

Background

- UNC (H1.4.2) requires the relevant Sub-committee (DESC) "*to review and where appropriate revise with effect from the start of a gas year the formula by which the CWV for an LDZ will be determined*"
- DESC asked its Technical Workgroup to preside over the detailed analysis and provide recommendations back to DESC
- Last review carried out in autumn 2009 and implemented on 1st October 2010. The next comprehensive review is being performed in autumn 2014 in order to support an implementation on 1st October 2015
- The review is usually done in conjunction with an update of the Seasonal Normal basis which is also scheduled to be revised in readiness for Gas Year 2015/16
- For more background information on the CWV calculation and the optimisation process – see the TWG meeting presentation given on 22nd September 2014

Trial Phase

- An approach document describing how the CWV Optimisation analysis would be performed was prepared and agreed earlier this year
- The approach included a Trial phase which would cover 4 LDZs enabling some initial results to be reviewed. The key objective of the Trial phase was to decide on the number of years to be included in the derivation of the CWV parameters
- At the DESC meeting on 15th October it was agreed that aggregate NDM demand data for **10 years** would be used to derive the majority of parameters – this covers the gas years **2004/05** upto and incl. **2013/14**
- The cold weather parameters use all available NDM demand data from 1996/97 upto and incl. 2013/14

Production Phase

- The objective of the Production Phase is to review all LDZs and seek the best set of CWV parameters for each LDZ which provide the best fit to aggregate NDM demand on average across the agreed period of 10 years
- For each LDZ a number of iterations using different ET ranges has been performed. Xoserve has provided a list of all the iterations in the results section and highlighted the runs which have been identified as the Top 2 ranked performing parameters
- At the end of the Production Phase TWG will be asked to provide its recommendation to DESC on the CWV parameters to be used for each LDZ with effect from 1st Oct '15
- Once approved the revised set of CWV parameters will be used in the calculation of the SNCWV which also needs to be reviewed and approved by the end of the year in readiness for AQ review 2015

Weather Data used in Production Phase

- Weather Station Substitution Methodology dataset produced by Met Office and approved in 2013 – used for first time during Optimisation Trial Phase
- More scientific approach to substitution means that WSSM data may differ from UKLink history – introduces additional change into parameters
- WSSM data runs to 30 September 2012 – remaining 2 Gas Years data taken from UKLink records
- In 2009 review certain years were excluded for some LDZs due to insufficient data points – especially 2005/06
- Where pseudo SNET graphs indicate that individual year(s) have a strong effect on shape of pseudo SNET, we have introduced additional iterations to test whether fits are better when excluded – these are flagged up in summary of iterations

CWV Optimisation

Explanation of Results

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Explanation of results provided
Results 1 – Example Format

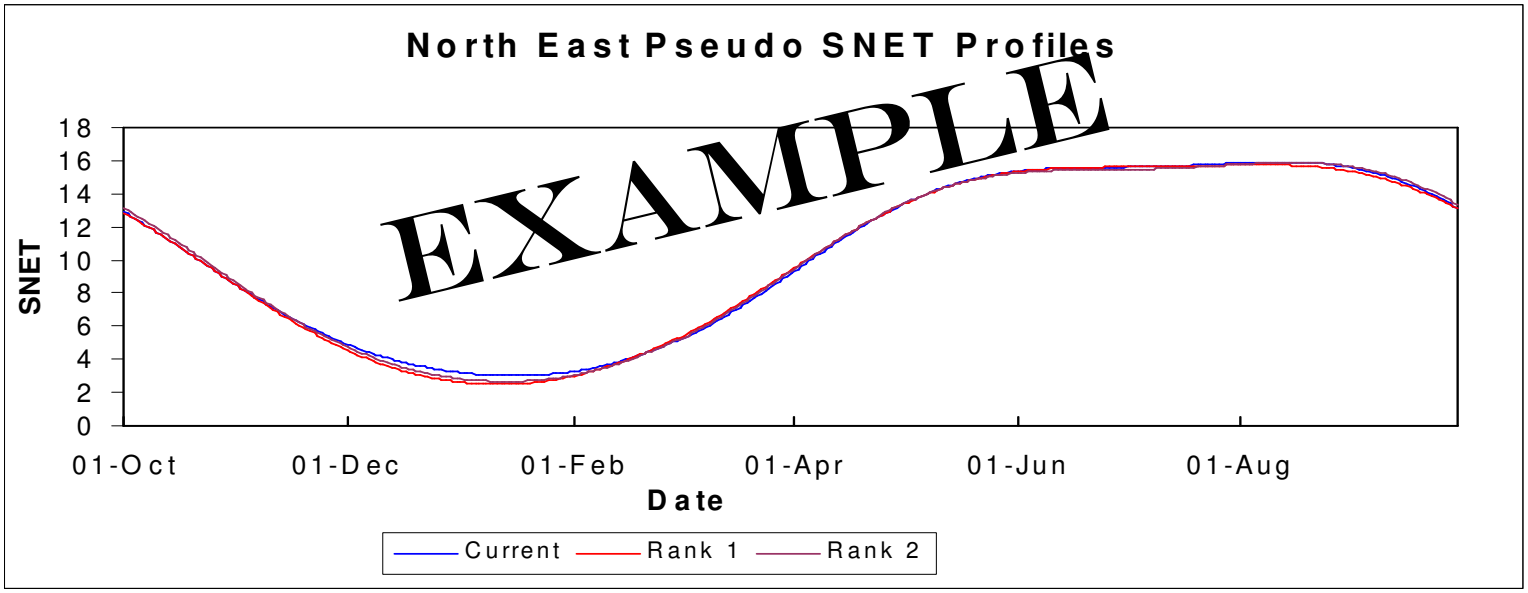
- **Objective:** To provide a summary of all the iterations attempted with the 2 highest ranked options highlighted. Ranking based on lowest Average RMSE

LDZ	Station
WM	BIR

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	3 to 13	0.698	0.0104	0.23	1	14	17.9	0.39		0.00%	6,436
	Current - New SNET	3 to 13	0.698	0.0104	0.23	1	14	17.9	0.39		1.51%	6,339
1	New	3 to 13	0.714	0.0115	0.14	3	13.8	17.3	0.42	0.05%	3.03%	6,241
2	New	2 to 13	0.72	0.0111	0.14	3	13.7	17.2	0.43	0.05%	3.01%	6,243
3	New	3 to 12	0.721	0.0117	0.14	3	13.8	17.2	0.43	0.05%	2.63%	6,267
4	New	2 to 12	0.727	0.0112	0.13	3	13.7	17.1	0.45	0.05%	2.56%	6,271
5	New	4 to 13	0.703	0.0126	0.16	3	13.7	17.3	0.43	0.04%	2.54%	6,273
6	New	4 to 12	0.711	0.0127	0.15	3	13.6	17	0.48	0.04%	2.32%	6,287
7	New	3 to 14	0.726	0.0119	0.14	3	14.1	17.3	0.42	0.04%	2.09%	6,302
8	New	2 to 14	0.734	0.0115	0.14	3	14.1	17.9	0.41	0.04%	1.99%	6,308
9	New	4 to 14	0.716	0.0131	0.17	3	14.1	17.3	0.43	0.03%	1.56%	6,336
										Pos - improvement against benchmark Neg - worse than benchmark		

Explanation of results provided
Results 2 – Example Format

- **Objective:** For the selected iterations compare all pseudo SNET profiles – Rank 1, Rank 2 and Current
- Visually compare profiles. High level observations on results provided



1 in 20 Explanation (1 of 2)

- Please note the following when considering the references to 1 in 20 calculations
- "Current" refers to use of WSSM plus UKLink weather dataset with EXISTING parameters. Therefore any assessment against "Current" in this optimisation exercise is not the same as comparing to EXISTING Gas Industry weather datasets with EXISTING parameters
- 1 in 20 Peak CWV (Results 7)
  - This is a theoretical value of the 1 in 20 CWV (as used in Appendix 12)
  - CWVs are calculated using WSSM plus UK Link weather data from 1st October 1960 to 30th September 2014
  - "Current" 1 in 20 is based on the new weather history and applying EXISTING parameters
  - A specific run's 1 in 20 is based on the weather history and applying that run's set of parameters.

1 in 20 Explanation (2 of 2)

- Average % difference in estimated 1 on 20 peak demand (Results 3)

- These are theoretical differences calculated as:
  - Regressions are run for each gas year 2004 - 2013 for Monday - Thursdays using
    - "Current" CWVs vs demands
    - A specific run's CWVs vs demands
  - A theoretical demand level is calculated using regression parameters (intercept and slope) for each gas year 2004 – 2013 for "Current" and revised CWV
  - % Difference for each gas year calculated between the "current" and revised theoretical 1 in 20 demand figures
  - The % Difference for each gas year is then averaged to give overall percentage difference used in the slides.

Explanation of results provided
Results 3 – Example Format

- **Objective:** To confirm the selected iterations provide a strong fit between weather and demand on average tested against 2004/05 to 2013/14 and assess change in estimated 1 in 20 peak aggregate NDM demand
- Results of current vs Alternatives are represented as **Green:** Better fit; **Red:** Worse fit

LDZ	Station
WM	BIR

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		3 to 13	3.91%	99.28%	6,436	
New	1	3 to 13	3.79%	99.33%	6,241	0.20
New	2	2 to 13	3.79%	99.33%	6,243	0.42

Explanation of results provided
Results 4 – Example Format

- **Objective:** To ensure strong relationship is maintained throughout the seasons
  MAPE* provides the absolute error on average across the period 2004/05 to 2013/14
  MPRE* assesses the average seasonal bias
- Results of Current vs Alternatives are represented as **Green:** Better fit; **Red:** Worse fit.

LDZ	Station
WM	BIR

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 13	2.76%	4.88%	6.48%	3.85%
New	1	3 to 13	2.67%	4.65%	6.27%	3.80%
New	2	2 to 13	2.66%	4.67%	6.31%	3.80%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 13	0.45%	-1.56%	1.74%	0.08%
New	1	3 to 13	0.06%	0.20%	-1.19%	0.18%
New	2	2 to 13	0.12%	0.22%	-1.24%	0.09%

- ** MAPE is the Mean Absolute Percentage Error*
- ** MPRE is the Mean Percentage Residual Error where (+) is Predicted < Actual and (-) is Predicted > Actual*

Explanation of results provided
Results 5 – Example Format

- **Objective:** To assess the average performance over each month. MAPE provides the absolute error on average per month across the period 2004/05 to 2013/14
- Results of Current vs Alternatives are represented as **Green:** Better fit; **Red:** Worse fit.

LDZ	Station
WM	BIR

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	2.73%	2.76%	2.77%	3.26%	5.94%	8.34%
New	1	3 to 13	2.60%	2.77%	2.64%	3.04%	5.79%	7.95%
New	2	2 to 13	2.58%	2.75%	2.63%	3.04%	5.82%	8.02%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	6.17%	6.76%	6.54%	5.35%	4.45%	2.98%
New	1	3 to 13	5.57%	6.24%	7.03%	5.02%	4.45%	2.98%
New	2	2 to 13	5.54%	6.44%	7.01%	4.99%	4.48%	2.98%

Explanation of results provided
Results 6 – Example Format

- **Objective:** To assess the average performance over each month. MPRE provides the average seasonal bias per month across the period 2004/05 to 2013/14
- Results of Current vs Alternatives are represented as **Green:** Less bias; **Red:** More bias

LDZ	Station
WM	BIR

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	0.85%	0.45%	0.16%	-1.01%	-2.01%	-2.61%
New	1	3 to 13	0.41%	0.04%	0.16%	-0.12%	0.78%	0.22%
New	2	2 to 13	0.38%	0.13%	-0.04%	0.01%	0.74%	0.02%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	2.41%	3.74%	-0.96%	0.62%	0.03%	-0.06%
New	1	3 to 13	0.99%	-0.95%	-3.73%	-0.09%	0.60%	-0.01%
New	2	2 to 13	0.96%	-1.05%	-3.75%	-0.44%	0.55%	-0.04%

Explanation of results provided
Results 7 – Example Format

- **Objective:** To compare Top 2 ranked Alternative CWV parameters with Current CWV parameters including 1 in 20 peak CWV

LDZ	Station
WM	BIR

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ETR Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		3 to 13	-540	0.698	0.0104	0.23	1	14	17.9	0.39
New	1	3 to 13	-582	0.714	0.0115	0.14	3	13.8	17.3	0.42
New	2	2 to 13	-576	0.72	0.0111	0.14	3	13.7	17.2	0.43

CWV Optimisation

Production Phase Results - SC

SC LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **SC** CWV Optimisation process is
  - Aggregate NDM demand for **SC** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **SC** CWV Optimisation process is
  - Weather data from **Glasgow Bishopton** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: SC LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
SC	BIS

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	4 to 13	0.653	0.0118	0.19	3	13.2	16	0.64		0.00%	6,042
	Current - New SNET	4 to 13	0.653	0.0118	0.19	3	13.2	16	0.64		1.05%	5,979
1	New	4 to 11	0.635	0.0119	0.15	3	12.2	16	0.64	0.04%	2.45%	5,894
2	New	3 to 11	0.65	0.0116	0.12	3	12.1	15.8	0.68	0.05%	2.45%	5,894
3	New	5 to 11	0.621	0.0125	0.16	3	11.9	15.8	0.66	0.04%	2.18%	5,910
4	New	2 to 11	0.662	0.0116	0.11	3	12.3	15.8	0.68	0.04%	2.15%	5,913
5	New	3 to 12	0.656	0.0115	0.14	3	12.7	16	0.64	0.04%	1.95%	5,925
6	New	2 to 12	0.665	0.0114	0.12	3	12.7	15.9	0.65	0.03%	1.77%	5,935
7	New	4 to 12	0.643	0.0119	0.18	3	13.1	16.4	0.57	0.03%	1.57%	5,947
8	New	3 to 13	0.663	0.0118	0.13	3	12.8	15.8	0.68	0.03%	1.30%	5,964
9	New	4 to 13	0.652	0.0123	0.16	3	12.9	16	0.66	0.02%	1.29%	5,964
10	New	2 to 13	0.671	0.0116	0.13	3	12.9	15.9	0.67	0.02%	1.21%	5,969
11	New	3 to 14	0.665	0.0118	0.15	3	13.2	15.9	0.68	0.01%	0.30%	6,024
12	New	4 to 14	0.652	0.0124	0.18	3	13.2	15.9	0.68	0.01%	0.27%	6,026
13	New	4 to 10	0.66	0.0125	0.13	3	13	16	0.65	0.01%	-0.22%	6,056
14	New	4 to 15	0.642	0.0126	0.2	3	13.4	15.9	0.68	-0.01%	-0.51%	6,073

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **2.45%** when compared with current parameters
- Rank 2 also displayed a **2.45%** improvement

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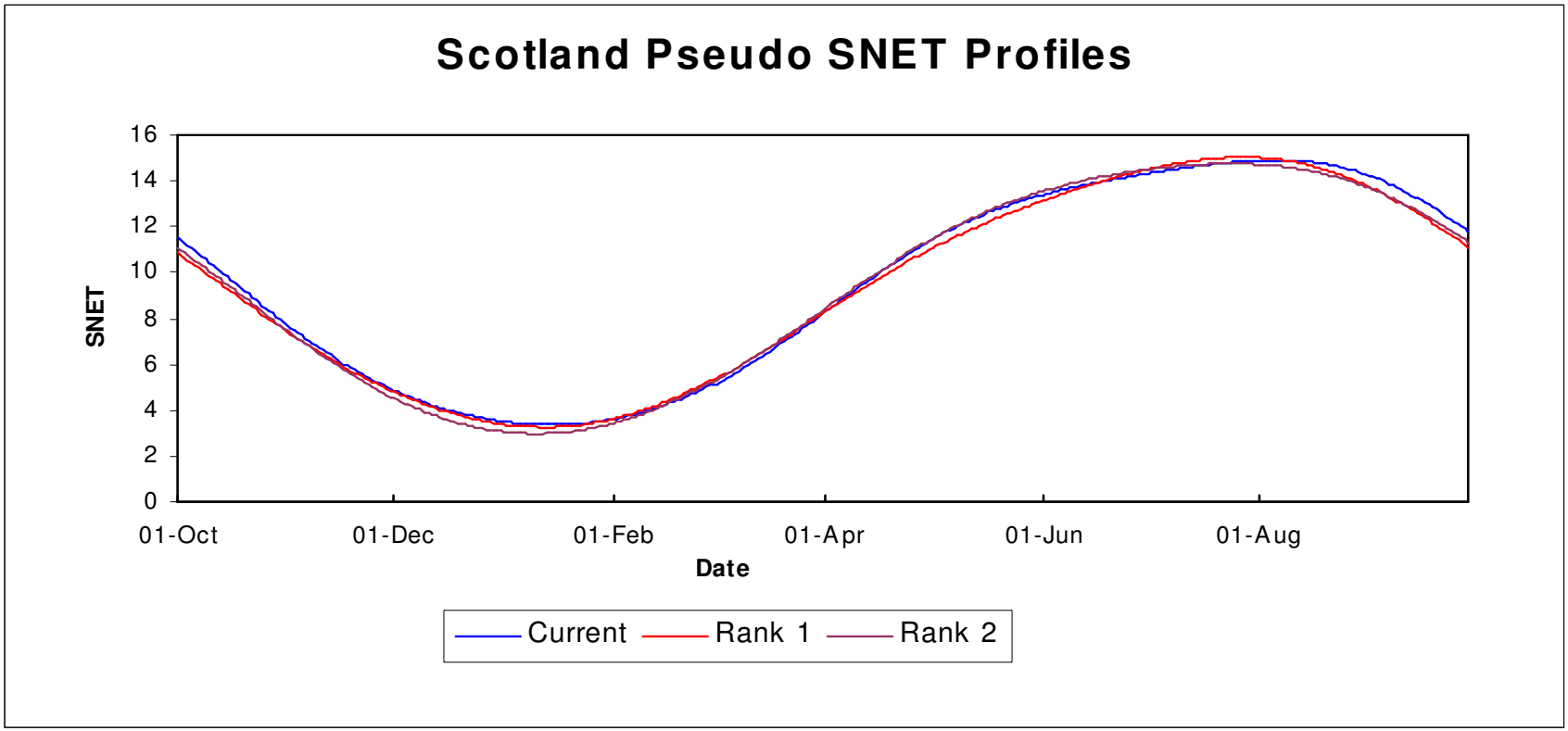
Results 2: SC LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles lower than current profile in early autumn, Rank 1 similar to current in winter whereas Rank 2 lower, Rank 1 lower in Spring and finally Rank1/2 profiles lower than current in late summer

Results 3: SC LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
SC	BIS

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		4 to 13	3.87%	99.10%	6,042	
New	1	4 to 11	3.78%	99.14%	5,894	-0.35
New	2	3 to 11	3.79%	99.14%	5,894	-0.67

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: SC LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
SC	BIS

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 13	2.51%	4.37%	7.22%	3.92%
New	1	4 to 11	2.49%	4.28%	6.84%	3.86%
New	2	3 to 11	2.49%	4.26%	6.95%	3.87%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 13	0.12%	-0.79%	-0.42%	0.72%
New	1	4 to 11	-0.17%	0.15%	-0.23%	0.20%
New	2	3 to 11	-0.13%	0.22%	-0.47%	0.18%

- On average, Rank 1 displays better seasonal fit for 2 quarters (MAPE)
- On average, Rank 1 indicates better seasonal bias for 2 quarters (MPRE)

Results 5: SC LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
SC	BIS

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 13	2.59%	2.53%	2.43%	3.55%	4.67%	6.21%
New	1	4 to 11	2.63%	2.50%	2.39%	3.55%	4.57%	5.90%
New	2	3 to 11	2.62%	2.50%	2.38%	3.52%	4.55%	5.91%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 13	7.09%	8.33%	6.40%	6.63%	4.05%	2.71%
New	1	4 to 11	6.81%	7.79%	6.06%	6.39%	4.01%	2.72%
New	2	3 to 11	6.74%	8.09%	6.18%	6.36%	4.04%	2.72%

- On average across the 12 months, Rank 2 has the best seasonal fit in 6 months Rank 1 is better in 4 months

Results 6 : SC LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
SC	BIS

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 13	0.71%	0.53%	-0.67%	-0.62%	-0.84%	-1.20%
New	1	4 to 11	0.34%	-0.12%	-0.57%	0.18%	0.13%	0.08%
New	2	3 to 11	0.11%	-0.02%	-0.40%	0.22%	0.21%	0.23%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 13	0.48%	-4.18%	1.89%	3.15%	0.38%	-0.05%
New	1	4 to 11	1.28%	-2.89%	0.51%	1.25%	0.19%	-0.22%
New	2	3 to 11	1.36%	-3.32%	0.13%	1.08%	0.38%	-0.33%

- For 10 of 12 months the revised parameters show better seasonal bias when compared to current. Rank 1 better for 5 months and Rank 2 better for 5 months

Results 7: SC LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
SC	BIS

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		4 to 13	-6.52	0.653	0.0118	0.19	3	13.2	16	0.64
New	1	4 to 11	-6.03	0.635	0.0119	0.15	3	12.2	16	0.64
New	2	3 to 11	-5.98	0.65	0.0116	0.12	3	12.1	15.8	0.68

- Similar weightings applied to L1 parameter
- Cold weather upturn still present with slightly less weighting
- Warm weather cut-off, V2, same for Rank 1 and slightly decreased for Rank 2

- On average Rank 1 and Rank 2 show an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for SC LDZ**

CWV Optimisation

Production Phase Results - NO

NO LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **NO** CWV Optimisation process is
  - Aggregate NDM demand for **NO** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis apart from 01/06/97 to 05/06/97, 07/08/08 and 09/06/2011
- For these gas years the weather data used in **NO** CWV Optimisation process is
  - Weather data from **Albermarle** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: NO LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
NO	ALB

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	2 to 11	0.636	0.0102	0.5	0	12.5	15.7	0.56		0.00%	4,583
	Current - New SNET	2 to 11	0.636	0.0102	0.5	0	12.5	15.7	0.56		-9.69%	5,027
1	New	2 to 12	0.659	0.0086	0.16	3	13	15.9	0.47	0.06%	2.24%	4,457
2	New	1 to 12	0.663	0.0086	0.15	3	13	16	0.46	0.06%	2.20%	4,459
3	New	3 to 12	0.643	0.0085	0.19	3	12.8	15.7	0.52	0.05%	2.04%	4,490
4	New	2 to 13	0.654	0.0086	0.17	3	13.2	16.2	0.43	0.05%	2.01%	4,491
5	New	1 to 13	0.66	0.0086	0.16	3	13.2	16.3	0.42	0.05%	1.97%	4,493
6	New	3 to 13	0.638	0.0086	0.19	3	12.9	15.7	0.52	0.05%	1.85%	4,499
7	New	3 to 11	0.654	0.0087	0.15	3	13.5	16.1	0.34	-0.01%	-0.45%	4,604
8	New	2 to 11	0.669	0.0088	0.08	3	13.5	17.3	0.29	-0.12%	-4.44%	4,787
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **2.24%** when compared with current parameters
- Rank 2 displayed a **2.20%** improvement

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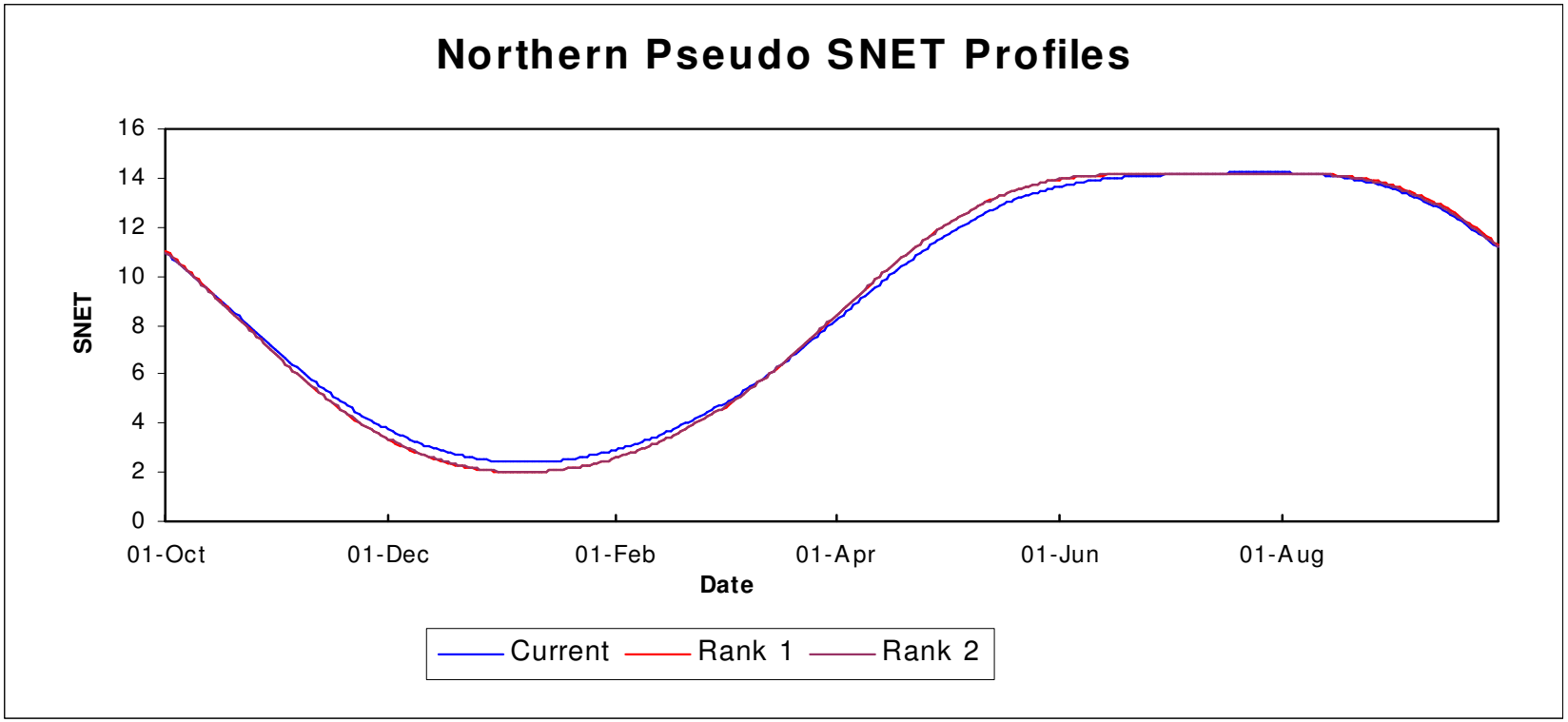
Results 2: NO LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles lower than current profile in winter and higher in spring / early summer
- Rank 1 and Rank 2 profiles very similar

Results 3: NO LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
NO	ALB

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		2 to 11	4.77%	98.74%	4,583	
New	1	2 to 12	4.63%	98.81%	4,457	-5.65
New	2	1 to 12	4.63%	98.81%	4,459	-5.71

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, Avge. Adj. R-sq. and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: NO LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
NO	ALB

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		2 to 11	3.16%	6.11%	8.48%	4.42%
New	1	2 to 12	2.91%	6.12%	8.21%	4.36%
New	2	1 to 12	2.91%	6.11%	8.22%	4.36%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		2 to 11	0.06%	-0.40%	0.08%	0.25%
New	1	2 to 12	-0.12%	0.37%	-1.14%	0.29%
New	2	1 to 12	-0.09%	0.30%	-1.02%	0.26%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 indicate worse seasonal bias for 3 quarters (MPRE)

Results 5: NO LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
NO	ALB

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		2 to 11	3.70%	2.87%	3.05%	4.93%	6.48%	9.00%
New	1	2 to 12	3.20%	2.62%	2.97%	4.86%	6.59%	9.05%
New	2	1 to 12	3.21%	2.60%	2.97%	4.85%	6.57%	9.11%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		2 to 11	10.02%	7.20%	7.98%	7.03%	4.90%	3.15%
New	1	2 to 12	9.45%	6.97%	8.02%	7.00%	4.86%	3.05%
New	2	1 to 12	9.48%	6.85%	8.11%	7.00%	4.89%	3.04%

- On average across the 12 months, Rank 1 has the best seasonal fit in 4 months and Rank 2 has the best in 5 months
- One or other of the top 2 runs is better than current for 9 months

Results 6 : NO LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
NO	ALB

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		2 to 11	0.86%	-0.44%	-0.04%	-0.26%	-0.13%	-1.24%
New	1	2 to 12	0.57%	-0.54%	-0.21%	0.33%	1.03%	-0.63%
New	2	1 to 12	0.65%	-0.51%	-0.21%	0.31%	0.93%	-0.81%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		2 to 11	2.40%	0.77%	-3.15%	1.22%	0.54%	-0.29%
New	1	2 to 12	2.23%	-1.65%	-4.39%	1.43%	0.48%	-0.25%
New	2	1 to 12	2.40%	-1.31%	-4.51%	1.15%	0.41%	-0.16%

- Mixed picture with current parameters showing better seasonal bias for 6 of 12 months with Rank 1 better for 3 months and Rank 2 better for 3 months.

Results 7: NO LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
NO	ALB

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		2 to 11	-6.83	0.636	0.0102	0.5	0	12.5	15.7	0.56
New	1	2 to 12	-5.73	0.659	0.0086	0.16	3	13	15.9	0.47
New	2	1 to 12	-5.68	0.663	0.0086	0.15	3	13	16	0.46

  - Slightly more weighting applied to L1 parameter
  - Cold weather upturn still present however L3 and V0 reflect it starting at warmer temperatures with a smaller weighting
  - Warm weather cut-off, V2, increased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for NO LDZ**

CWV Optimisation

Production Phase Results - NW

NW LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **NW** CWV Optimisation process is
  - Aggregate NDM demand for **NW** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **NW** CWV Optimisation process is
  - Weather data from **Rostherne No.2** weather station. Combination of WSSM and UK Link (bias adjustment incorporated)
- All years in period used to derive Pseudo SNET profile

Results 1: NW LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
NW	ROS

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	4 to 15	0.661	0.0149	0.26	3	15.5	18.5	0.41		0.00%	8,999
	Current - New SNET	4 to 15	0.661	0.0149	0.26	3	15.5	18.5	0.41		0.10%	8,990
1	New	2 to 15	0.697	0.0149	0.3	3	14.9	18	0.38	0.09%	4.52%	8,592
2	New	3 to 15	0.688	0.0149	0.32	3	14.9	17.9	0.39	0.09%	4.47%	8,597
3	New	1 to 15	0.704	0.0146	0.28	3	14.9	17.8	0.39	0.09%	4.36%	8,606
4	New	4 to 15	0.68	0.0159	0.34	3	14.9	17.9	0.4	0.09%	4.13%	8,627
5	New	3 to 14	0.694	0.0145	0.3	3	15	18.3	0.34	0.08%	4.03%	8,636
6	New	2 to 14	0.701	0.0146	0.28	3	15	18.4	0.33	0.08%	4.02%	8,637
7	New	2 to 16	0.685	0.0156	0.32	3	15.1	18.4	0.34	0.08%	3.94%	8,644
8	New	1 to 16	0.692	0.0151	0.3	3	15.1	18.5	0.33	0.08%	3.88%	8,650
9	New	3 to 16	0.676	0.0157	0.35	3	15.2	18.8	0.31	0.08%	3.79%	8,657

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **4.52%** when compared with current parameters
- Rank 2 displayed a **4.47%** improvement

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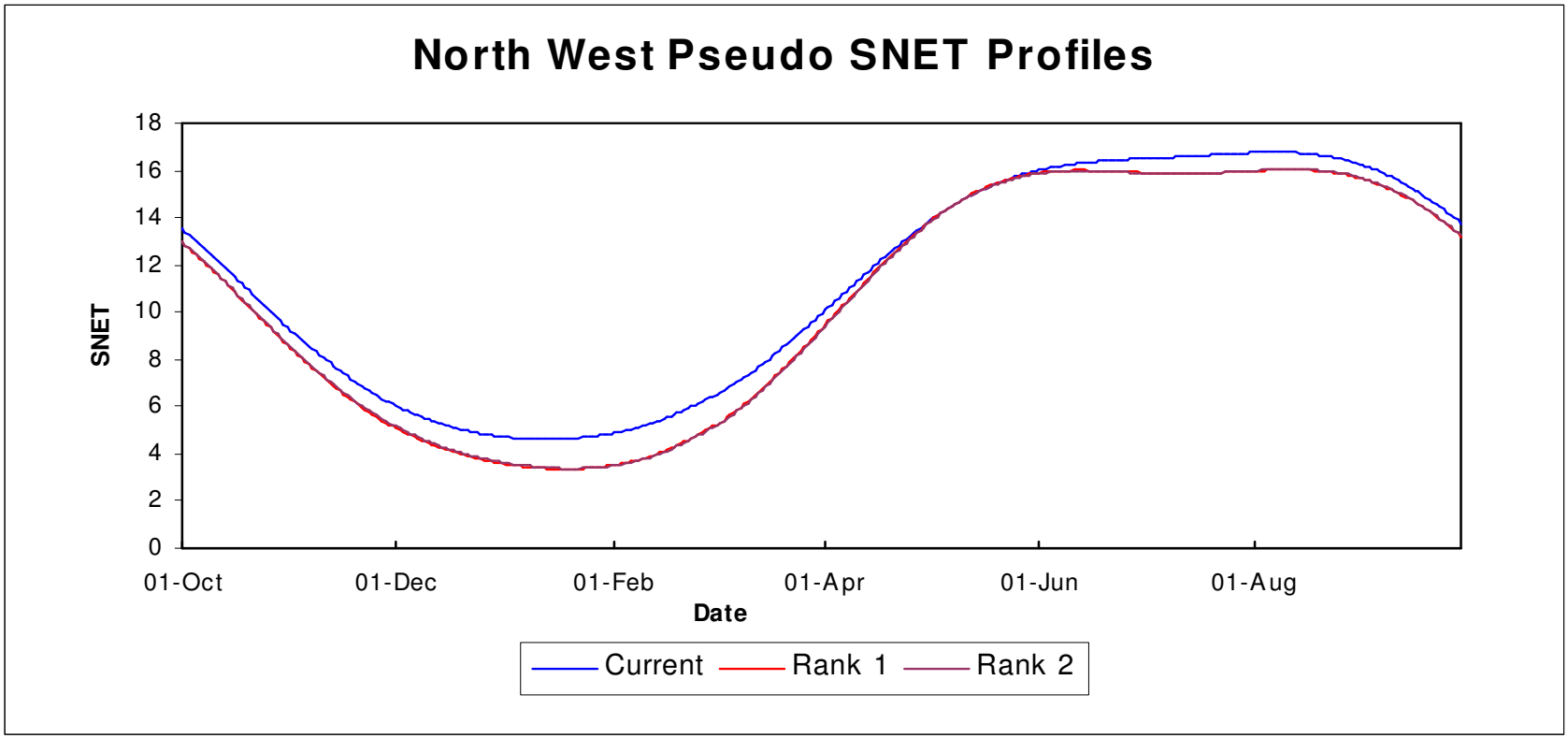
Results 2: NW LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles markedly lower than current profile in autumn, winter and spring and lower again during summer
- Rank 1 and Rank 2 profiles very similar

Results 3: NW LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
NW	ROS

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		4 to 15	4.22%	99.10%	8,999	
New	1	2 to 15	3.96%	99.20%	8,592	2.85
New	2	3 to 15	3.96%	99.19%	8,597	3.08

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, Avge. Adj. R-Sq and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: NW LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green:** Better fit **Red:** Worse fit

LDZ	Station
NW	ROS

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 15	2.71%	5.27%	7.82%	4.11%
New	1	2 to 15	2.58%	5.14%	6.66%	3.89%
New	2	3 to 15	2.62%	5.13%	6.63%	3.87%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 15	0.29%	-0.71%	2.21%	-0.65%
New	1	2 to 15	-0.14%	0.46%	-1.70%	0.46%
New	2	3 to 15	-0.19%	0.43%	-1.63%	0.53%

- On average, Rank 2 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 marginally less seasonal bias (MPRE)

Results 5: NW LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit; **Red:** Worse fit

LDZ	Station
NW	ROS

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 15	2.90%	2.55%	2.74%	3.66%	6.06%	9.05%
New	1	2 to 15	2.60%	2.46%	2.69%	3.62%	6.01%	8.49%
New	2	3 to 15	2.64%	2.48%	2.73%	3.63%	6.00%	8.38%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 15	8.34%	7.73%	7.35%	6.86%	4.22%	3.07%
New	1	2 to 15	6.28%	6.67%	7.04%	6.47%	4.34%	2.68%
New	2	3 to 15	6.25%	6.69%	6.96%	6.44%	4.28%	2.69%

- On average across the 12 months, Rank 1 has better seasonal fit in 6 months and better than current for 11 months

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Results 6 : NW LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
NW	ROS

			MPRE					
Parameters	**Ranking**	**ET Range**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**
Current		4 to 15	0.38%	0.53%	0.00%	0.63%	-1.20%	-4.14%
New	1	2 to 15	0.41%	0.21%	-0.82%	0.72%	0.85%	-1.07%
New	2	3 to 15	0.55%	0.13%	-0.97%	0.58%	0.87%	-0.81%

			MPRE					
Parameters	**Ranking**	**ET Range**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**
Current		4 to 15	0.71%	4.93%	1.11%	1.05%	-0.62%	-1.27%
New	1	2 to 15	-0.22%	-1.22%	-3.72%	1.48%	1.27%	-0.44%
New	2	3 to 15	-0.16%	-1.26%	-3.51%	1.61%	1.28%	-0.35%

- Mixed results for seasonal bias when compared with current parameters

Results 7: NW LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
NW	ROS

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		4 to 15	-5.48	0.661	0.0149	0.26	3	15.5	18.5	0.41
New	1	2 to 15	-6.58	0.697	0.0149	0.3	3	14.9	18	0.38
New	2	3 to 15	-6.65	0.688	0.0149	0.32	3	14.9	17.9	0.39

- Slightly more weighting applied to L1 parameter
- Cold weather upturn still present at similar levels
- Warm weather cut-off, V2, decreased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for NW LDZ**

CWV Optimisation

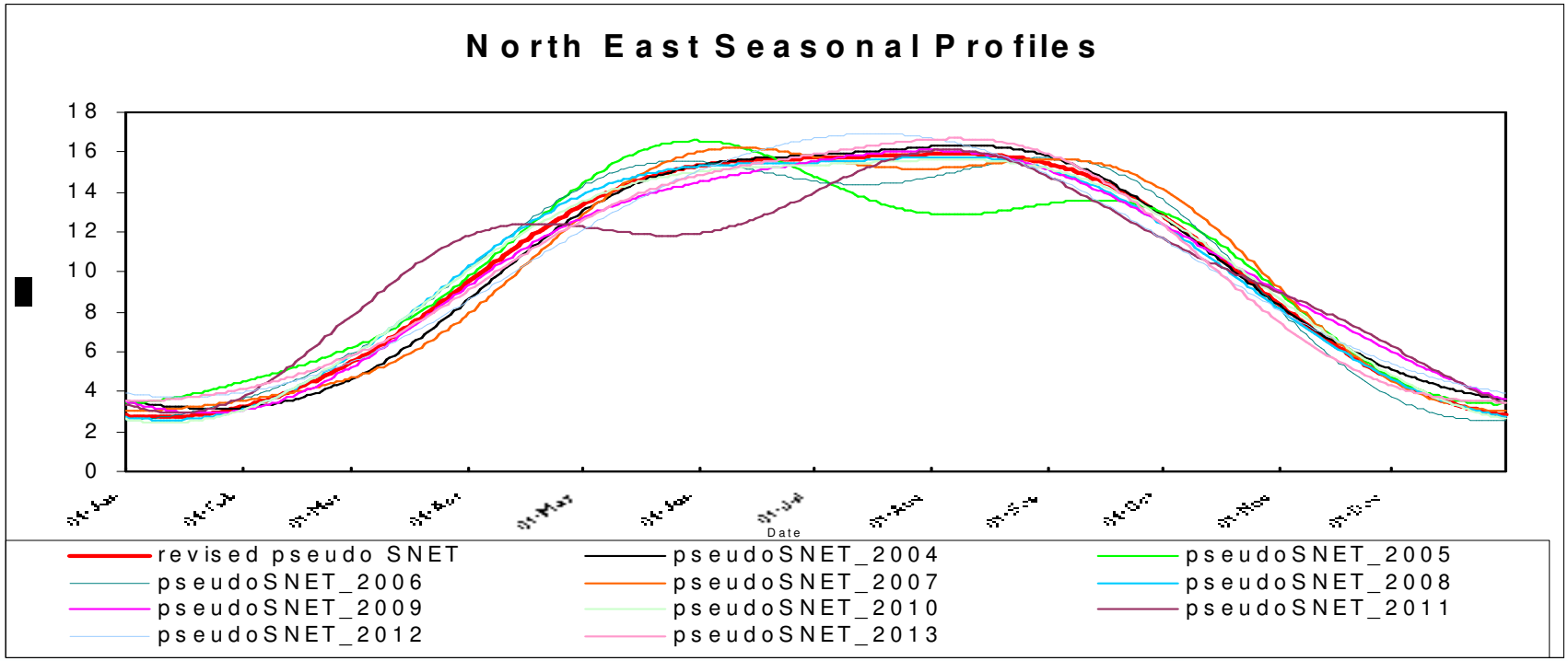
Production Phase Results - NE

NE LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **NE** CWV Optimisation process is
  - Aggregate NDM demand for **NE** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **NE** CWV Optimisation process is
  - Weather data from **Nottingham Watnall** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile. In some instances additional runs were attempted excl. 2005/06 and/or 2011/12 gas year(s)

NE LDZ Pseudo SNET

- Some results were improved when 2005/06 and 2011/12 gas year(s) was removed from the Pseudo SNET calculation – see next slide for iterations where this was tried



Results 1: NE LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
NE	WAT

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	3 to 15	0.692	0.0150	0	0	14.8	17.9	0.43		0.00%	5,516
	Current - New SNET	3 to 15	0.692	0.0150	0	0	14.8	17.9	0.43		0.40%	5,494
1	New: SNET 05/06,11/12 L1,L2 11/12 Rem	3 to 14	0.659	0.0157	0.03	3	14.5	17.8	0.41	0.03%	1.20%	5,450
2	New	3 to 14	0.676	0.0159	0	0	14.7	17.9	0.38	0.03%	1.10%	5,455
3	New: L1,L2 11/12 Rem	3 to 14	0.666	0.0156	0.02	3	14.7	17.9	0.39	0.03%	1.08%	5,456
4	New: L1,L2 11/12 Rem (V0,L3 as 0)	3 to 14	0.666	0.0156	0	0	14.7	17.9	0.39	0.03%	1.08%	5,456
5	New: SNET 05/06,11/12 L1,L2 05/06,11/12 Rem	3 to 14	0.651	0.0165	0.04	3	14.6	17.8	0.4	0.02%	1.00%	5,461
6	New	2 to 14	0.681	0.0157	0	0	14.7	17.9	0.39	0.03%	0.96%	5,463
7	New	2 to 15	0.672	0.0161	0.01	3	14.7	17.9	0.4	0.03%	0.95%	5,464
8	New: V0 as 0	3 to 15	0.668	0.0165	0	0	14.7	17.9	0.4	0.02%	0.89%	5,467
9	New	3 to 15	0.668	0.0165	0.01	3	14.7	17.9	0.4	0.02%	0.89%	5,467
10	New: V0 as 0	2 to 15	0.672	0.0161	0	0	14.7	17.9	0.4	0.02%	0.87%	5,468
11	New: SNET 11/12 Rem	3 to 14	0.685	0.0163	0.01	3	14.7	18	0.4	0.02%	0.85%	5,469
12	New	4 to 14	0.661	0.018	0	0	14.6	17.8	0.41	0.02%	0.67%	5,479
13	New	3 to 13	0.686	0.0158	0	0	14.8	18	0.37	0.02%	0.52%	5,487
14	New	2 to 16	0.663	0.017	0.03	3	14.9	18	0.39	0.01%	0.32%	5,498
15	New	4 to 15	0.655	0.0186	0	0	14.7	17.9	0.4	0.01%	0.26%	5,502
16	New	3 to 16	0.659	0.0175	0.02	3	14.9	18	0.39	0.01%	0.18%	5,506
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **1.20%** when compared with current parameters
- Rank 2 displayed a **1.10%** improvement

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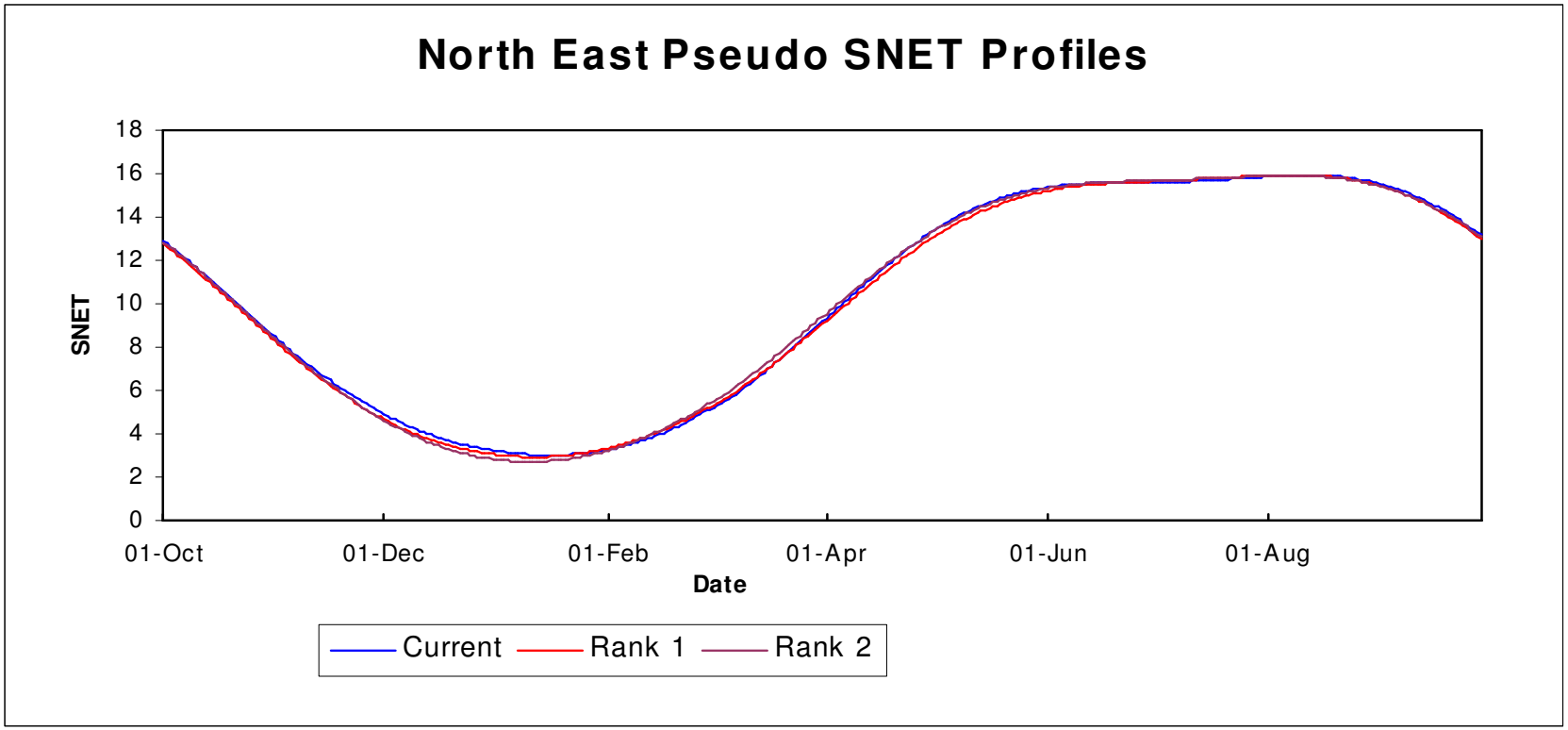
Results 2: NE LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles similar shape and level to current Pseudo SNET

Results 3: NE LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
NE	WAT

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		3 to 15	4.76%	98.79%	5,516	
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	4.65%	98.82%	5,450	1.15
New	2	3 to 14	4.66%	98.82%	5,455	0.73

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: NE LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
NE	WAT

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 15	3.30%	5.95%	7.62%	4.72%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	3.27%	5.85%	7.07%	4.66%
New	2	3 to 14	3.26%	5.86%	7.14%	4.67%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 15	0.53%	-0.72%	-0.59%	0.10%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	0.18%	0.08%	-1.22%	0.13%
New	2	3 to 14	0.13%	0.28%	-1.37%	0.09%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 2 displays better seasonal bias for 2 quarters (MPRE)

Results 5: NE LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
NE	WAT

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 15	3.51%	3.08%	3.37%	4.86%	6.17%	8.93%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	3.32%	3.10%	3.39%	4.83%	6.23%	8.39%
New	2	3 to 14	3.28%	3.11%	3.37%	4.81%	6.22%	8.53%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 15	8.74%	6.42%	7.58%	6.68%	5.00%	3.84%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	7.98%	6.06%	7.06%	6.33%	4.95%	3.87%
New	2	3 to 14	8.06%	6.15%	7.10%	6.38%	4.98%	3.86%

- On average across the 12 months, Rank 1 has the best seasonal fit in 6 months and is better than current for 8 months

Results 6 : NE LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
NE	WAT

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 15	1.38%	0.73%	-0.22%	-1.17%	0.49%	-1.42%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	0.72%	0.17%	-0.18%	-0.67%	1.33%	0.30%
New	2	3 to 14	0.55%	0.01%	-0.04%	-0.26%	1.58%	-0.32%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 15	0.72%	0.16%	-2.72%	0.67%	0.44%	-0.32%
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	1.41%	-1.33%	-3.93%	1.17%	0.93%	-0.76%
New	2	3 to 14	1.13%	-1.28%	-4.15%	0.85%	0.90%	-0.70%

- Mixed picture for seasonal bias with Rank 1 or 2 better for 5 months and current parameters better for 7 months

Results 7: NE LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
NE	WAT

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		3 to 15	-5.78	0.692	0.015	0	0	14.8	17.9	0.43
New: SNET 05/06,11/12 L1,L2 11/12 Rem	1	3 to 14	-6.03	0.659	0.0157	0.03	3	14.5	17.8	0.41
New	2	3 to 14	-5.98	0.676	0.0159	0	0	14.7	17.9	0.38

- Less weighting applied to L1 parameter
- Small Cold weather upturn now present
- Warm weather cut-off, V2, not much change evident

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for NE LDZ**

CWV Optimisation

Production Phase Results - EM

EM LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **EM** CWV Optimisation process is
  - Aggregate NDM demand for **EM** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **EM** CWV Optimisation process is
  - Weather data from **Nottingham Watnall** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: EM LDZ – Iteration summary

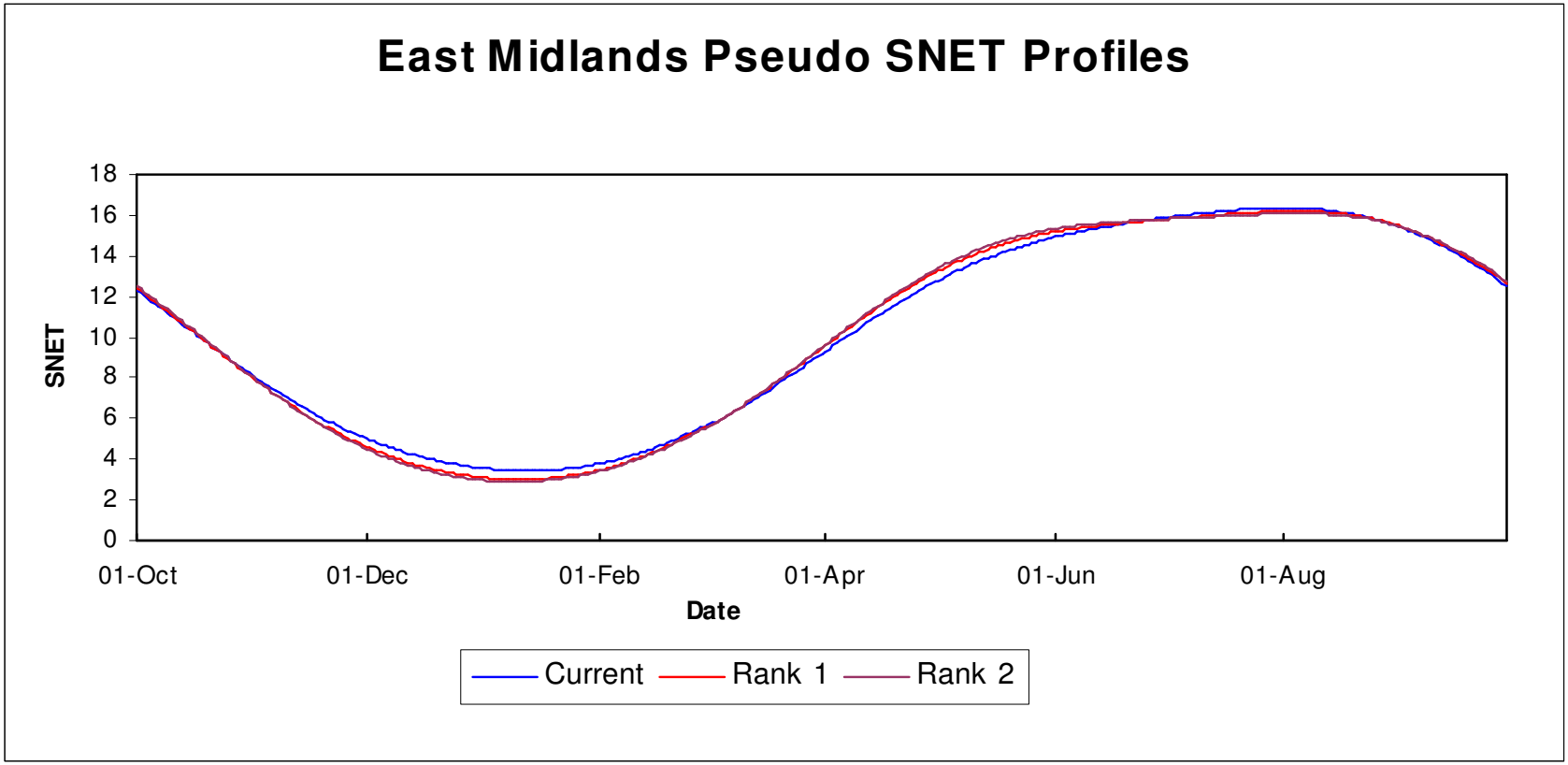
- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
EM	WAT

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	3 to 13	0.687	0.0131	0	0	13.8	16.9	0.52		0.00%	7,392
	Current - New SNET	3 to 13	0.687	0.0131	0	0	13.8	16.9	0.52		2.12%	7,235
1	New	3 to 13	0.691	0.0144	0.05	3	13.5	16.8	0.49	0.06%	3.71%	7,118
2	New	2 to 13	0.699	0.0139	0.05	3	13.5	16.7	0.51	0.06%	3.65%	7,122
3	New: SNET, L1,L2 11/12 Rem	3 to 13	0.691	0.0144	0.08	3	13.5	16.8	0.51	0.06%	3.63%	7,123
4	New: SNET 11/12 Rem	3 to 13	0.701	0.0147	0.06	3	13.5	16.9	0.5	0.06%	3.37%	7,130
5	New	2 to 14	0.704	0.0143	0.06	3	13.9	16.9	0.48	0.05%	3.03%	7,168
6	New	3 to 14	0.698	0.0148	0.06	3	13.8	16.7	0.51	0.05%	2.97%	7,172
7	New	4 to 13	0.677	0.0158	0.05	3	13.4	16.9	0.48	0.05%	2.87%	7,180
8	New	4 to 14	0.686	0.0163	0.07	3	13.8	16.8	0.5	0.04%	2.24%	7,226
9	New	3 to 12	0.722	0.0149	0	0	14.7	17.8	0.24	-0.17%	-11.04%	8,208
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **3.71%** when compared with current parameters
- Rank 2 displayed a **3.65%** improvement

Results 2: EM LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles lower than current profile in winter and higher in spring / early summer
- Rank 1 and Rank 2 profiles very similar

Results 3: EM LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
EM	WAT

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		3 to 13	4.02%	99.21%	7,392	
New	1	3 to 13	3.83%	99.28%	7,118	3.49
New	2	2 to 13	3.85%	99.28%	7,122	3.15

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, Avge. Adj. R-sq. and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: EM LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
EM	WAT

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 13	2.55%	5.05%	7.11%	4.15%
New	1	3 to 13	2.48%	4.89%	6.24%	4.02%
New	2	2 to 13	2.46%	4.91%	6.39%	4.03%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		3 to 13	0.64%	-1.49%	2.69%	-0.67%
New	1	3 to 13	0.13%	0.15%	-0.68%	-0.08%
New	2	2 to 13	0.14%	0.20%	-0.89%	-0.05%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 displays better seasonal bias for 3 quarters (MPRE)

Results 5: EM LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
EM	WAT

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	2.61%	2.41%	2.62%	3.55%	5.50%	9.12%
New	1	3 to 13	2.51%	2.39%	2.53%	3.47%	5.44%	8.55%
New	2	2 to 13	2.48%	2.38%	2.52%	3.48%	5.46%	8.58%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	7.41%	7.34%	6.58%	6.06%	4.59%	3.24%
New	1	3 to 13	6.30%	6.43%	6.00%	5.35%	4.52%	3.27%
New	2	2 to 13	6.42%	6.66%	6.09%	5.34%	4.55%	3.26%

- On average across the 12 months, Rank 1 has the best seasonal fit in 7 months and is better than current for 11 months

Results 6 : EM LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
EM	WAT

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	1.32%	0.57%	0.24%	-0.86%	-1.81%	-2.94%
New	1	3 to 13	0.63%	-0.04%	-0.05%	-0.10%	0.70%	0.01%
New	2	2 to 13	0.51%	-0.01%	0.01%	-0.08%	0.75%	0.13%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	2.89%	3.75%	1.43%	-1.01%	-1.06%	-0.30%
New	1	3 to 13	1.46%	-1.12%	-2.56%	-0.77%	0.57%	-0.27%
New	2	2 to 13	1.53%	-1.51%	-2.87%	-0.85%	0.71%	-0.27%

- Rank 1 showing better seasonal bias for 7 of 12 months with Rank 2 better for 4 months

Results 7: EM LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
EM	WAT

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		3 to 13	-5.03	0.687	0.0131	0	0	13.8	16.9	0.52
New	1	3 to 13	-5.98	0.691	0.0144	0.05	3	13.5	16.8	0.49
New	2	2 to 13	-5.90	0.699	0.0139	0.05	3	13.5	16.7	0.51

- Slightly more weighting applied to L1 parameter
- Small Cold weather upturn now present
- Warm weather cut-off, V2, slightly decreased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for EM LDZ**

CWV Optimisation

Production Phase Results - WM

WM LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **WM** CWV Optimisation process is
  - Aggregate NDM demand for **WM** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **WM** CWV Optimisation process is
  - Weather data from **Winterbourne No.2** weather station (Temperatures) and **Coleshill** weather station (Wind Speed). Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: WM LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

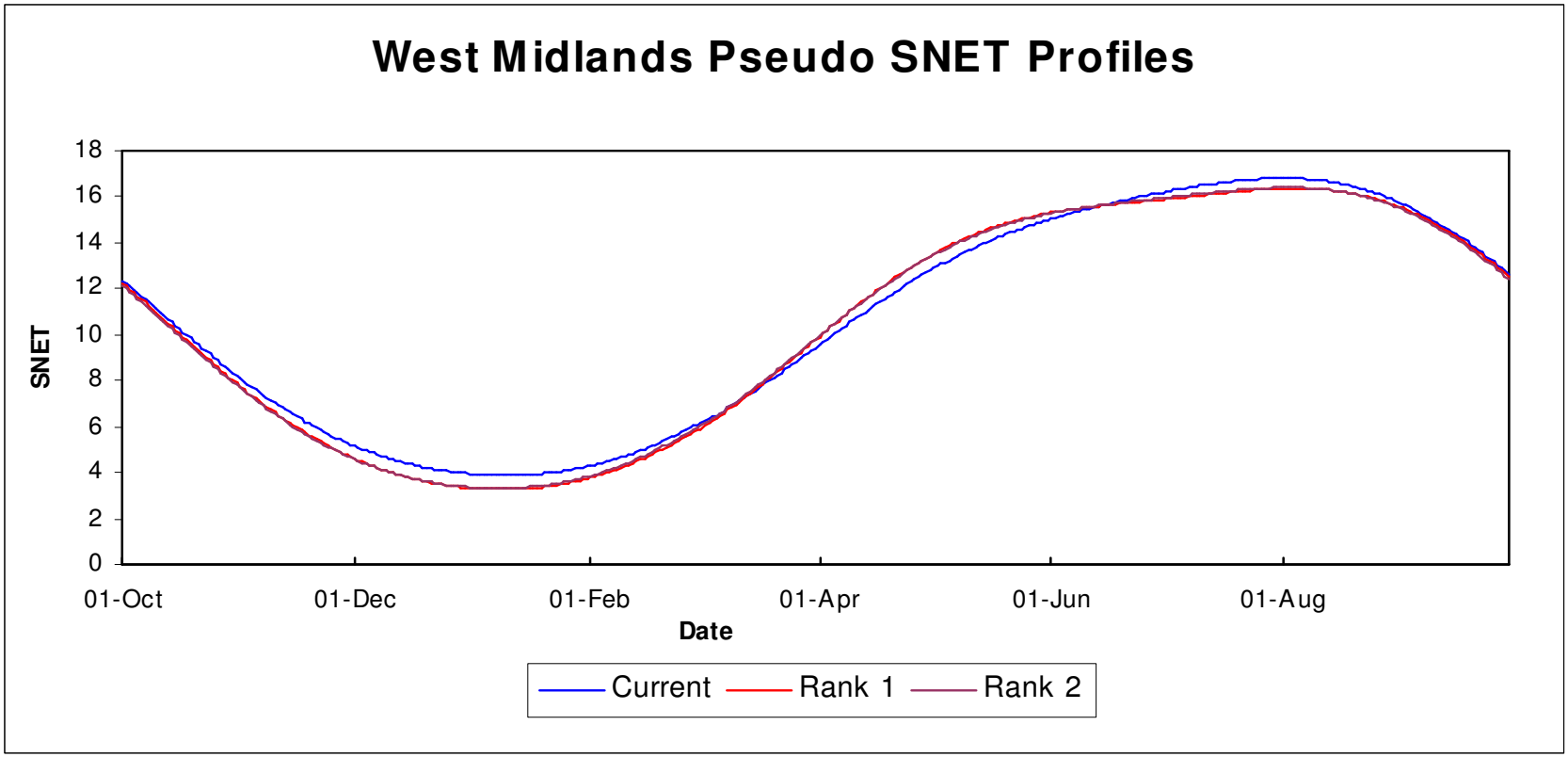
LDZ	Station
WM	BIR

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	3 to 13	0.698	0.0104	0.23	1	14	17.9	0.39		0.00%	6,436
	Current - New SNET	3 to 13	0.698	0.0104	0.23	1	14	17.9	0.39		1.51%	6,339
1	New	3 to 13	0.714	0.0115	0.14	3	13.8	17.3	0.42	0.05%	3.03%	6,241
2	New	2 to 13	0.72	0.0111	0.14	3	13.7	17.2	0.43	0.05%	3.01%	6,243
3	New	3 to 12	0.721	0.0117	0.14	3	13.8	17.2	0.43	0.05%	2.63%	6,267
4	New	2 to 12	0.727	0.0112	0.13	3	13.7	17.1	0.45	0.05%	2.56%	6,271
5	New	4 to 13	0.703	0.0126	0.16	3	13.7	17.3	0.43	0.04%	2.54%	6,273
6	New	4 to 12	0.711	0.0127	0.15	3	13.6	17	0.48	0.04%	2.32%	6,287
7	New	3 to 14	0.726	0.0119	0.14	3	14.1	17.3	0.42	0.04%	2.09%	6,302
8	New	2 to 14	0.734	0.0115	0.14	3	14.1	17.9	0.41	0.04%	1.99%	6,308
9	New	4 to 14	0.716	0.0131	0.17	3	14.1	17.3	0.43	0.03%	1.56%	6,336

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **3.03%** when compared with current parameters
- Rank 2 displayed a **3.01%** improvement

Results 2: WM LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles lower than current profile in winter, higher in spring and lower again during summer
- Rank 1 and Rank 2 profiles very similar

Results 3: WM LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
WM	BIR

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		3 to 13	3.91%	99.28%	6,436	
New	1	3 to 13	3.79%	99.33%	6,241	0.20
New	2	2 to 13	3.79%	99.33%	6,243	0.42

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: WM LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
WM	BIR

			MAPE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		3 to 13	2.76%	4.88%	6.48%	3.85%
New	1	3 to 13	2.67%	4.65%	6.27%	3.80%
New	2	2 to 13	2.66%	4.67%	6.31%	3.80%

			MPRE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		3 to 13	0.45%	-1.56%	1.74%	0.08%
New	1	3 to 13	0.06%	0.20%	-1.19%	0.18%
New	2	2 to 13	0.12%	0.22%	-1.24%	0.09%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 indicate less seasonal bias for 3 quarters (MPRE)

Results 5: WM LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
WM	BIR

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	2.73%	2.76%	2.77%	3.26%	5.94%	8.34%
New	1	3 to 13	2.60%	2.77%	2.64%	3.04%	5.79%	7.95%
New	2	2 to 13	2.58%	2.75%	2.62%	3.04%	5.82%	8.02%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	6.17%	6.76%	6.54%	5.35%	4.45%	2.98%
New	1	3 to 13	5.57%	6.24%	7.03%	5.02%	4.45%	2.98%
New	2	2 to 13	5.54%	6.44%	7.01%	4.99%	4.48%	2.98%

- On average across the 12 months, Rank 2 has better seasonal fit in 7 months, although overall Rank 1 still improved over current for 8 months

Results 6 : WM LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
WM	BIR

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		3 to 13	0.85%	0.45%	0.16%	-1.01%	-2.01%	-2.61%
New	1	3 to 13	0.41%	0.04%	-0.16%	-0.12%	0.78%	0.22%
New	2	2 to 13	0.33%	0.13%	-0.04%	0.01%	0.74%	0.02%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		3 to 13	2.41%	3.74%	-0.96%	0.62%	0.03%	-0.06%
New	1	3 to 13	0.99%	-0.95%	-3.73%	-0.09%	0.60%	-0.01%
New	2	2 to 13	0.96%	-1.05%	-3.75%	-0.44%	0.55%	-0.04%

- On average, 10 of 12 months show improved seasonal bias when compared with current parameters. Rank 2 better for 6 months and Rank 1 better for 4 months

Results 7: WM LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
WM	BIR

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		3 to 13	-5.40	0.698	0.0104	0.23	1	14	17.9	0.39
New	1	3 to 13	-5.82	0.714	0.0115	0.14	3	13.8	17.3	0.42
New	2	2 to 13	-5.76	0.72	0.0111	0.14	3	13.7	17.2	0.43

- Slightly more weighting applied to L1 parameter
- Cold weather upturn still present however L3 and V0 reflect it starting at warmer temperatures
- Warm weather cut-off, V2, decreased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for WM LDZ**

CWV Optimisation

Production Phase Results - WS

WS LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **WS** CWV Optimisation process is
  - Aggregate NDM demand for **WS** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis except 2 days in 96/97, 2 in 97/98, 1 in 08/09, 1 in 09/10, 1 in 10/11, 5 in 12/13 and 12 in 13/14
- For these gas years the weather data used in **WS** CWV Optimisation process is
  - Weather data from **St. Athan** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: WS LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
WS	STA

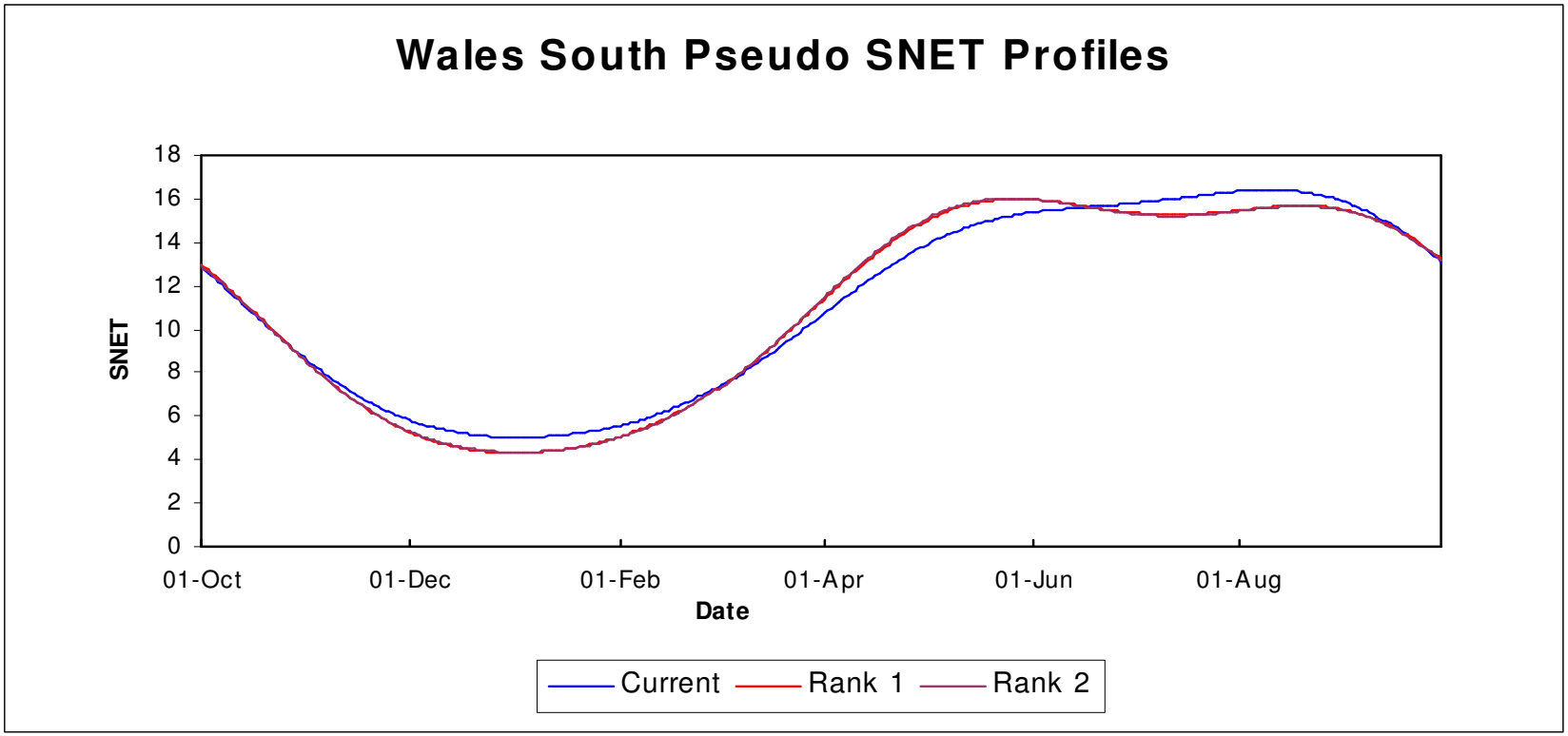
Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	5 to 15	0.634	0.0111	0.15	2	14.9	17.9	0.47		0.00%	3,412
	Current - New SNET	5 to 15	0.634	0.0111	0.15	2	14.9	17.9	0.47		1.35%	3,366
1	New	3 to 15	0.662	0.0104	0.12	3	14.7	17.8	0.49	0.09%	2.49%	3,320
2	New	2 to 15	0.669	0.0101	0.11	3	14.8	17.9	0.46	0.09%	2.48%	3,321
3	New	4 to 15	0.661	0.0104	0.13	3	14.8	17.9	0.47	0.08%	2.46%	3,321
4	New	5 to 15	0.656	0.0105	0.15	3	14.8	17.9	0.47	0.08%	2.46%	3,322
5	New	3 to 14	0.656	0.0103	0.1	3	14.4	17.8	0.49	0.08%	2.28%	3,327
6	New	2 to 16	0.658	0.0104	0.01	3	14.9	17.8	0.48	0.08%	2.21%	3,330
7	New	3 to 16	0.651	0.0107	0.14	3	14.9	17.8	0.48	0.08%	2.20%	3,330
8	New	4 to 16	0.648	0.0107	0.14	3	14.9	17.8	0.48	0.07%	2.09%	3,334
9	New	4 to 14	0.667	0.01	0.01	3	15.4	19.6	0.23	-0.35%	-12.06%	3,816

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **2.49%** when compared with current parameters
- Rank 2 displayed a **2.48%** improvement

respect › commitment › teamwork

Results 2: WS LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET lower in winter, higher in spring and lower in the summer
- Rank 1 and Rank 2 profiles very similar

Results 3: WS LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
WS	STA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		5 to 15	5.28%	98.54%	3,412	
New	1	3 to 15	5.16%	98.63%	3,320	0.54
New	2	2 to 15	5.15%	98.63%	3,321	0.21

- Rank 1 parameters produced best fit in terms of Avge. RMSE with Rank 2 marginally better for Avge.Mean Absolute % Error, Avge. Adj. R-sq.
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: WS LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
WS	STA

			MAPE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		5 to 15	3.37%	7.09%	8.87%	5.03%
New	1	3 to 15	3.26%	6.75%	8.85%	5.06%
New	2	2 to 15	3.25%	6.75%	8.80%	5.08%

			MPRE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		5 to 15	0.47%	-1.91%	2.27%	0.13%
New	1	3 to 15	-0.20%	0.59%	-1.85%	0.53%
New	2	2 to 15	-0.17%	0.53%	-1.87%	0.54%

- On average, Rank 1 displays better seasonal fit for 1 quarter (MAPE)
- On average, Rank 1 displays better seasonal bias for 1 quarter (MPRE)

Results 5: WS LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
WS	STA

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		5 to 15	3.46%	3.09%	3.58%	5.26%	9.04%	9.70%
New	1	3 to 15	3.43%	2.93%	3.45%	5.20%	8.45%	8.85%
New	2	2 to 15	3.40%	2.92%	3.44%	5.20%	8.46%	8.86%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		5 to 15	9.08%	8.75%	8.76%	8.75%	5.74%	3.27%
New	1	3 to 15	9.23%	8.72%	8.60%	8.54%	5.80%	3.37%
New	2	2 to 15	9.18%	8.61%	8.59%	8.58%	5.83%	3.37%

- On average across the 12 months, Rank 2 has the best seasonal fit in 6 months and better than current for 9 months

Results 6 : WS LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
WS	STA

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		5 to 15	0.59%	0.68%	0.21%	-0.24%	-3.90%	-3.92%
New	1	3 to 15	-0.36%	-0.16%	-0.14%	0.81%	-0.09%	1.03%
New	2	2 to 15	-0.18%	-0.10%	-0.23%	0.75%	-0.07%	0.84%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		5 to 15	-1.38%	4.00%	4.31%	3.08%	-0.42%	-0.54%
New	1	3 to 15	-2.32%	-1.73%	-1.48%	2.32%	1.11%	-0.48%
New	2	2 to 15	-2.45%	-1.62%	-1.52%	2.30%	0.98%	-0.35%

- Rank 1 showing better seasonal bias for 2 of 12 months with Rank 2 better for 7 months

Results 7: WS LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
WS	STA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		5 to 15	-4.18	0.634	0.0111	0.15	2	14.9	17.9	0.47
New	1	3 to 15	-4.35	0.662	0.0104	0.12	3	14.7	17.8	0.49
New	2	2 to 15	-4.24	0.669	0.0101	0.11	3	14.8	17.9	0.46

  - More weighting applied to L1 parameter
  - Similar Cold weather upturn present
  - Warm weather cut-off, V2, decreased for Rank 1 and same for Rank 2

- On average Rank 1 and Rank 2 show an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for WS LDZ**

CWV Optimisation

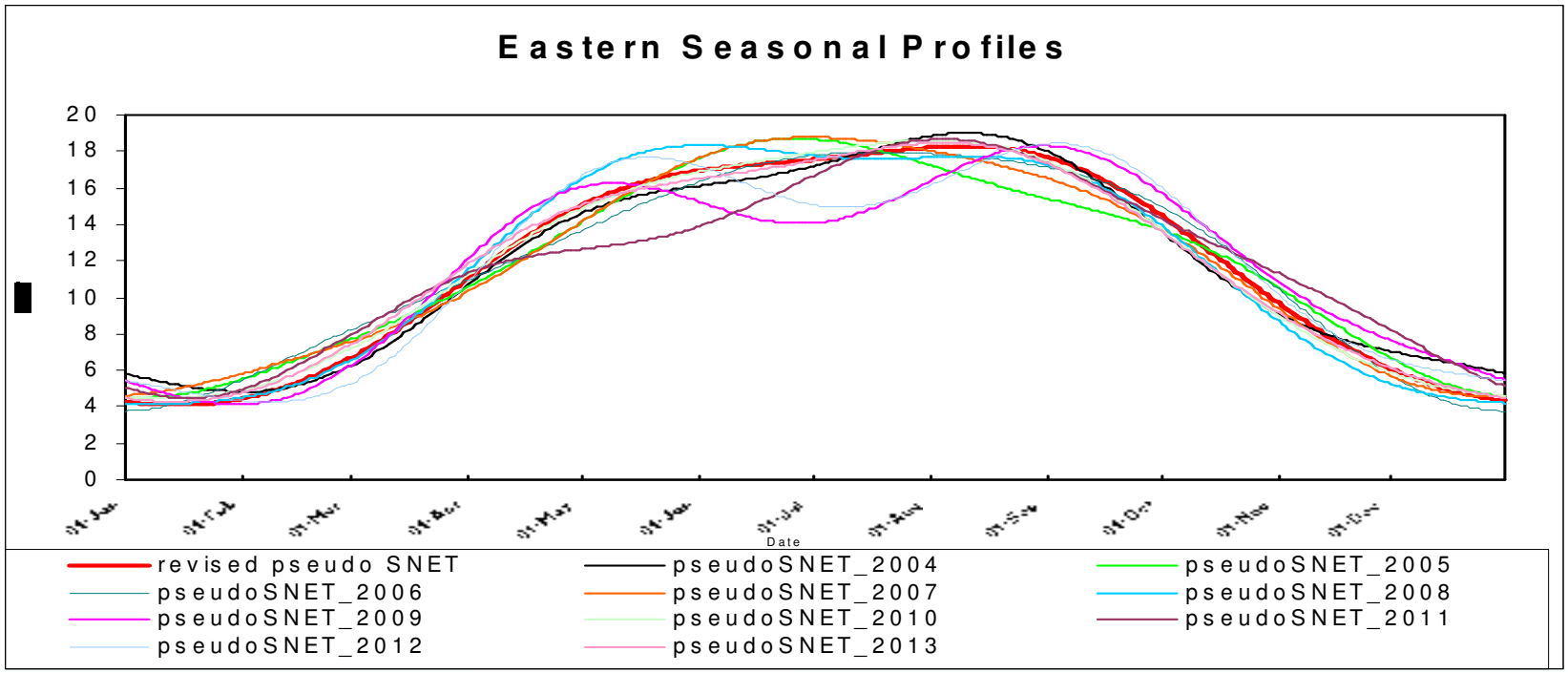
Production Phase Results - EA

EA LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **EA** CWV Optimisation process is
  - Aggregate NDM demand for **EA** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **EA** CWV Optimisation process is
  - Weather data from **London Heathrow** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile except 2005/06 gas year

EA LDZ Pseudo SNET

- As with the previous optimisation in 2009 it was found the overall results were improved when 2005/06 gas year was removed from the Pseudo SNET calculation



Results 1: EA LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
EA	HEA

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	ET below 14	0.69	0.0118	0	0	15.1	19.1	0.37		0.00%	6,059
	Current - New SNET	ET below 14	0.69	0.0118	0	0	15.1	19.1	0.37		-3.18%	6,252
1	New: SNET 05/06 Rem	5 to 14	0.727	0.0143	0.08	3	15.3	19.1	0.35	0.04%	2.73%	5,894
2	New: SNET 05/06 Rem	5 to 15	0.719	0.0144	0.09	3	15.3	19.2	0.34	0.04%	2.72%	5,894
3	New	5 to 14	0.733	0.0144	0.08	3	15.3	19	0.37	0.04%	2.65%	5,898
4	New: SNET 05/06 Rem	4 to 15	0.73	0.014	0.08	3	15.3	19	0.36	0.04%	2.62%	5,900
5	New: SNET 05/06 Rem	4 to 14	0.736	0.014	0.06	3	15.3	19.1	0.35	0.04%	2.60%	5,901
6	New: SNET 05/06 Rem	6 to 14	0.719	0.0153	0.1	3	15.2	18.9	0.38	0.04%	2.55%	5,904
7	New: SNET 05/06 Rem	ET below 14	0.742	0.0132	0.05	3	15.3	19.1	0.34	0.04%	2.44%	5,911
8	New: SNET 05/06 Rem	6 to 15	0.712	0.0153	0.1	3	15.2	19.1	0.36	0.04%	2.44%	5,911
9	New: SNET 05/06 Rem	ET below 15	0.743	0.0132	0.05	3	15.3	19	0.36	0.04%	2.18%	5,926
10	New: SNET 05/06 Rem	5 to 16	0.733	0.0155	0.11	3	15.7	19	0.36	0.02%	1.56%	5,964
11	New: SNET 05/06 Rem	5 to 13	0.766	0.0151	0.05	3	16	19	0.32	-0.02%	-1.14%	6,128

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **2.73%** when compared with current parameters
- Rank 2 displayed a **2.72%** improvement

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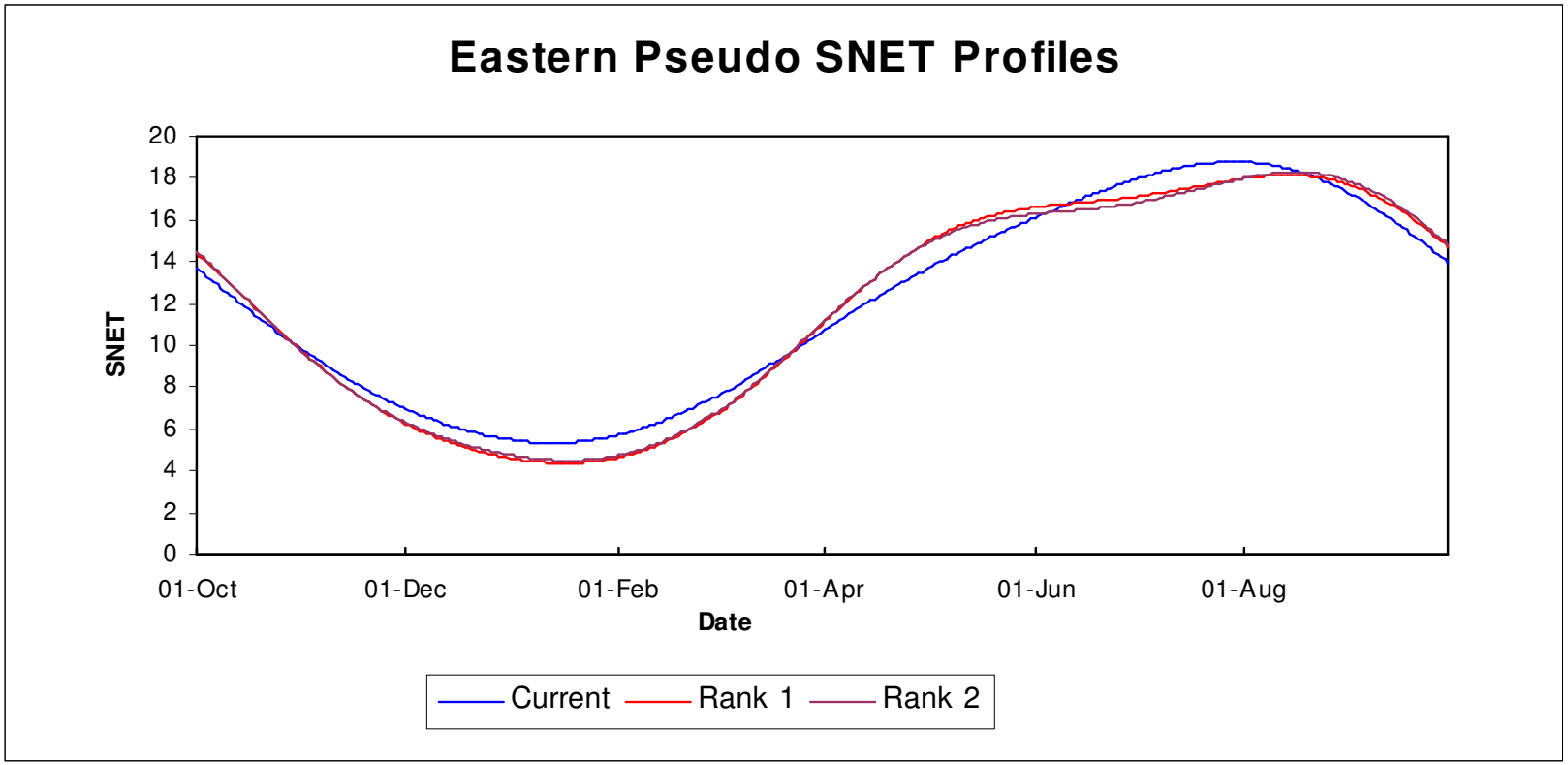
Results 2: EA LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles quite different to current profile, lower in winter, higher in spring and lower early summer
- Rank 1 and Rank 2 profiles similar shape with slightly different levels

Results 3: EA LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
EA	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		ET below 14	4.13%	99.18%	6,059	
New: SNET 05/06 Rem	1	5 to 14	3.95%	99.22%	5,894	4.24
New: SNET 05/06 Rem	2	5 to 15	3.94%	99.22%	5,894	4.47

- Rank 1 parameters produced best fit in terms of Avge. Adj. R-sq. and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: EA LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
EA	HEA

			MAPE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		ET below 14	2.81%	5.40%	5.85%	4.37%
New: SNET 05/06 Rem	1	5 to 14	2.75%	5.09%	5.20%	4.34%
New: SNET 05/06 Rem	2	5 to 15	2.76%	5.09%	5.08%	4.33%

			MPRE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		ET below 14	0.29%	-0.85%	3.37%	-1.00%
New: SNET 05/06 Rem	1	5 to 14	-0.08%	0.52%	-1.16%	0.11%
New: SNET 05/06 Rem	2	5 to 15	-0.12%	0.60%	-1.37%	0.17%

- On average, Rank 1 displays better seasonal fit for 1 quarter (MAPE)
- On average, Rank 1 displays better seasonal bias for 4 quarters (MPRE)

Results 5: EA LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
EA	HEA

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		ET below 14	2.75%	2.65%	2.99%	4.40%	6.19%	7.39%
New: SNET 05/06 Rem	1	5 to 14	2.71%	2.71%	2.80%	4.22%	5.57%	7.21%
New: SNET 05/06 Rem	2	5 to 15	2.73%	2.72%	2.82%	4.24%	5.55%	7.15%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		ET below 14	6.42%	6.24%	4.87%	5.23%	4.74%	3.88%
New: SNET 05/06 Rem	1	5 to 14	5.53%	5.25%	4.79%	4.55%	5.00%	3.87%
New: SNET 05/06 Rem	2	5 to 15	5.44%	5.14%	4.63%	4.38%	5.03%	3.88%

- On average across the 12 months, Rank 1 has the best seasonal fit in 4 months and better than current for 10 months

Results 6 : EA LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
EA	HEA

			MPRE					
Parameters	**Ranking**	**ET Range**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**
Current		ET below 14	0.08%	0.17%	0.53%	0.12%	-3.21%	-0.08%
New: SNET 05/06 Rem	1	5 to 14	-0.01%	-0.05%	-0.16%	0.18%	-0.09%	2.70%
New: SNET 05/06 Rem	2	5 to 15	0.01%	-0.10%	-0.22%	0.29%	0.18%	2.34%

			MPRE					
Parameters	**Ranking**	**ET Range**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**
Current		ET below 14	4.38%	4.01%	1.66%	-2.55%	-0.74%	-0.67%
New: SNET 05/06 Rem	1	5 to 14	1.17%	-2.36%	-2.47%	-1.20%	1.34%	-0.25%
New: SNET 05/06 Rem	2	5 to 15	0.27%	-2.51%	-2.00%	-0.38%	1.38%	-0.40%

- Rank 1 showing better seasonal bias for 6 of 12 months with Rank 2 better for 2 months

Results 7: EA LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
EA	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		ET below 14	-3.16	0.69	0.0118			15.1	19.1	0.37
New: SNET 05/06 Rem	1	5 to 14	-4.95	0.727	0.0143	0.08	3	15.3	19.1	0.35
New: SNET 05/06 Rem	2	5 to 15	-4.95	0.719	0.0144	0.09	3	15.3	19.2	0.34

- More weighting applied to L1 parameter
- Cold weather upturn now present
- Warm weather cut-off, V2, same for Rank 1 and increased for Rank 2

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for EA LDZ**

CWV Optimisation

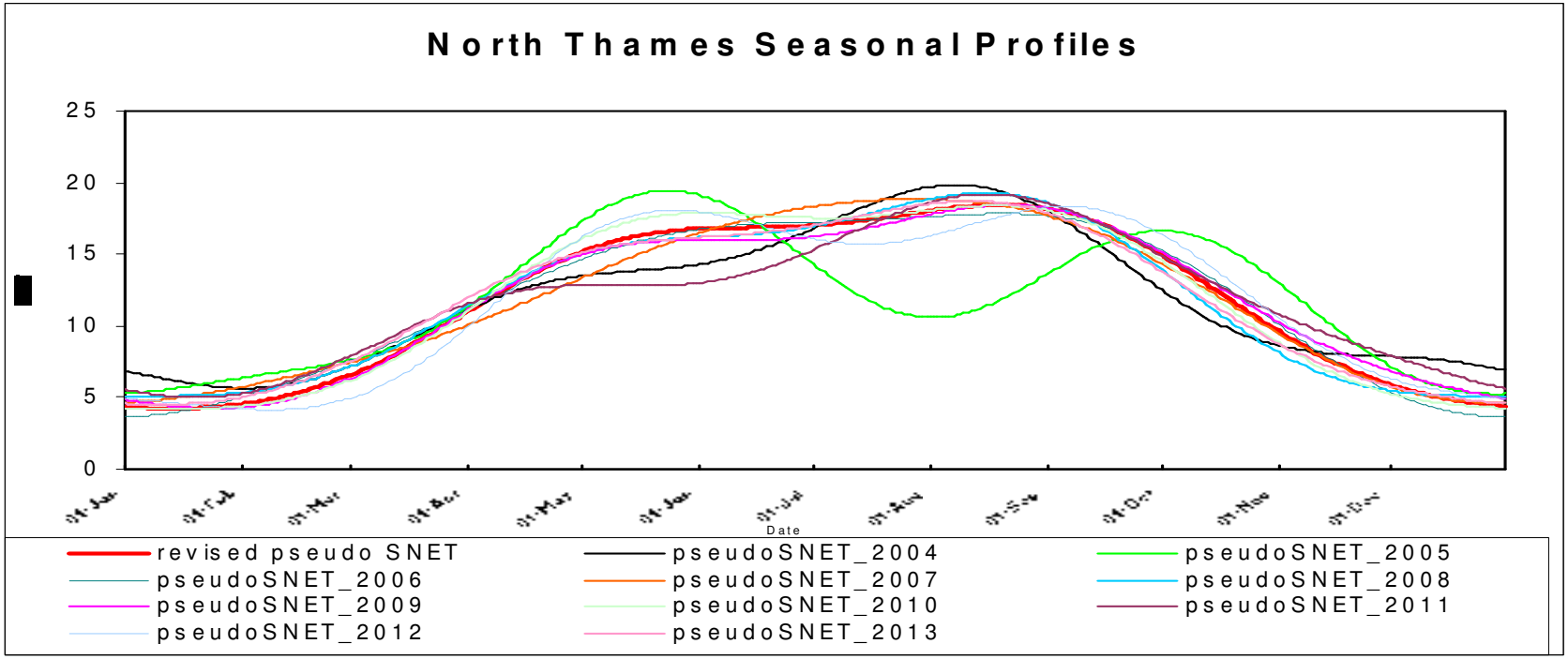
Production Phase Results - NT

NT LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **NT** CWV Optimisation process is
  - Aggregate NDM demand for **NT** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis except gas day 29/09/2004
- For these gas years the weather data used in **NT** CWV Optimisation process is
  - Weather data from **London Heathrow** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile except 2005/06 gas year

NT LDZ Pseudo SNET

- As with the previous optimisation in 2009 it was found the overall results were improved when 2005/06 gas year was removed from the Pseudo SNET calculation



Results 1: NT LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
NT	HEA

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	4 to 14	0.703	0.0129	0	0	15.2	19.2	0.35		0.00%	7,233
	Current - New SNET	4 to 14	0.703	0.0129	0	0	15.2	19.2	0.35		-11.55%	8,069
1	New: SNET 05/06 Rem	6 to 15	0.727	0.0151	0.22	3	15.2	19.2	0.38	0.06%	4.13%	6,934
2	New: SNET 05/06 Rem	6 to 14	0.745	0.015	0.2	3	15.3	18.9	0.41	0.06%	3.97%	6,946
3	New: SNET 05/06 Rem	5 to 15	0.739	0.0139	0.21	3	15.2	19	0.4	0.06%	3.94%	6,948
4	New	6 to 15	0.746	0.0154	0.22	3	15.4	19.1	0.41	0.06%	3.69%	6,966
5	New: SNET 05/06 Rem	3 to 15	0.757	0.0136	0.18	3	15.3	19	0.39	0.06%	3.67%	6,968
6	New: SNET 05/06 Rem	4 to 15	0.752	0.0134	0.19	3	15.2	18.9	0.41	0.06%	3.66%	6,969
7	New: SNET 05/06 Rem	5 to 14	0.755	0.0139	0.18	3	15.3	19	0.4	0.06%	3.64%	6,970
8	New: SNET 05/06 Rem	7 to 15	0.709	0.016	0.25	3	15.1	19	0.41	0.06%	3.57%	6,975
9	New: SNET 05/06 Rem	2 to 15	0.761	0.0135	0.18	3	15.3	19	0.4	0.06%	3.49%	6,981
10	New: SNET 05/06 Rem	4 to 14	0.767	0.0134	0.17	3	15.4	19	0.39	0.05%	3.22%	7,001
11	New: SNET 05/06 Rem	6 to 16	0.745	0.0163	0.22	3	15.6	19	0.41	0.05%	2.88%	7,025
12	New: SNET 05/06 Rem	ET below 15	0.77	0.0128	0.16	3	15.3	18.8	0.41	0.05%	2.82%	7,029
13	New: SNET 05/06 Rem	5 to 16	0.755	0.015	0.21	3	15.6	18.8	0.42	0.05%	2.80%	7,031
14	New: SNET 05/06 Rem	4 to 16	0.766	0.0143	0.19	3	15.7	19	0.39	0.04%	2.63%	7,043
15	New: SNET 05/06 Rem	3 to 16	0.771	0.0145	0.18	3	15.7	18.9	0.4	0.04%	2.55%	7,049
16	New: SNET 05/06 Rem, V0 & L3 as 0	4 to 14	0.767	0.0134	0	0	15.4	19	0.39	0.04%	2.38%	7,061
17	New: SNET 05/06 Rem	2 to 16	0.776	0.0144	0.17	3	15.7	19.1	0.39	0.04%	2.31%	7,067
18	New: SNET 05/06 Rem	4 to 13	0.787	0.0135	0.04	3	15.9	20.8	0.18	-1.34%	-70.58%	12,339
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **4.13%** when compared with current parameters
- Rank 2 displayed a **3.97%** improvement

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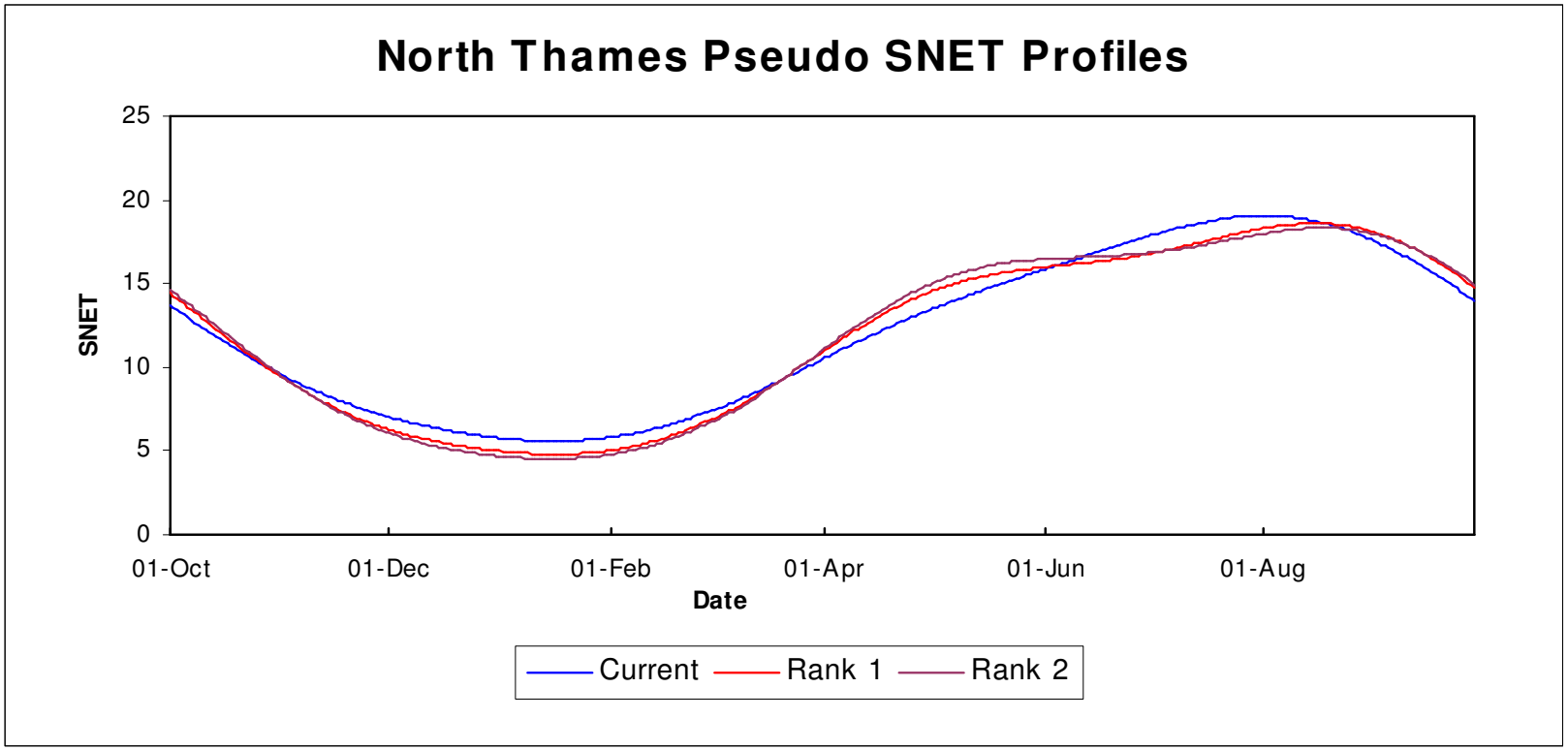
Results 2: NT LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles quite different to current profile, lower in winter, higher in spring and lower early summer
- Rank 1 and Rank 2 profiles similar shape with slightly different levels

Results 3: NT LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
NT	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		4 to 14	3.72%	99.30%	7,233	
New: SNET 05/06 Rem	1	6 to 15	3.51%	99.36%	6,934	7.87
New: SNET 05/06 Rem	2	6 to 14	3.55%	99.36%	6,946	7.31

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, Avge. Adj. R-sq. and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: NT LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
NT	HEA

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	2.57%	4.76%	5.19%	3.93%
New: SNET 05/06 Rem	1	6 to 15	2.43%	4.50%	4.53%	3.86%
New: SNET 05/06 Rem	2	6 to 14	2.40%	4.53%	4.84%	3.87%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	0.27%	-0.81%	2.90%	-0.88%
New: SNET 05/06 Rem	1	6 to 15	-0.12%	0.70%	-0.77%	-0.14%
New: SNET 05/06 Rem	2	6 to 14	-0.10%	0.75%	-1.01%	-0.14%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 displays better seasonal bias for 2 quarters (MPRE)

Results 5: NT LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
NT	HEA

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 14	2.59%	2.28%	2.82%	3.97%	5.75%	5.64%
New: SNET 05/06 Rem	1	6 to 15	2.42%	2.24%	2.61%	3.83%	5.24%	5.42%
New: SNET 05/06 Rem	2	6 to 14	2.38%	2.22%	2.58%	3.80%	5.27%	5.67%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 14	6.00%	5.47%	4.03%	4.69%	4.48%	3.33%
New: SNET 05/06 Rem	1	6 to 15	4.95%	4.26%	4.34%	4.35%	4.45%	3.33%
New: SNET 05/06 Rem	2	6 to 14	5.32%	4.70%	4.46%	4.37%	4.47%	3.31%

- On average across the 12 months, Rank 1 has the best seasonal fit in 6 months and better than current for 11 months

Results 6 : NT LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
NT	HEA

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 14	0.60%	0.34%	-0.01%	0.08%	-2.86%	-0.28%
New: SNET 05/06 Rem	1	6 to 15	0.14%	0.01%	-0.42%	0.72%	0.15%	1.52%
New: SNET 05/06 Rem	2	6 to 14	0.05%	0.09%	-0.37%	0.63%	0.20%	2.07%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 14	4.29%	3.39%	0.91%	-0.94%	-0.63%	-1.03%
New: SNET 05/06 Rem	1	6 to 15	0.42%	-1.14%	-1.69%	-0.10%	1.07%	-0.92%
New: SNET 05/06 Rem	2	6 to 14	1.01%	-1.83%	-2.37%	-0.56%	1.16%	-0.81%

- Rank 1 showing better seasonal bias for 5 of 12 months with Rank 2 better for 2 months

Results 7: NT LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
NT	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		4 to 14	-3.48	0.703	0.0129	0	0	15.2	19.2	0.35
New: SNET 05/06 Rem	1	6 to 15	-6.09	0.727	0.0151	0.22	3	15.2	19.2	0.38
New: SNET 05/06 Rem	2	6 to 14	-6.16	0.745	0.015	0.2	3	15.3	18.9	0.41

- More weighting applied to L1 parameter
- Cold weather upturn now present
- Warm weather cut-off, V2, same for Rank 1 and decreased for Rank 2

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for NT LDZ**

CWV Optimisation

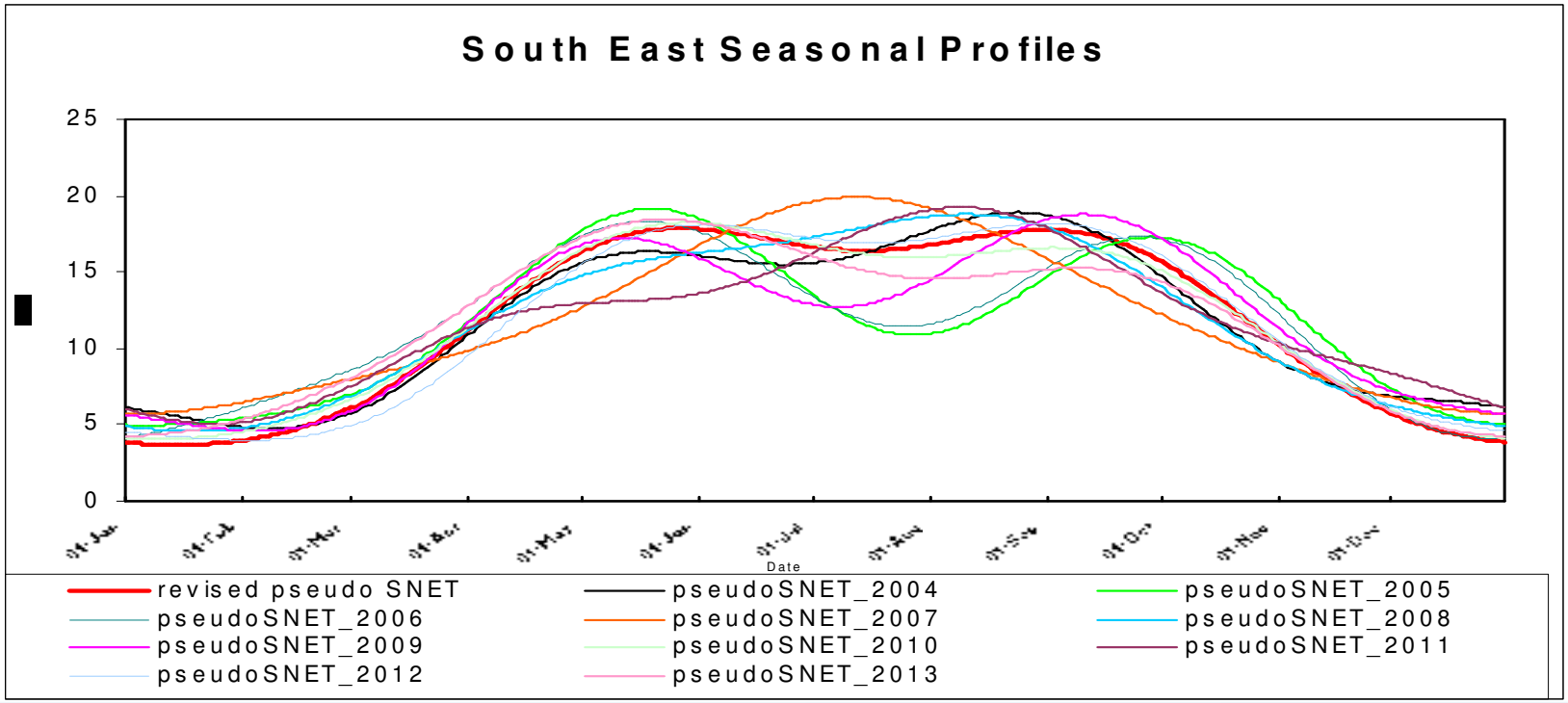
Production Phase Results - SE

SE LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **SE** CWV Optimisation process is
  - Aggregate NDM demand for **SE** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **SE** CWV Optimisation process is
  - Weather data from **London Heathrow** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile except 2005/06 gas year

SE LDZ Pseudo SNET

- As with the previous optimisation in 2009 it was found the overall results were improved when 2005/06 gas year was removed from the Pseudo SNET calculation



Results 1: SE LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
SE	HEA

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE
	Current	4 to 14	0.704	0.0125	0.05	3	15.1	19	0.37	0.00%	0.00%	7,942
	Current - New SNET	4 to 14	0.704	0.0125	0.05	3	15.1	19	0.37	-0.19%	-10.85%	8,803
1	New: SNET 05/06 Rem	6 to 15	0.712	0.0140	0.33	3	15.1	18.7	0.38	0.06%	3.63%	7,653
2	New: SNET 05/06 Rem	5 to 15	0.728	0.0133	0.31	3	15.1	18.7	0.39	0.06%	3.60%	7,656
3	New: SNET 05/06 Rem	3 to 15	0.749	0.0129	0.26	3	15.1	18.5	0.42	0.06%	3.28%	7,681
4	New: SNET 05/06 Rem	4 to 15	0.742	0.0126	0.28	3	15.1	18.5	0.41	0.06%	3.26%	7,682
5	New	6 to 15	0.733	0.0143	0.32	3	15.3	18.6	0.43	0.06%	3.24%	7,685
6	New: SNET 05/06 Rem	2 to 15	0.756	0.0129	0.25	3	15.2	18.5	0.41	0.06%	3.11%	7,695
7	New: SNET 05/06 Rem	5 to 16	0.74	0.0144	0.31	3	15.5	18.5	0.41	0.05%	3.05%	7,700
8	New: SNET 05/06 Rem	6 to 14	0.741	0.0141	0.3	3	15.4	18.6	0.41	0.05%	2.99%	7,704
9	New: SNET 05/06 Rem	6 to 16	0.726	0.0152	0.33	3	15.4	18.5	0.43	0.05%	2.98%	7,705
10	New: SNET 05/06 Rem	7 to 15	0.689	0.0151	0.36	3	15.1	19	0.36	0.05%	2.87%	7,714
11	New: SNET 05/06 Rem	4 to 16	0.752	0.0136	0.28	3	15.5	18.5	0.41	0.05%	2.82%	7,717
12	New: SNET 05/06 Rem	3 to 16	0.759	0.0138	0.27	3	15.5	18.5	0.42	0.05%	2.75%	7,723
13	New: SNET 05/06 Rem	2 to 16	0.766	0.0138	0.25	3	15.6	18.6	0.39	0.05%	2.57%	7,738
14	New: SNET 05/06 Rem	3 to 14	0.77	0.0131	0.24	3	15.4	18.5	0.41	0.05%	2.47%	7,745
15	New: SNET 05/06 Rem	4 to 14	0.765	0.0128	0.26	3	15.4	18.5	0.40	0.05%	2.46%	7,746

Pos - improvement against benchmark
Neg - worse than benchmark

- Rank 1 displayed best average RMSE improvement of **3.63%** when compared with current parameters
- Rank 2 displayed a **3.60%** improvement

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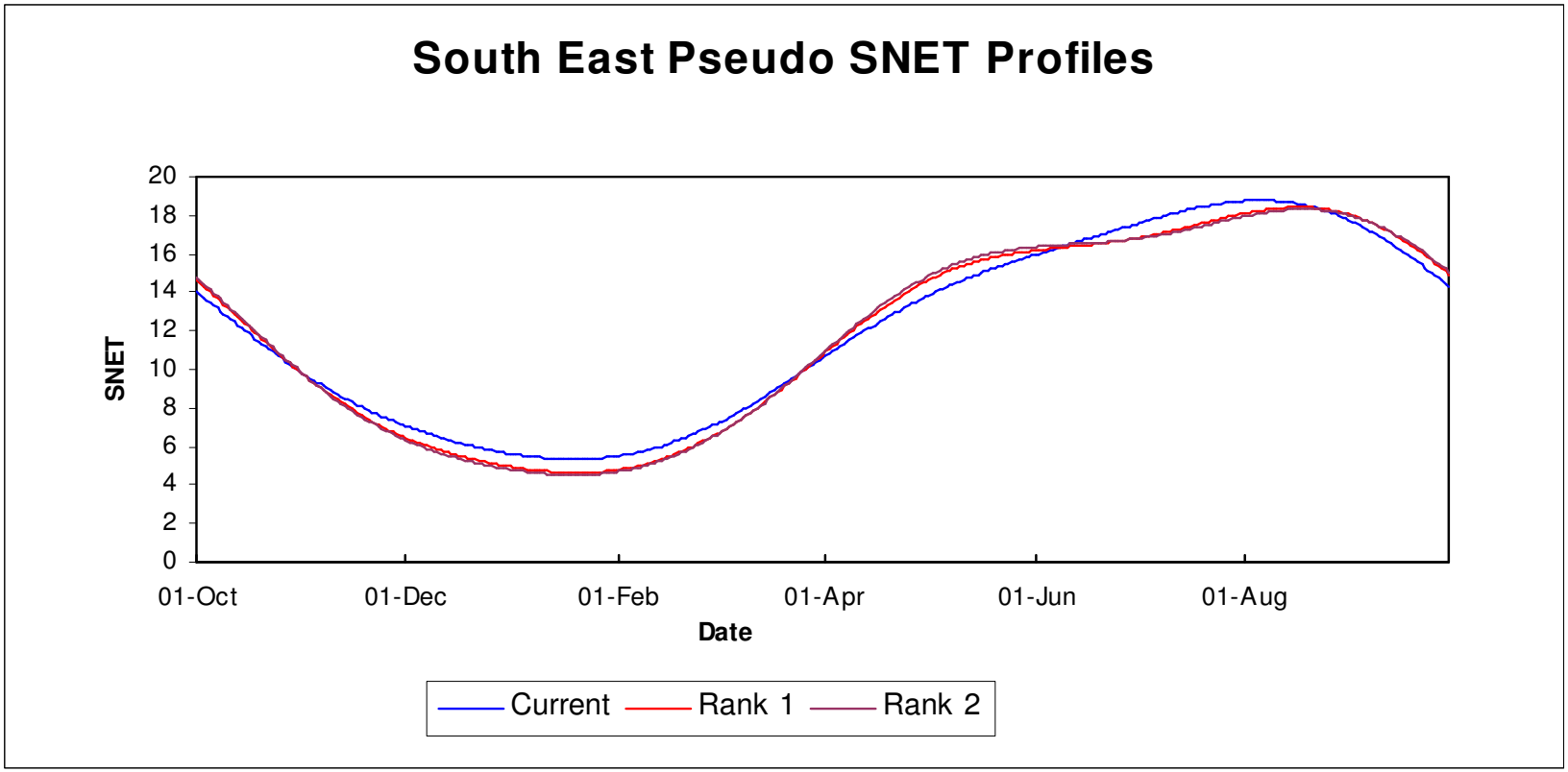
Results 2: SE LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles quite different to current profile, lower in winter, higher in spring and lower early summer
- Rank 1 and Rank 2 profiles similar shape

Results 3: SE LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
SE	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		4 to 14	4.95%	98.96%	8,974	
New: SNET 05/06 Rem	1	6 to 15	4.05%	99.25%	7,653	8.87
New: SNET 05/06 Rem	2	5 to 15	4.07%	99.25%	7,656	8.16

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: SE LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
SE	HEA

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	3.29%	6.31%	9.11%	4.81%
New: SNET 05/06 Rem	1	6 to 15	2.94%	5.17%	5.41%	4.30%
New: SNET 05/06 Rem	2	5 to 15	2.91%	5.19%	5.65%	4.31%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	-0.87%	3.13%	-6.06%	0.76%
New: SNET 05/06 Rem	1	6 to 15	-0.11%	0.70%	-1.13%	-0.06%
New: SNET 05/06 Rem	2	5 to 15	-0.06%	0.71%	-1.45%	-0.04%

- On average, Rank 1 displays better seasonal fit for 3 quarters (MAPE)
- On average, Rank 1 displays better seasonal bias for 2 quarters (MPRE)

Results 5: SE LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
SE	HEA

			MAPE					
Parameters	**Ranking**	**ET Range**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**
Current		4 to 14	3.30%	2.87%	3.66%	4.51%	7.01%	11.35%
New: SNET 05/06 Rem	1	6 to 15	3.00%	2.60%	3.22%	4.25%	6.15%	6.66%
New: SNET 05/06 Rem	2	5 to 15	2.95%	2.56%	3.19%	4.24%	6.19%	6.75%

			MAPE					
Parameters	**Ranking**	**ET Range**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**
Current		4 to 14	6.53%	9.75%	11.29%	5.53%	6.08%	3.82%
New: SNET 05/06 Rem	1	6 to 15	5.99%	5.83%	4.34%	4.83%	5.10%	3.64%
New: SNET 05/06 Rem	2	5 to 15	6.13%	6.04%	4.72%	4.79%	5.16%	3.65%

- On average across the 12 months, Rank 1 has the best seasonal fit in 7 months and better than current for 12 months

Results 6 : SE LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
SE	HEA

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 14	-0.77%	-0.79%	-1.00%	0.44%	3.95%	10.99%
New: SNET 05/06 Rem	1	6 to 15	0.50%	0.03%	-0.66%	0.66%	-0.22%	2.43%
New: SNET 05/06 Rem	2	5 to 15	0.36%	0.18%	-0.55%	0.67%	-0.21%	2.44%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 14	0.64%	-8.96%	-10.49%	-0.10%	4.25%	-1.09%
New: SNET 05/06 Rem	1	6 to 15	0.45%	-2.14%	-1.85%	0.59%	0.74%	-0.73%
New: SNET 05/06 Rem	2	5 to 15	0.33%	-2.47%	-2.39%	0.22%	0.93%	-0.70%

- Rank 1 showing better seasonal bias for 5 of 12 months with Rank 2 better for 5 months

Results 7: SE LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
SE	HEA

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		4 to 14	-4.25	0.704	0.0125	0.05	3	15.1	19	0.37
New: SNET 05/06 Rem	1	6 to 15	-6.45	0.712	0.014	0.33	3	15.1	18.7	0.38
New: SNET 05/06 Rem	2	5 to 15	-6.28	0.728	0.0133	0.31	3	15.1	18.7	0.39

  - More weighting applied to L1 parameter
  - More of a Cold weather upturn now evident
  - Warm weather cut-off, V2, decreased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for SE LDZ**

CWV Optimisation

Production Phase Results - SO

SO LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **SO** CWV Optimisation process is
  - Aggregate NDM demand for **SO** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **SO** CWV Optimisation process is
  - Weather data from **Southampton** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile

Results 1: SO LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
SO	SOC

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	6 to 14	0.677	0.0127	0.39	2	14.8	18.1	0.38		0.00%	5,626
	Current - New SNET	6 to 14	0.677	0.0127	0.39	2	14.8	18.1	0.38		-1.84%	5,730
1	New	5 to 15	0.737	0.0118	0.23	3	15	18.2	0.37	0.07%	3.80%	5,412
2	New	6 to 13	0.72	0.0134	0.24	3	14.8	18.2	0.37	0.07%	3.77%	5,414
3	New	5 to 13	0.74	0.0119	0.21	3	14.9	18.3	0.36	0.07%	3.74%	5,416
4	New	4 to 15	0.747	0.0113	0.21	3	15	18.2	0.37	0.06%	3.73%	5,416
5	New	6 to 15	0.716	0.0136	0.26	3	14.9	18.2	0.38	0.06%	3.56%	5,426
6	New	6 to 14	0.721	0.0134	0.26	3	14.9	18.2	0.38	0.06%	3.47%	5,431
7	New	5 to 14	0.745	0.0118	0.22	3	15	18.1	0.39	0.06%	3.34%	5,438
8	New	5 to 16	0.744	0.0126	0.25	3	15.3	18	0.4	0.05%	2.84%	5,466
9	New	4 to 16	0.756	0.012	0.2	3	15.3	18	0.39	0.05%	2.81%	5,468
10	New	7 to 15	0.697	0.0154	0.3	3	14.9	18.3	0.38	0.04%	2.26%	5,499
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **3.80%** when compared with current parameters
- Rank 2 displayed a **3.77%** improvement

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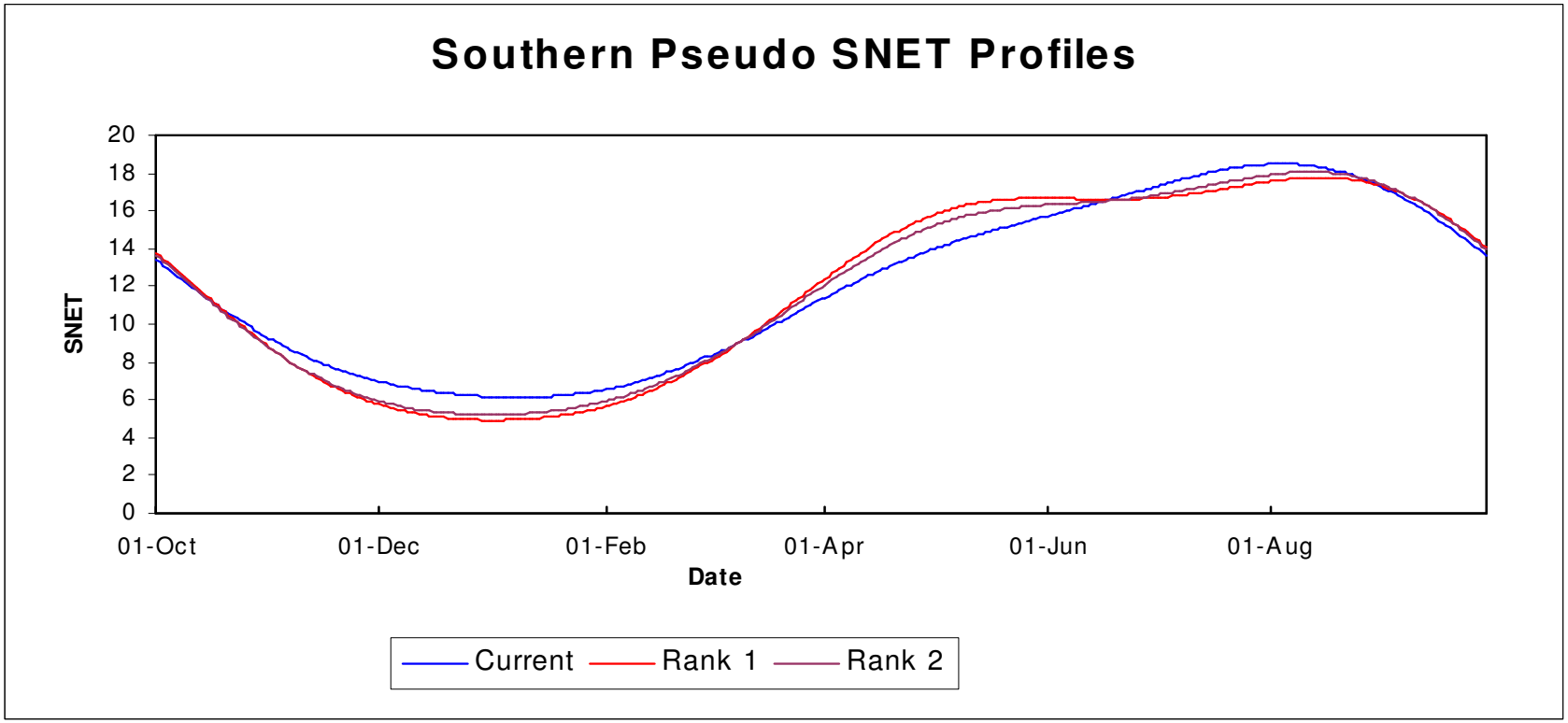
Results 2: SO LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles markedly lower than current profile in winter and markedly higher in spring and lower again during summer
- Rank 1 and Rank 2 profiles similar shape but different levels

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Results 3: SO LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
SO	SOC

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		6 to 14	4.29%	99.14%	5,626	
New	1	5 to 15	4.12%	99.21%	5,412	-1.83
New	2	6 to 13	4.11%	99.21%	5,414	-0.24

- Rank 1 parameters produced best fit in terms Avge. RMSE
- Rank 2 slightly better for Avge. Mean Abs. % Error and Avge. Adj. R-sq.
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: SO LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
SO	SOC

			MAPE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		6 to 14	3.10%	5.58%	5.93%	4.39%
New	1	5 to 15	2.94%	5.16%	5.28%	4.61%
New	2	6 to 13	2.98%	5.11%	5.11%	4.64%

			MPRE			
Parameters	**Ranking**	**ET Range**	**DEC - FEB**	**MAR to MAY**	**JUN to AUG**	**SEP to NOV**
Current		6 to 14	0.39%	-1.88%	2.94%	0.00%
New	1	5 to 15	0.01%	0.50%	-1.59%	0.13%
New	2	6 to 13	0.05%	0.26%	-1.31%	0.18%

- On average, Rank 2 displays better seasonal fit for 2 quarters (MAPE)
- On average, Rank 2 indicate less seasonal bias for 2 quarters (MPRE)

Results 5: SO LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
SO	SOC

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		6 to 14	2.98%	3.20%	3.08%	4.19%	7.36%	7.27%
New	1	5 to 15	2.93%	2.99%	2.91%	3.93%	6.49%	7.10%
New	2	6 to 13	2.95%	3.05%	2.93%	3.91%	6.46%	6.94%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		6 to 14	5.58%	6.82%	5.40%	4.86%	5.53%	3.57%
New	1	5 to 15	5.91%	5.46%	4.42%	4.68%	5.95%	3.78%
New	2	6 to 13	5.73%	5.39%	4.19%	4.67%	6.07%	3.76%

- On average across the 12 months, Rank 2 has better seasonal fit in 6 months, although overall Rank 1 still improved over current for 9 months

Results 6 : SO LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
SO	SOC

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		6 to 14	0.64%	0.53%	0.09%	-0.55%	-4.36%	-2.17%
New	1	5 to 15	-0.40%	0.29%	0.05%	0.54%	-0.21%	1.62%
New	2	6 to 13	-0.38%	0.32%	0.10%	0.48%	-0.72%	1.24%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		6 to 14	1.01%	3.48%	4.44%	0.29%	1.03%	-0.71%
New	1	5 to 15	-1.64%	-2.38%	-0.76%	-0.36%	2.29%	-1.03%
New	2	6 to 13	-1.69%	-1.96%	-0.25%	-0.22%	2.50%	-1.09%

- On average, 9 of 12 months show improved seasonal bias when compared with current parameters. Rank 2 better for 6 months and Rank 1 better for 3 months

Results 7: SO LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
SO	SOC

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		6 to 14	-4.75	0.677	0.0127	0.39	2	14.8	18.1	0.38
New	1	5 to 15	-4.90	0.737	0.0118	0.23	3	15	18.2	0.37
New	2	6 to 13	-5.25	0.72	0.0134	0.24	3	14.8	18.2	0.37

  - Slightly more weighting applied to L1 parameter
  - Cold weather upturn still present however V0 reflect its starting at warmer temperatures
  - Warm weather cut-off, V2, slightly increased

- On average Rank 1 shows an improved fit overall in terms of lower RMSE, however Rank 2 parameters appear better in other performance measures
- **TWG to now decide on preferred set of parameters for SO LDZ**

CWV Optimisation

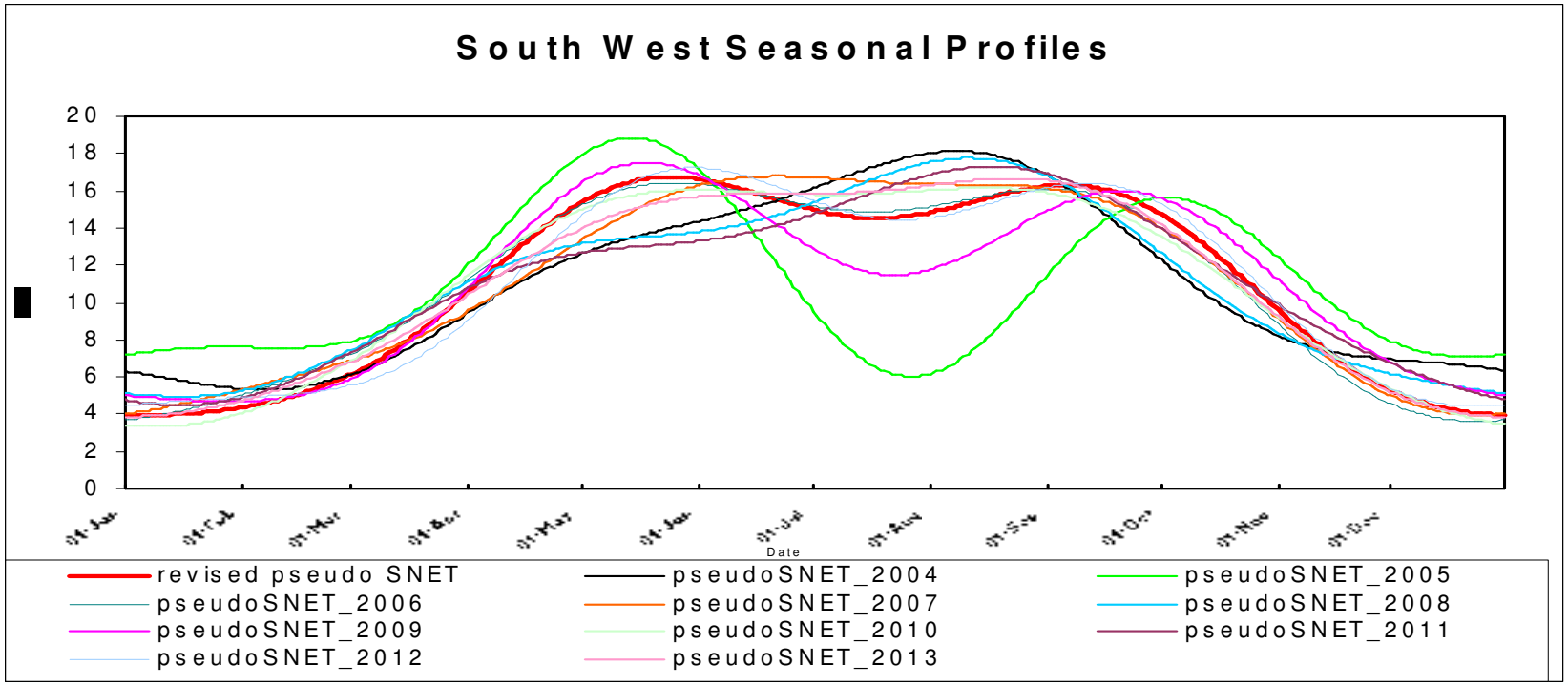
Production Phase Results - SW

SW LDZ Optimisation Overview

- Gas Years used for deriving parameters are 2004/05 to 2013/14
- For these gas years the demand data used in **SW** CWV Optimisation process is
  - Aggregate NDM demand for **SW** LDZ. Note: All available Mon. to Thurs. non holiday demand data points used in analysis
- For these gas years the weather data used in **SW** CWV Optimisation process is
  - Weather data from **Filton** weather station. Combination of WSSM and UK Link
- All years in period used to derive Pseudo SNET profile except 2005/06 gas year

SW LDZ Pseudo SNET

- As with the previous optimisation in 2009 it was found the overall results were improved when 2005/06 gas year was removed from the Pseudo SNET calculation



Results 1: SW LDZ – Iteration summary

- Results shown in order of RMSE ('best' to 'worst'). Rank 1 & 2 iterations highlighted

LDZ	Station
SW	FIL

Ranking	Parameters	ET Range	L1	L2	L3	V0	V1	V2	Q	Increase in R-sq	% decrease in RMSE	Average RMSE (MWHs)
	Current	4 to 14	0.637	0.0088	0.09	3	14.3	17.6	0.38		0.00%	4,727
	Current - New SNET	4 to 14	0.637	0.0088	0.09	3	14.3	17.6	0.38		-9.32%	5,168
1	New: SNET 05/06 Rem	3 to 14	0.682	0.01	0.22	3	14.2	17.3	0.42	0.10%	5.13%	4,485
2	New: SNET 05/06 Rem	2 to 14	0.689	0.0099	0.2	3	14.2	17.1	0.43	0.10%	5.00%	4,491
3	New: SNET 05/06 Rem	5 to 14	0.66	0.0103	0.29	3	14.2	17.2	0.42	0.09%	4.99%	4,491
4	New: SNET 05/06 Rem	3 to 13	0.684	0.01	0.21	3	14.2	17.3	0.4	0.10%	4.99%	4,491
5	New: SNET 05/06 Rem	4 to 13	0.677	0.0098	0.24	3	14.2	17.3	0.41	0.09%	4.87%	4,497
6	New: SNET 05/06 Rem	2 to 13	0.69	0.01	0.2	3	14.2	17.2	0.41	0.09%	4.84%	4,499
7	New: SNET 05/06 Rem	1 to 14	0.694	0.0097	0.2	3	14.2	17.2	0.43	0.09%	4.81%	4,500
8	New: SNET 05/06 Rem	0 to 14	0.698	0.0099	0.18	3	14.2	17.1	0.43	0.09%	4.78%	4,501
9	New: SNET 05/06 Rem	4 to 14	0.674	0.0099	0.27	3	14.2	17.2	0.43	0.09%	4.61%	4,509
10	New: SNET 05/06 Rem	3 to 15	0.687	0.0103	0.24	3	14.5	17.1	0.44	0.08%	4.47%	4,516
11	New: SNET 05/06 Rem	4 to 15	0.678	0.0102	0.27	3	14.5	17.1	0.44	0.08%	4.44%	4,517
12	New: SNET 05/06 Rem	5 to 15	0.664	0.0108	0.31	3	14.5	17.2	0.43	0.08%	4.38%	4,520
13	New: SNET 05/06 Rem	2 to 15	0.695	0.0102	0.22	3	14.5	16.9	0.48	0.08%	4.25%	4,526
14	New	3 to 14	0.705	0.0103	0.22	3	14.8	17.2	0.41	0.05%	2.89%	4,591
15	New	4 to 14	0.697	0.0101	0.26	3	14.9	17.2	0.41	0.04%	2.45%	4,611
										Pos - improvement against benchmark Neg - worse than benchmark		

- Rank 1 displayed best average RMSE improvement of **5.13%** when compared with current parameters
- Rank 2 displayed a **5.00%** improvement

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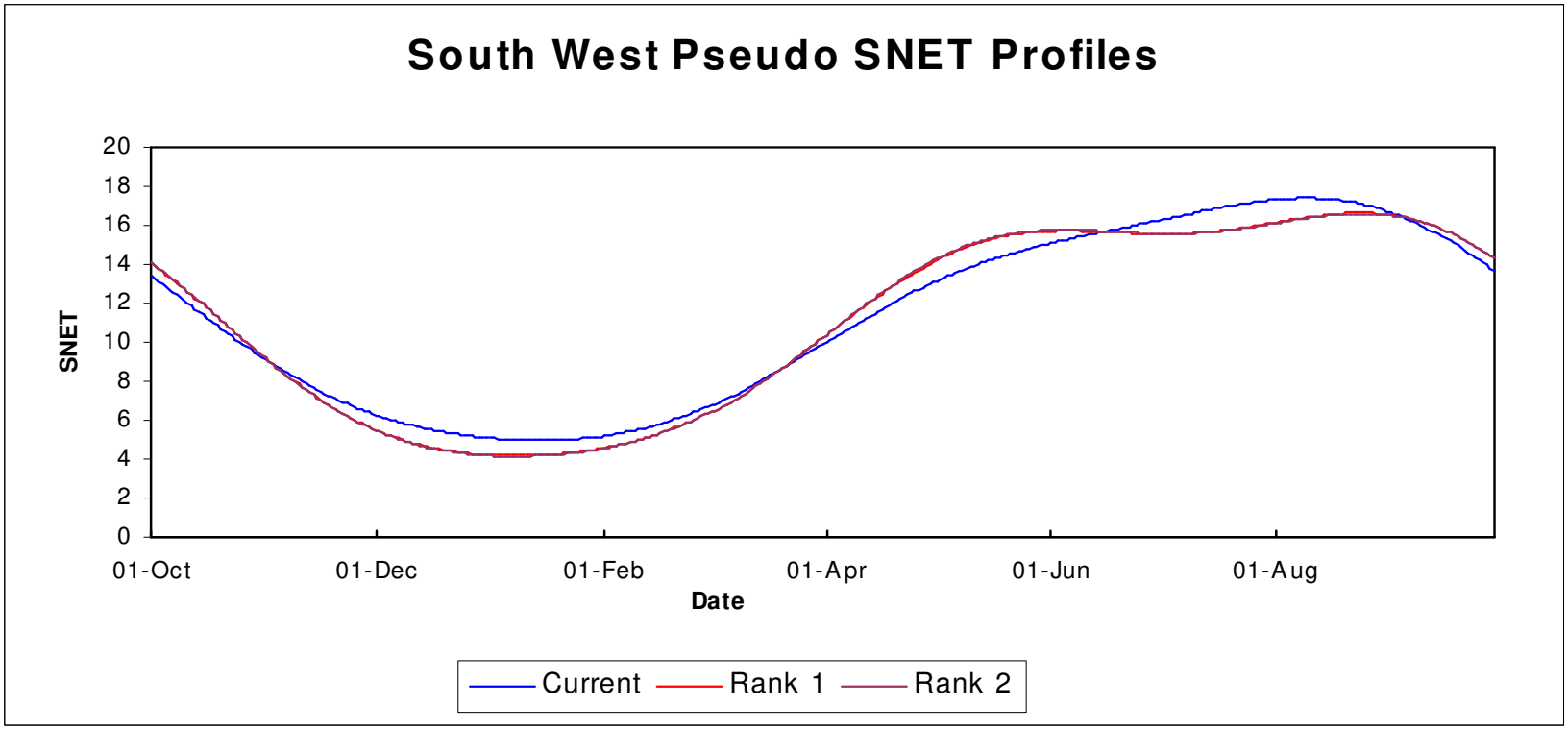
Results 2: SW LDZ – Pseudo SNET Profiles



- Revised Pseudo SNET profiles quite different to current profile, lower in winter, higher in spring and lower early summer
- Rank 1 and Rank 2 profiles very similar

Results 3: SW LDZ – Fit between weather and demand

- Results of current vs Alternatives are represented as **Green**: Better fit **Red**: Worse fit.

LDZ	Station
SW	FIL

Gas Years	2004/05 to 2013/14

Parameters	Ranking	ET Range	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Average RMSE (MWHs)	Avg. % diff. in est. 1 in 20 peak demand
Current		4 to 14	4.54%	99.04%	4,727	
New: SNET 05/06 Rem	1	3 to 14	4.27%	99.14%	4,485	5.94
New: SNET 05/06 Rem	2	2 to 14	4.27%	99.14%	4,491	5.63

- Rank 1 parameters produced best fit in terms of Avge.Mean Absolute % Error, Avge. Adj. R-sq. and Avge. RMSE
- See slide 12 for comments in relation to 1 in 20 estimate peak demand

Results 4: SW LDZ – Quarterly MAPE and MPRE

- Results of Current vs Alternatives are represented as **Green**: Better fit **Red:** Worse fit

LDZ	Station
SW	FIL

			MAPE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	3.09%	6.22%	6.55%	4.49%
New: SNET 05/06 Rem	1	3 to 14	2.88%	5.74%	5.98%	4.44%
New: SNET 05/06 Rem	2	2 to 14	2.88%	5.75%	5.97%	4.47%

			MPRE			
Parameters	Ranking	ET Range	DEC - FEB	MAR to MAY	JUN to AUG	SEP to NOV
Current		4 to 14	0.37%	-1.39%	3.78%	-0.78%
New: SNET 05/06 Rem	1	3 to 14	-0.07%	0.37%	-1.75%	0.46%
New: SNET 05/06 Rem	2	2 to 14	-0.04%	0.32%	-1.93%	0.53%

- On average, Rank 1 displays better seasonal fit for 2 quarters (MAPE)
- On average, Rank 1 displays better seasonal bias for 2 quarters (MPRE)

Results 5: SW LDZ – Monthly MAPE

- Monthly MAPE - Results of Current vs Alternatives are represented as:
  Green: Better fit **Red:** Worse fit

LDZ	Station
SW	FIL

			MAPE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 14	3.46%	2.63%	3.24%	4.85%	7.56%	8.66%
New: SNET 05/06 Rem	1	3 to 14	3.17%	2.59%	2.96%	4.49%	6.91%	8.05%
New: SNET 05/06 Rem	2	2 to 14	3.15%	2.58%	2.95%	4.48%	6.94%	8.09%

			MAPE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 14	6.25%	6.97%	6.43%	5.92%	5.53%	3.43%
New: SNET 05/06 Rem	1	3 to 14	5.98%	6.31%	5.65%	5.40%	5.73%	3.38%
New: SNET 05/06 Rem	2	2 to 14	5.94%	6.52%	5.44%	5.42%	5.81%	3.37%

- On average across the 12 months, Rank 2 has the best seasonal fit in 7 months. Rank 1 still better than current for 11 months

Results 6 : SW LDZ – Monthly MPRE

- Monthly MPRE - Results of Current vs Alternatives are represented as:
  Green: Less bias; **Red:** more bias.

LDZ	Station
SW	FIL

			MPRE					
Parameters	Ranking	ET Range	DEC	JAN	FEB	MAR	APR	MAY
Current		4 to 14	1.32%	0.10%	-0.02%	0.01%	-3.07%	-3.28%
New: SNET 05/06 Rem	1	3 to 14	0.34%	-0.24%	-0.19%	0.62%	-0.11%	0.35%
New: SNET 05/06 Rem	2	2 to 14	0.34%	-0.17%	-0.18%	0.59%	-0.19%	0.26%

			MPRE					
Parameters	Ranking	ET Range	JUN	JUL	AUG	SEP	OCT	NOV
Current		4 to 14	2.28%	4.69%	4.41%	1.04%	-1.37%	-0.99%
New: SNET 05/06 Rem	1	3 to 14	-0.71%	-2.69%	-1.89%	0.54%	1.98%	-0.48%
New: SNET 05/06 Rem	2	2 to 14	-0.66%	-3.22%	-1.97%	0.63%	2.06%	-0.42%

- Rank 1 showing better seasonal bias for 5 of 12 months with Rank 2 better for 3 months

Results 7: SW LDZ Parameters

- Comparison of Top 2 ranked CWV parameters with Current CWV parameters

LDZ	Station
SW	FIL

Gas Year	2004/05 to 2013/14

Parameters	Ranking	ET Range	1 in 20 Peak CWV	L1	L2	L3	V0	V1	V2	Q
Current		4 to 14	-3.11	0.637	0.0088	0.09	3	14.3	17.6	0.38
New: SNET 05/06 Rem	1	3 to 14	-4.94	0.682	0.0100	0.22	3	14.2	17.3	0.42
New: SNET 05/06 Rem	2	2 to 14	-4.86	0.689	0.0099	0.20	3	14.2	17.1	0.43

- Slightly more weighting applied to L1 parameter
- Slightly more weighting for Cold weather upturn now present
- Warm weather cut-off, V2, decreased

- On average Rank 1 shows an improved fit overall and lower RMSE than current parameters
- **TWG to now decide on preferred set of parameters for SW LDZ**

CWV Optimisation

Recommendations and Next Steps

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Recommendations

Recap on recommendations for each LDZ

Next steps

- At todays DESC meeting, members to consider TWG recommendations for revised CWV parameters and provide approval for their use from 1st October 2015
- Revised parameters to be used in the calculation of new Seasonal Normal basis for the Composite Weather Variable (SNCWV). This will be calculated following the DESC approved methodology, available on J.O website
- New SNCWVs to be reviewed at DESC meeting on 3rd December 2014 (published beforehand)
- Request for wider industry comments during w/c 8th December 2014
- DESC T.Con on 17th December 2014 to discuss any comments received and finalise the SNCWVs for use in AQ calculations and Demand Estimation modelling