Results of Composite Weather Variable Review

## Demand Estimation Sub-Committee

22nd December 2009

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  - CWV parameters and fit statistics for all remaining LDZs

Background to CWV Review

Composite Weather Variable (CWV) – 1 of 2

- The CWV is a single measure of daily weather in each LDZ and is a function of effective temperature, wind speed and pseudo Seasonal Normal Effective Temperature (SNET)

- The CWV is defined to give a linear relationship between Monday to Thursday non holiday daily aggregate NDM demand in the LDZ and the CWV

- The relationship between weather and demand is fundamental to demand estimation and forecasting processes. It is important to produce a weather variable that provides the strongest possible 'fit' for the weather and demand models.

Figure A3.8 - Demand against CWV, Monday to Thursday, Including Holidays Domestic Band
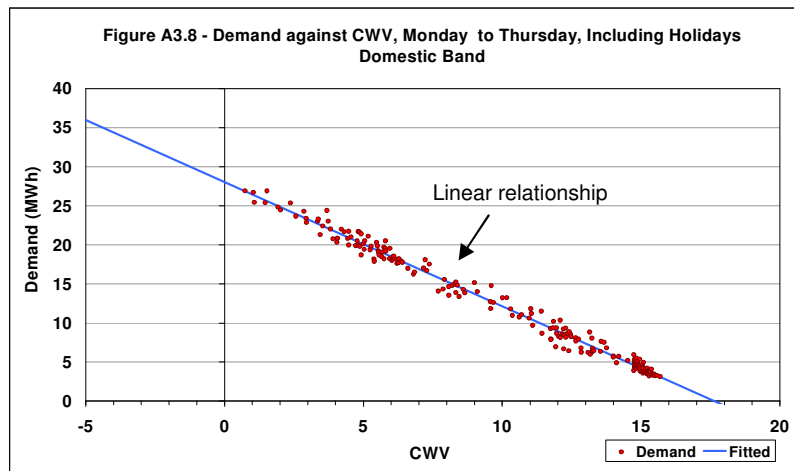
- This relationship is key to providing the Demand Estimation parameters:
  - Annual Load Profile (ALP)
  - Daily Adjustment Factor (DAF)
  - Load Factors
- The parameters are required for:
  - Allocation process
  - AQ calculation
  - Derivation of SOQ

Composite Weather Variable (CWV) – 2 of 2

- Key features of the composite weather variable include:

    - Effective temperature
    - Wind chill
    - Cold weather upturn
    - Warm weather cut off

- Further background and details relating to CWV can be found on Joint Office website under 31st March 2009 DESC meeting – 'Summary of CWV Methodology review.pdf'

Why were the CWV parameters reviewed

- UNC (H1.4.2) requires Transporters every 5 years after consultation with DESC "to review and where appropriate revise with effect from the start of a gas year" composite weather variable (CWV) definitions for each LDZ.

- Last such review carried out in autumn 2004 and implemented on 1st October 2005. (Some CWVs revised since then because of weather station changes).

- Therefore comprehensive review of all LDZ CWVs was carried out in Autumn 2009 for implementation on 1st October 2010.

- In March 2009, DESC agreed the CWV methodology was fit for purpose and number of years used to derive most of the parameters should be 13 (1996/97 to 2008/09).

- Methodology document: 'Autumn 2009 CWV Review – Proposed Approach.pdf' published on Joint Office website under 11th May 2009 DESC meeting, however key points are…..

Key points of CWV methodology

- Uses aggregate NDM demand (outside holiday periods)
  - currently 13 gas years, 1996/97 to 2008/09.

- The pseudo SNET profile (introduced during last review in 2004) is derived from models of aggregate NDM demand and weather. Its shape is designed to minimise seasonal bias on average for years modelled (13 gas years, 1996/97 to 2008/09).

- CWV parameters (except for cold weather upturn) are derived from models of aggregate NDM demand and weather.

- Maximum potential demand (MPD) data prior to 1996/97 is included in the derivation of cold weather upturn parameters (insufficient cold weather in recent years to derive these).

- The values of the CWV parameters are chosen to give the best fit to demand on average.

- Suspect / unusual data for particular days or years may be excluded from the analysis or corrected.

Summary of analysis – 1 of 2

- Use methodology to derive revised CWVs for 12 LDZs (all except WN – has same CWV definition as NW LDZ).

- Use same raw weather data as current CWVs (no weather station changes).

- Derive aggregate NDM demand models for all LDZs for revised and current CWVs (13 gas years, 1996/97 to 2008/09).

- Assess average fit of CWVs to aggregate NDM demand (over 13 gas years and most recent 5 gas years).

- Assess average seasonal bias of aggregate NDM demand models using the mean percentage residual error (MPRE):
  MPRE = $100 \times \dfrac{\text{avg. actual demand} - \text{avg. fitted demand}}{\text{avg. actual demand}}$
  (for quarters Dec-Feb, Mar-May, Jun-Aug and Sep-Nov).

- Assess change to 1 in 20 peak aggregate NDM demand estimates (using demand models and 1 in 20 peak CWVs derived from 81 gas years).

Summary of analysis – 2 of 2

- Final results presented in same format as 'CWV review' process published earlier this year

- Results of 6 LDZs selected for review at DESC, namely:
    - SC, NO, WM, NT, SO, SW
    - Remaining LDZs provided as appendices at end of presentation

- Additional results also produced for gas year 2008/09 for 4 LDZs selected as part of CWV review process
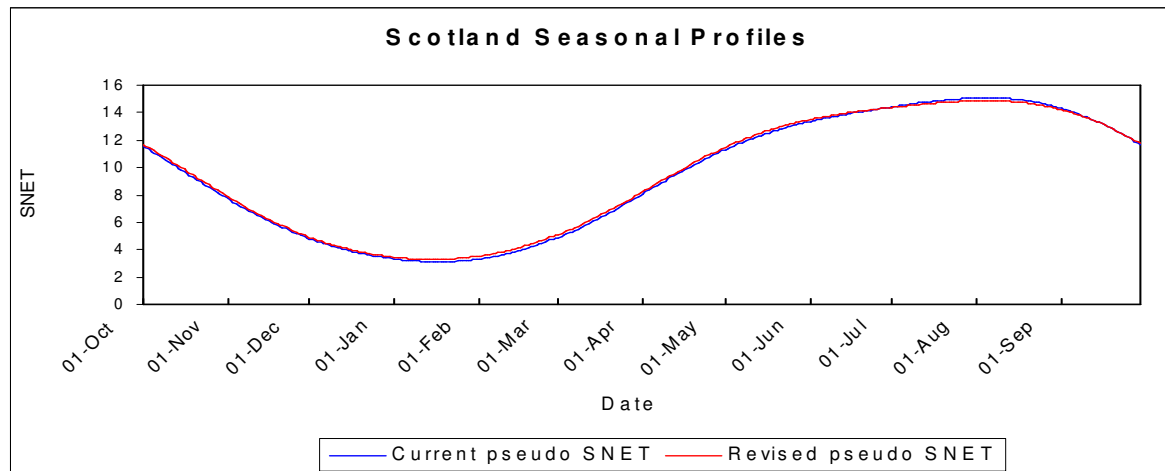
Explanation of CWV review results

- **Slide 1:**
  - **Objective:** Compare revised CWV parameters with current CWV parameters including 1 in 20 peak CWV
  - **Analysis:** Use current methodology to derive revised CWVs for each LDZ including the additional 4 years of weather/demand history. High level observations on results provided

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.65	0.656	0.0125	0.22	3	13.3	16.0	0.64
Revised	-4.25	0.652	0.0119	0.19	3	13.4	16.2	0.62

Explanation of CWV review results

- ## Slide 2:

  - **Objective:** Compare revised pseudo SNET profile with current pseudo SNET profile

  - **Analysis:** Calculate revised pseudo Seasonal Normal Effective Temperature (SNET) and visually compare profile with current pseudo SNET. High level observations on results provided

Scotland Seasonal Profiles

[Chart: Line graph with SNET on the y-axis (0 to 16) and Date on the x-axis (01-Oct through 01-Sep). Two overlapping curves: Current pseudo SNET (blue) and Revised pseudo SNET (red).]

Legend: —— Current pseudo SNET   —— Revised pseudo SNET

Explanation of CWV review results

- **Slide 3:**
  - **Objective:** To confirm the current CWV methodology provides a strong fit between weather and demand and to assess change in estimated 1 in 20 peak aggregate NDM demand estimates
  - **Analysis:** Derive aggregate NDM demand models for revised and current CWVs. Assess average 'fit' of CWVs to aggregate NDM demand. Results of current vs revised are represented as:
    Green: better fit; Red: worse fit.
    Use demand models and 1 in 20 peak CWVs to assess estimated 1 in 20 peak demand.

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97	3.69%	98.97%	6,218	-0.66%
Revised	- 2008/09	3.68%	98.98%	6,196	
Current	2004/05	3.84%	99.02%	6,338	-0.67%
Revised	- 2008/09	3.80%	99.05%	6,258	

Explanation of CWV review results

- **Slide 4:**
  - **Objective:** To ensure strong relationship is maintained throughout the seasons ('seasonal fit')
  - **Analysis:** Assess average seasonal bias ((for quarters Mar-May, Jun-Aug, Sep-Nov and Dec-Feb) of aggregate NDM demand models using the mean percentage residual error (MPRE):

$$MPRE = 100*\frac{(avg.\ actual\ demand - avg.\ fitted\ demand)}{avg.\ actual\ demand}$$

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.50%	-0.11%	4.03%	-0.41%	6.46%	-0.41%	4.13%	0.67%
Revised		2.48%	-0.10%	4.02%	-0.05%	6.53%	-0.52%	4.11%	0.35%
Current	2004/05-2008/09	2.58%	-0.10%	4.10%	-1.06%	7.74%	-0.30%	4.21%	1.21%
Revised		2.55%	-0.10%	4.01%	-0.68%	7.84%	-0.39%	4.14%	0.89%

Explanation of Additonal CWV review results for 4 LDZs

- **Slide 5:**
  - **Objective:** To view actual and fitted demand for Monday to Thursday (non-holidays) for most recent gas year (2008/09) using **current** CWV

  - **Analysis:** Graph of actual demand by season vs fitted demand line

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using current CWV, 2008/09, SC LDZ
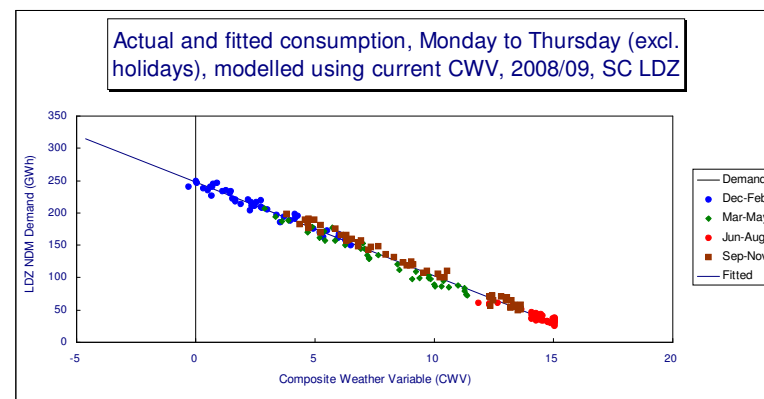
- **Slide 6:**
  - **Objective:** To view actual and fitted demand for Monday to Thursday (non-holidays) for most recent gas year (2008/09) using **revised** CWV

  - **Analysis:** Graph of actual demand by season vs fitted demand line

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using revised CWV, 2008/09, SC LDZ
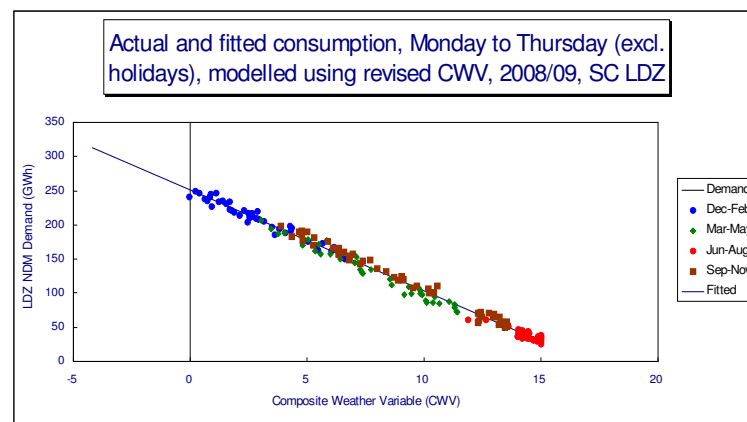
Explanation of Additonal CWV review results for 4 LDZs

- **Slide 7:**

  - **Objective:** To compare model parameters and statistical results from current and revised CWVs for Gas Year 2008/09, i.e the numbers behind the graphs in slide 5 and 6

  - **Analysis:** Table of results summarising model outputs and statistical fits with high level observations of results

Gas Year	CWV	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Adj. RMSE (MWh)
2008/09	Current	247.99	-14.54	4.32%	99.01%	6,799
2008/09	Revised	251.01	-14.80	4.18%	99.08%	6,563

Review of CWV parameters by LDZ

SC LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.63	0.656	0.0125	0.22	3	13.3	16.0	0.64
Revised	-4.19	0.653	0.0118	0.19	3	13.2	16.0	0.64

- Similar CWV parameter values for current and revised CWV.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

SC LDZ - comparison of pseudo SNET profiles

Scotland Seasonal Profiles

Legend: Current pseudo SNET — Revised pseudo SNET

- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter and lower in summer.

SC LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.69%	98.97%	6,218	-0.66%
Revised		3.68%	98.98%	6,196	
Current	2004/05 - 2008/09	3.84%	99.02%	6,338	-0.67%
Revised		3.80%	99.05%	6,258	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

xoserve

SC LDZ - comparison of seasonal fit and bias

| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.50%	-0.11%	4.03%	-0.41%	6.46%	-0.41%	4.13%	0.67%
Revised		2.48%	-0.10%	4.02%	-0.05%	6.53%	-0.52%	4.11%	0.35%
Current	2004/05-2008/09	2.58%	-0.10%	4.10%	-1.06%	7.74%	-0.30%	4.21%	1.21%
Revised		2.55%	-0.10%	4.01%	-0.68%	7.84%	-0.39%	4.14%	0.89%

- On average, neither the current nor revised CWV show much seasonal bias .

- Slightly better seasonal fit on average for revised CWV for most quarters.

NO LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-8.17	0.625	0.0116	0.50	0	12.6	15.7	0.55
Revised	-7.58	0.636	0.0102	0.50	0	12.5	15.7	0.56

- Some years in the 1980s had suspect MPD data and were excluded from the cold weather upturn analysis.

- Some data points (01/06/97 to 05/06/97) were excluded from the analysis to derive the other CWV parameters.

- Similar CWV parameter values for current and revised CWV.

- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

NO LDZ - comparison of pseudo SNET profiles

Northern Seasonal Profiles
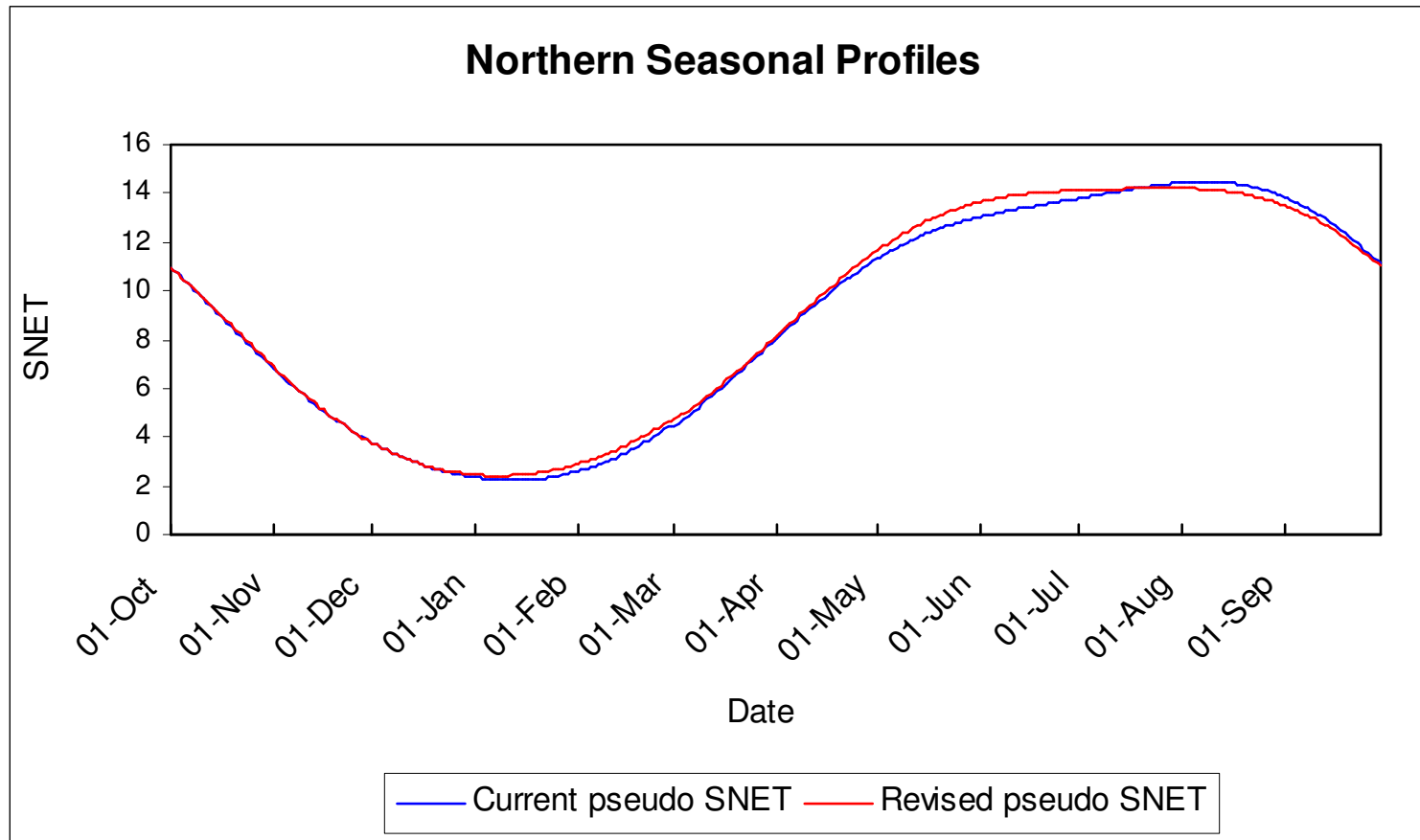
- Revised pseudo SNET profile is similar to current profile, but slightly flatter in summer.

NO LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97	4.20%	98.72%	4,715	-0.83%
Revised	- 2008/09	4.18%	98.75%	4,660	
Current	2004/05	4.74%	98.54%	5,092	-0.82%
Revised	- 2008/09	4.60%	98.63%	4,915	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

NO LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.88%	-0.12%	5.38%	-0.31%	6.99%	-0.47%	4.18%	0.60%
Revised		2.79%	-0.01%	5.34%	0.04%	7.22%	0.00%	4.19%	-0.02%
Current	2004/05-2008/09	3.38%	-0.40%	5.82%	-0.65%	8.05%	0.22%	4.77%	1.14%
Revised		3.15%	-0.31%	5.68%	-0.31%	8.15%	0.67%	4.69%	0.54%

- On average, neither the current nor revised CWV show much seasonal bias .

- Slightly better seasonal fit on average for revised CWV for most quarters.

WM LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-6.51	0.717	0.0113	0.25	1	14.7	18.2	0.34
Revised	-5.67	0.698	0.0104	0.23	1	14.0	17.9	0.39

- CWV parameter values broadly similar.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

XOserve

WM LDZ - comparison of pseudo SNET profiles

West Midlands Seasonal Profiles
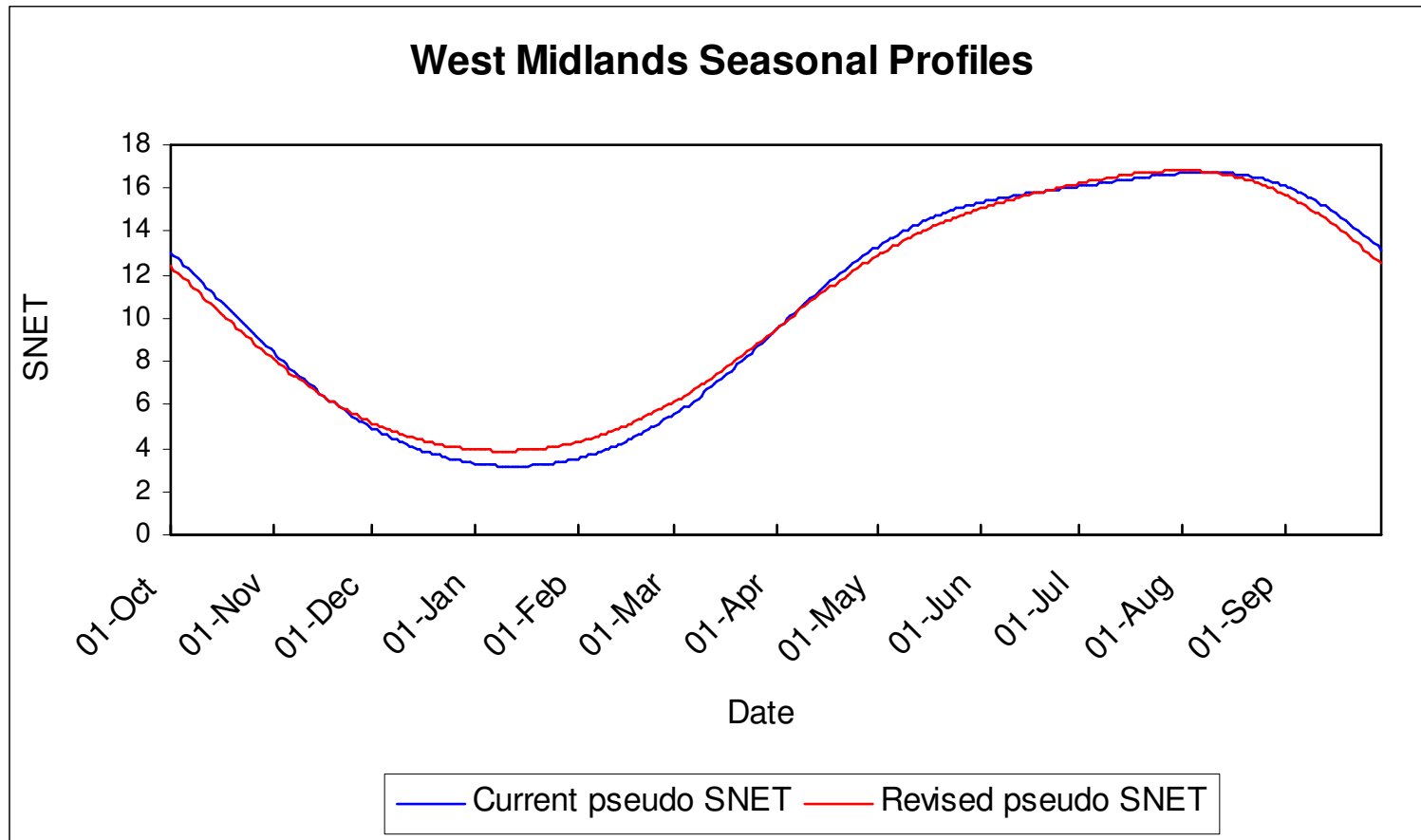
- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter.

WM LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.50%	99.21%	6,915	-0.47%
Revised		3.49%	99.22%	6,850	
Current	2004/05 - 2008/09	3.72%	99.23%	6,855	-0.42%
Revised		3.59%	99.29%	6,602	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

WM LDZ - comparison of seasonal fit and bias

| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.44%	0.03%	4.45%	-0.46%	5.24%	-0.66%	3.72%	0.58%
Revised		2.39%	0.11%	4.44%	0.15%	5.30%	-0.43%	3.75%	-0.18%
Current	2004/05-2008/09	2.58%	0.06%	4.87%	-1.82%	5.91%	0.77%	3.81%	1.37%
Revised		2.49%	0.12%	4.74%	-1.14%	5.52%	0.76%	3.71%	0.64%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

NT LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.33	0.708	0.0119	0.00	0	15.5	19.6	0.31
Revised	-4.58	0.703	0.0129	0.00	0	15.2	19.2	0.35

- Data on 29/09/04 was excluded from the analysis.
- 2005/06 was excluded from the analysis to derive the pseudo SNET profile because effective temperature was consistently high from May to September.
- CWV parameter values broadly similar.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

NT LDZ - comparison of pseudo SNET profiles

North Thames Seasonal Profiles
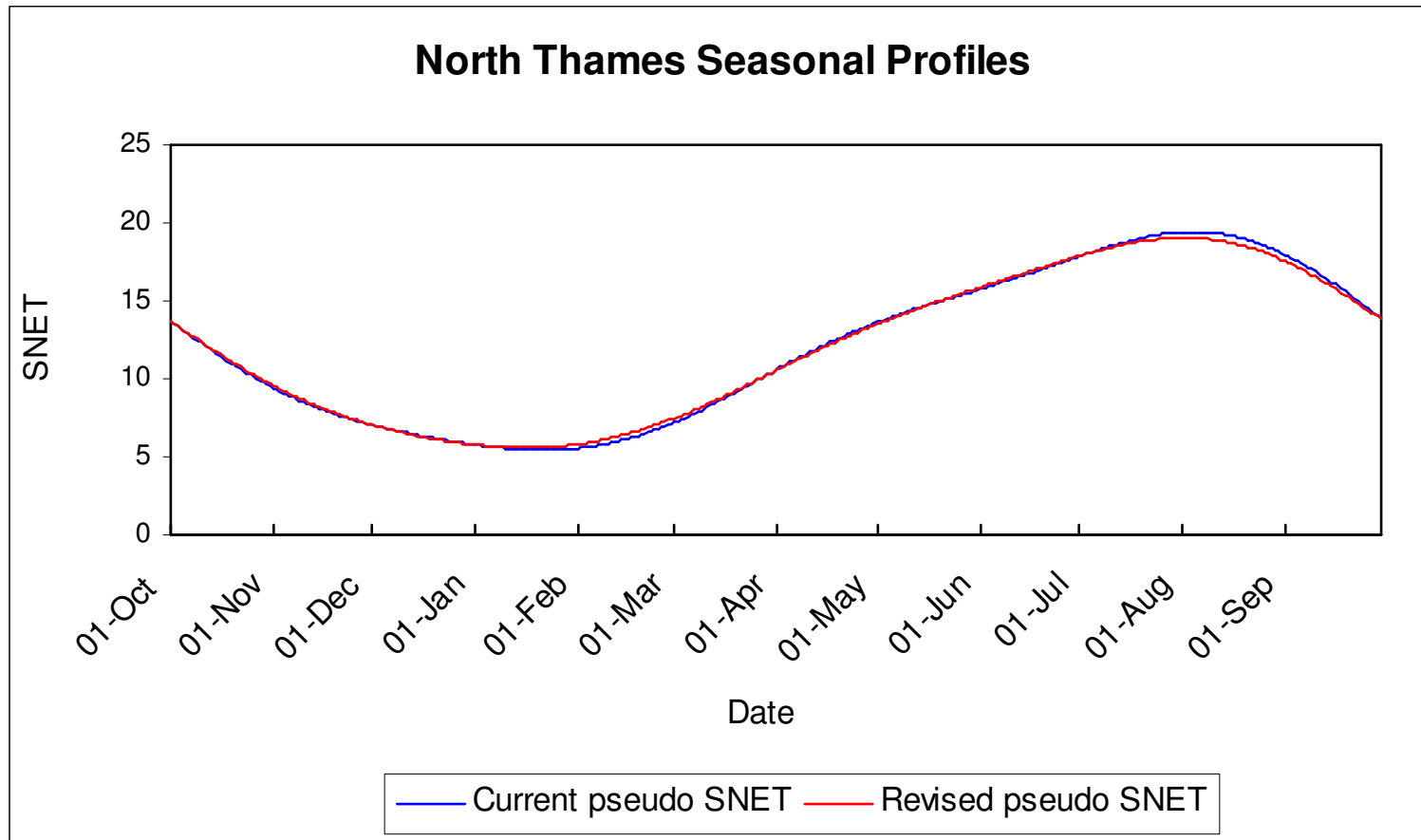
- Revised pseudo SNET profile is similar to current profile, but slightly lower in summer.

NT LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.49%	99.24%	7,847	1.38%
Revised		3.46%	99.26%	7,772	
Current	2004/05 - 2008/09	3.50%	99.29%	7,418	1.43%
Revised		3.43%	99.32%	7,309	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- Relatively small change in estimated peak demand.

NT LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.59%	0.20%	4.40%	0.05%	4.67%	1.14%	3.71%	-0.71%
Revised		2.53%	0.12%	4.30%	0.21%	4.76%	0.47%	3.74%	-0.52%
Current	2004/05-2008/09	2.50%	0.27%	4.34%	-0.71%	4.78%	2.85%	3.92%	-0.66%
Revised		2.41%	0.18%	4.25%	-0.56%	4.71%	2.18%	3.91%	-0.44%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

SO LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-5.41	0.710	0.0137	0.31	2	15.0	18.1	0.41
Revised	-4.94	0.677	0.0127	0.39	2	14.8	18.1	0.38

- CWV parameter values broadly similar.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

SO LDZ - comparison of pseudo SNET profiles

Southern Seasonal Profiles
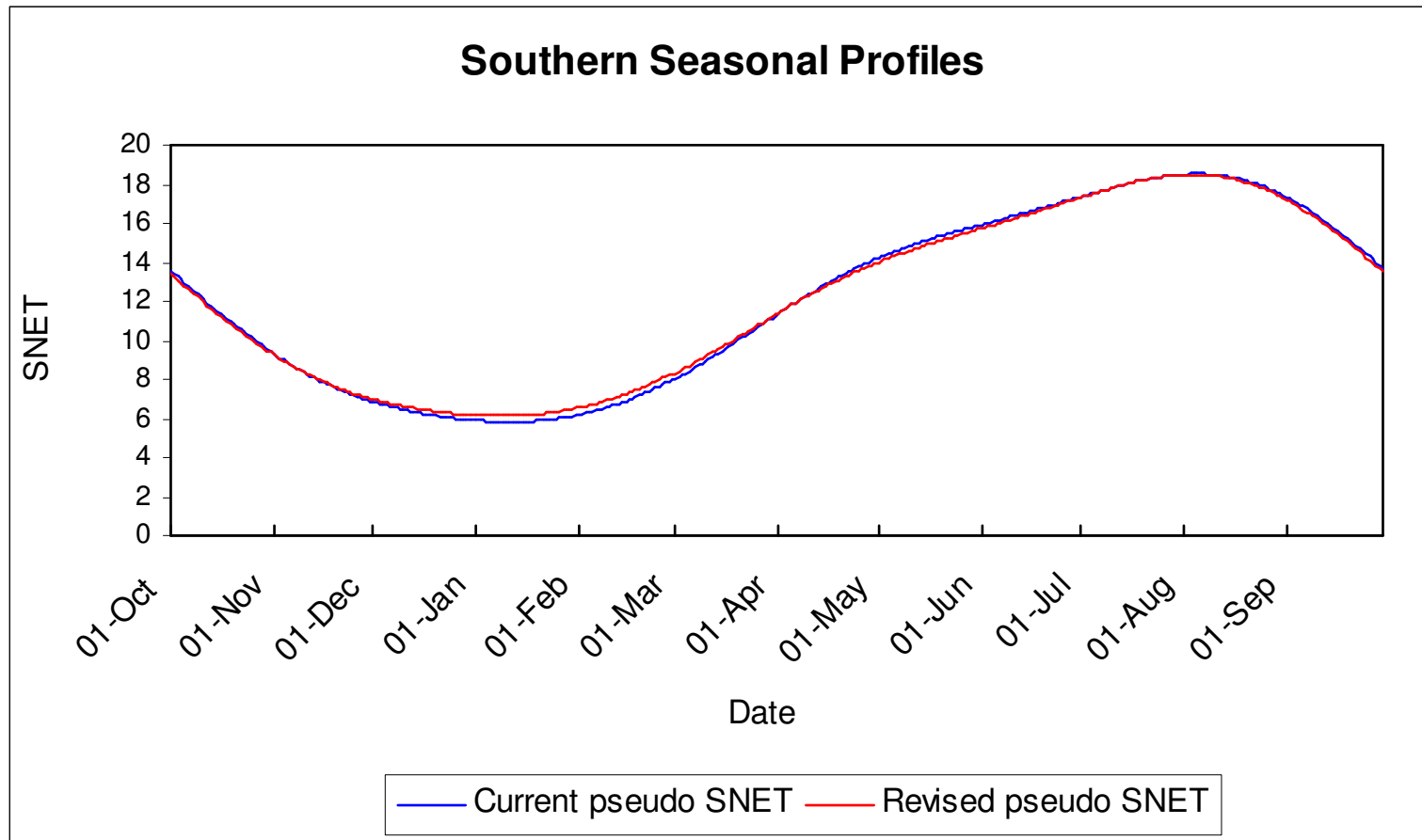
- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter.

SO LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	4.10%	99.04%	5,986	0.37%
Revised		4.07%	99.05%	5,950	
Current	2004/05 - 2008/09	4.21%	99.07%	5,984	0.42%
Revised		4.08%	99.13%	5,805	

- Good fit for both CWVs on average.
- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.
- No significant change in estimated peak demand.

SO LDZ - comparison of seasonal fit and bias

| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	3.02%	0.30%	5.39%	-0.86%	5.46%	-0.24%	4.26%	0.39%
Revised		3.03%	0.11%	5.30%	0.01%	5.27%	-0.26%	4.28%	-0.11%
Current	2004/05-2008/09	2.87%	0.53%	5.39%	-2.32%	6.24%	1.03%	4.75%	1.01%
Revised		2.86%	0.33%	5.11%	-1.37%	5.81%	1.04%	4.65%	0.45%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

SW LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.53	0.660	0.0094	0.05	3	14.5	17.8	0.36
Revised	-4.27	0.637	0.0088	0.09	3	14.3	17.6	0.38

- 2005/06 was excluded from the analysis to derive the pseudo SNET profile because effective temperature was consistently high from May to September.

- CWV parameter values broadly similar.

- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

SW LDZ - comparison of pseudo SNET profiles
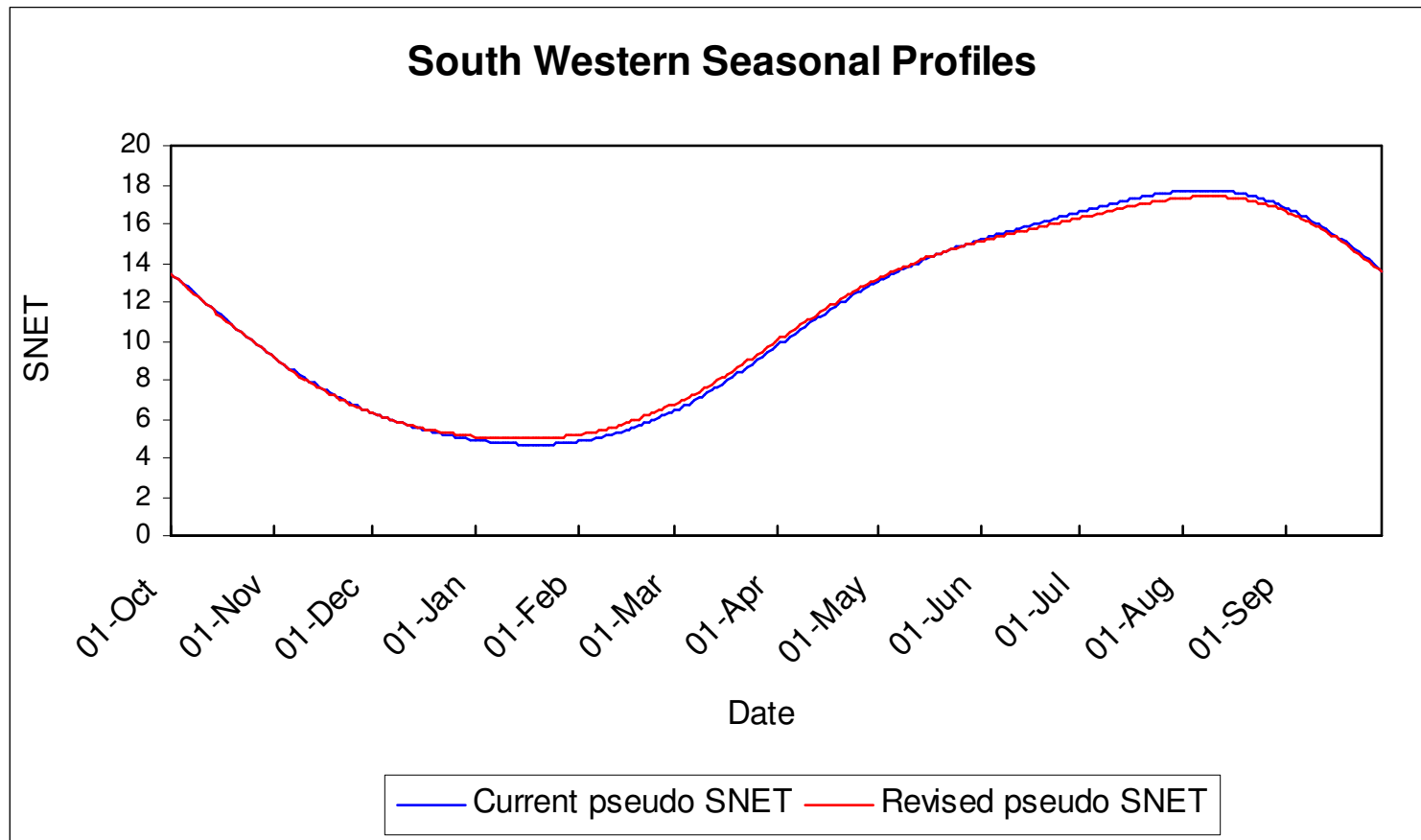
South Western Seasonal Profiles

Legend: Current pseudo SNET — Revised pseudo SNET

- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter and lower in summer.

SW LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.91%	99.08%	4,582	0.45%
Revised		3.88%	99.09%	4,563	
Current	2004/05 - 2008/09	4.28%	98.99%	4,933	0.49%
Revised		4.11%	99.07%	4,768	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

SW LDZ - comparison of seasonal fit and bias

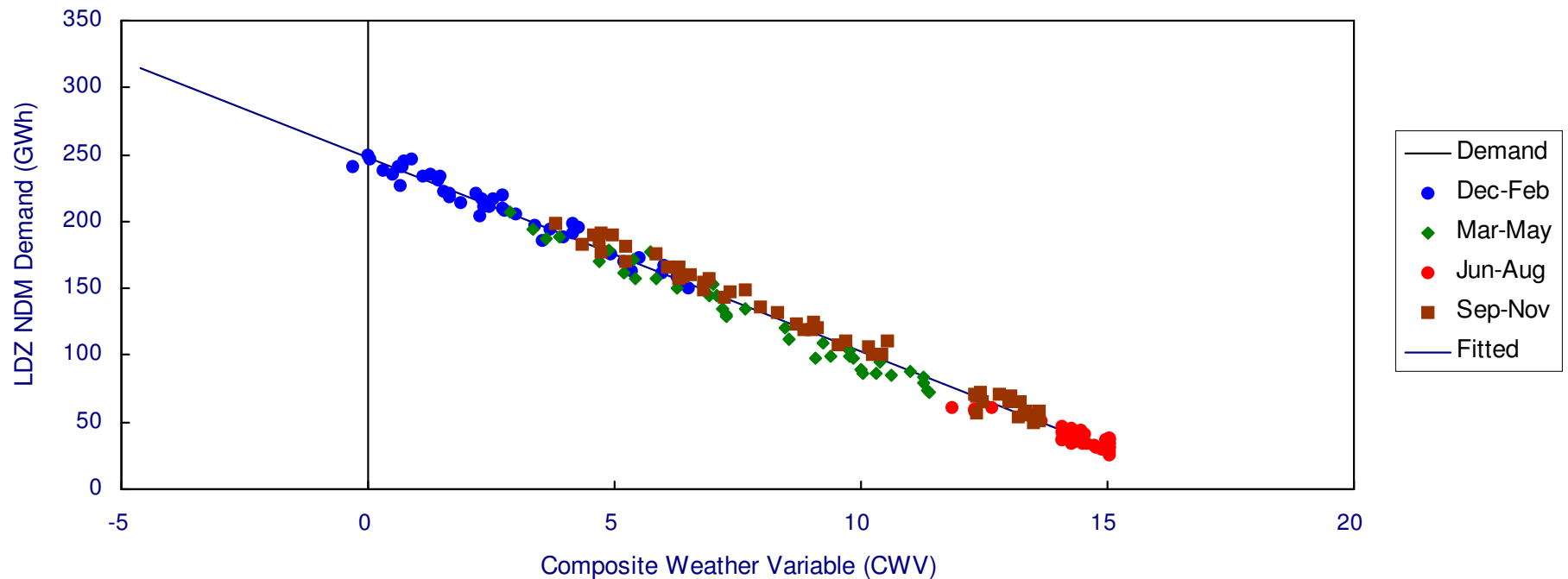| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.81%	0.08%	5.42%	-0.56%	4.97%	0.44%	3.93%	0.27%
Revised		2.78%	-0.11%	5.35%	0.49%	4.98%	-0.21%	3.91%	-0.23%
Current	2004/05-2008/09	3.19%	0.29%	5.97%	-2.10%	5.60%	2.28%	4.10%	0.85%
Revised		3.10%	0.09%	5.65%	-0.96%	5.42%	1.62%	3.95%	0.30%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.
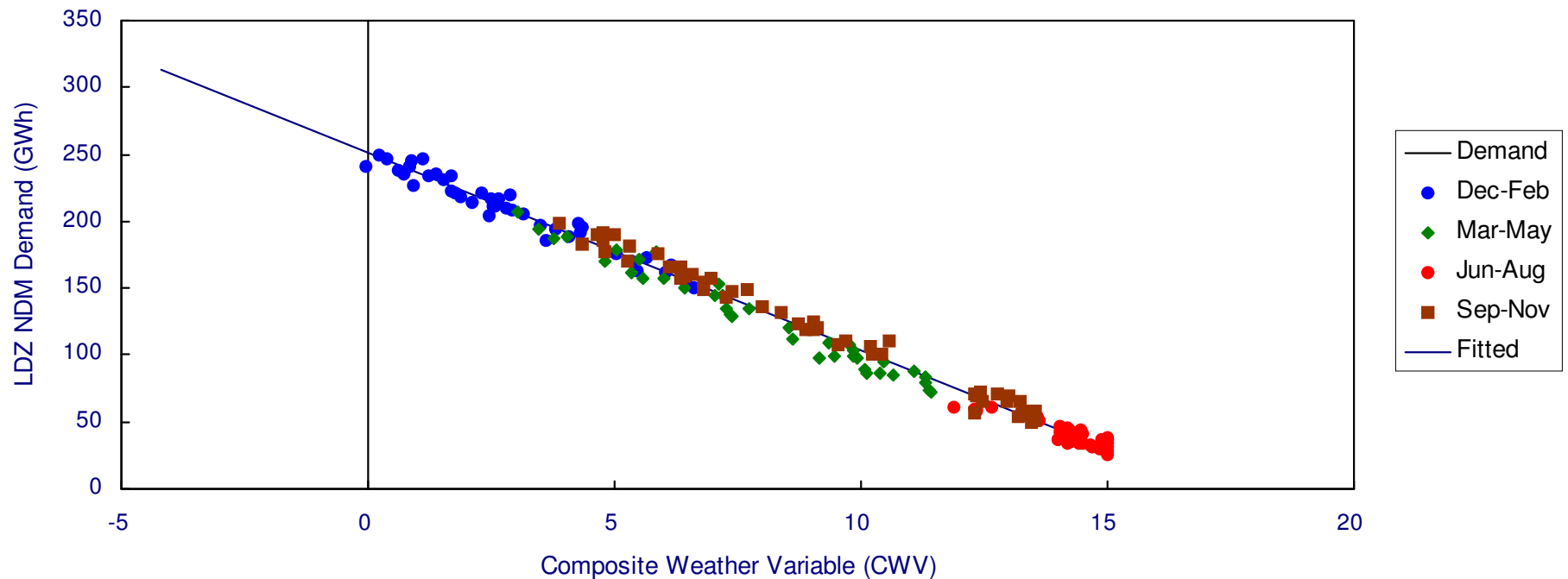
Example Graphs for 2008/09

SC LDZ - example graph for current CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using current CWV, 2008/09, SC LDZ

SC LDZ - example graph for revised CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using revised CWV, 2008/09, SC LDZ
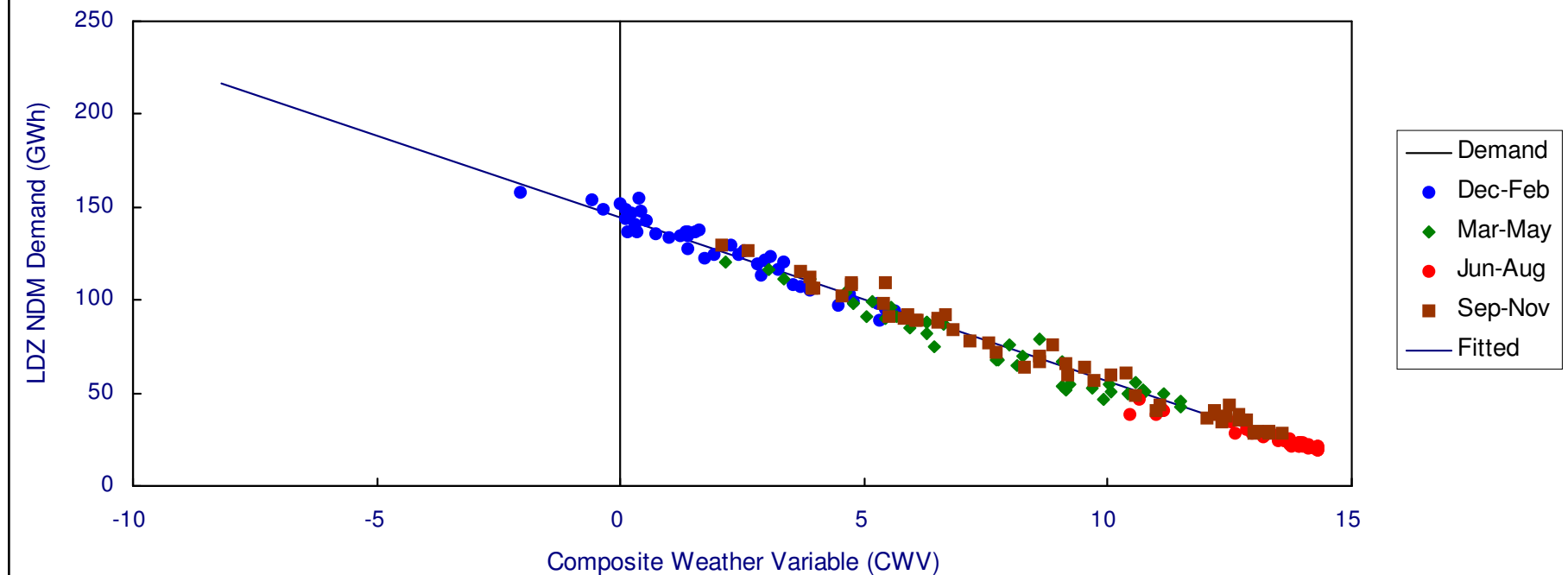
SC LDZ - example graphs - parameters & statistics

Gas Year	CWV	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Adj. RMSE (MWh)
2008/09	Current	247.99	-14.54	4.32%	99.01%	6,799
2008/09	Revised	251.01	-14.80	4.18%	99.08%	6,563

- Parameters and fit statistics for most recent gas year 2008/09 - Monday to Thursday (non-holiday) models.

- 2008/09 had a fairly cool autumn and a relatively cold winter followed by a warm spring and a wet summer.
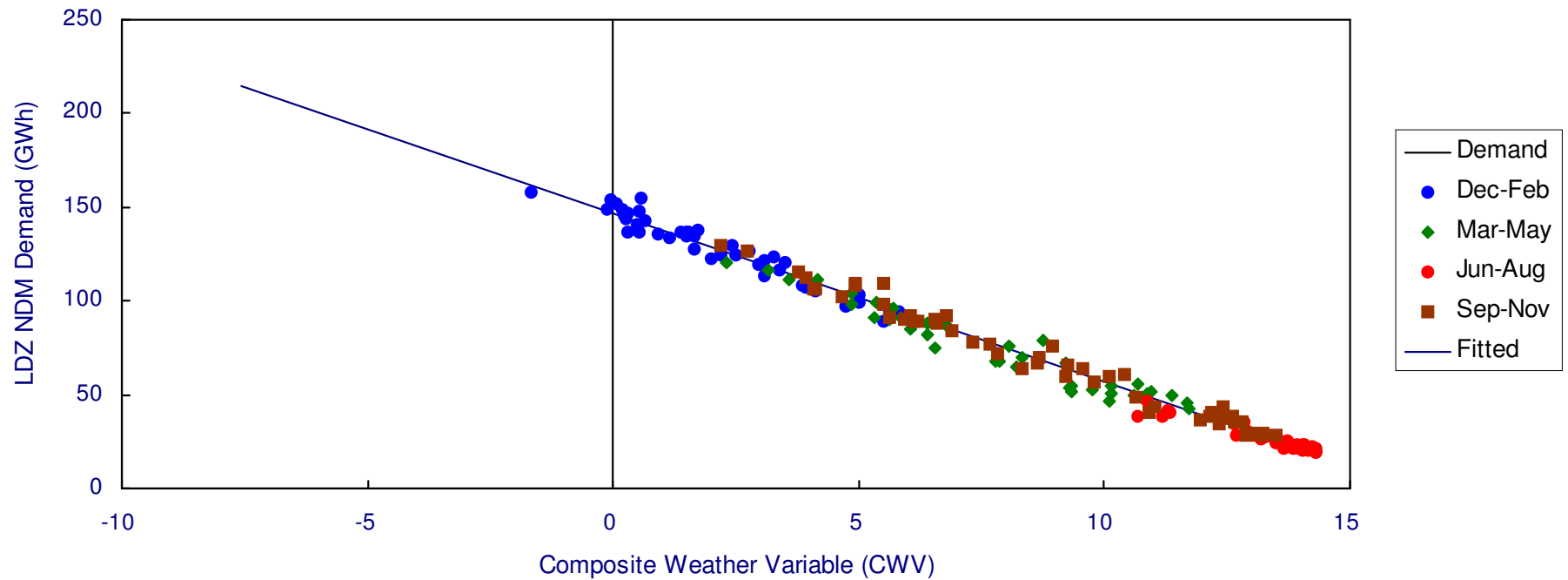
- Coldest day in February.

NO LDZ - example graph for current CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using current CWV, 2008/09, NO LDZ

NO LDZ - example graph for revised CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using revised CWV, 2008/09, NO LDZ

NO LDZ - example graphs - parameters & statistics

Gas Year	CWV	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Adj. RMSE (MWh)
2008/09	Current	144.24	-8.83	4.79%	98.74%	4,678
2008/09	Revised	146.24	-8.97	4.63%	98.83%	4,506

- Parameters and fit statistics for most recent gas year 2008/09 - Monday to Thursday (non-holiday) models.

- 2008/09 had a fairly cool autumn and a relatively cold winter followed by a warm spring and a wet summer.

- Coldest day in January.

WM LDZ - example graph for current CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using current CWV, 2008/09, WM LDZ

WM LDZ - example graph for revised CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using revised CWV, 2008/09, WM LDZ
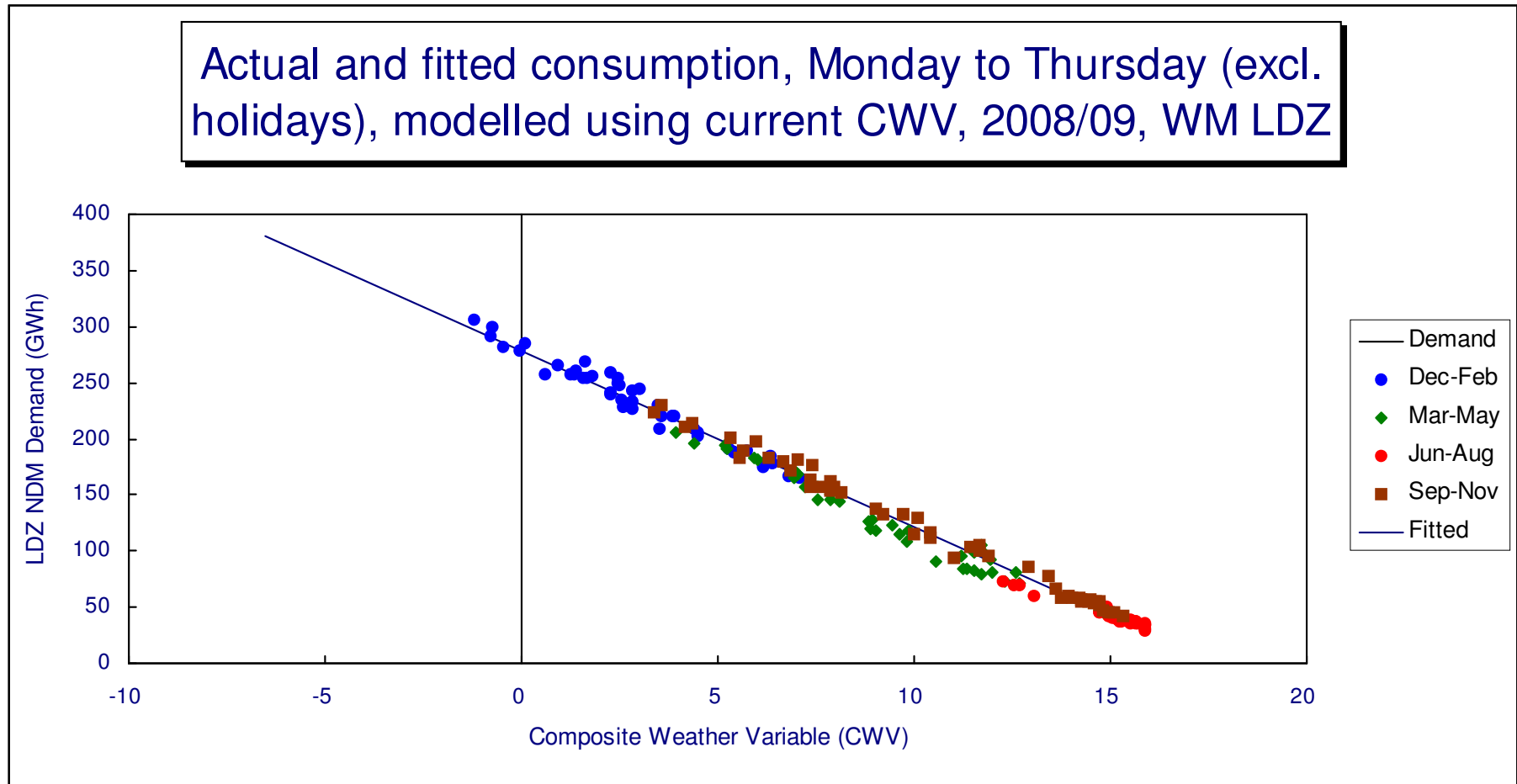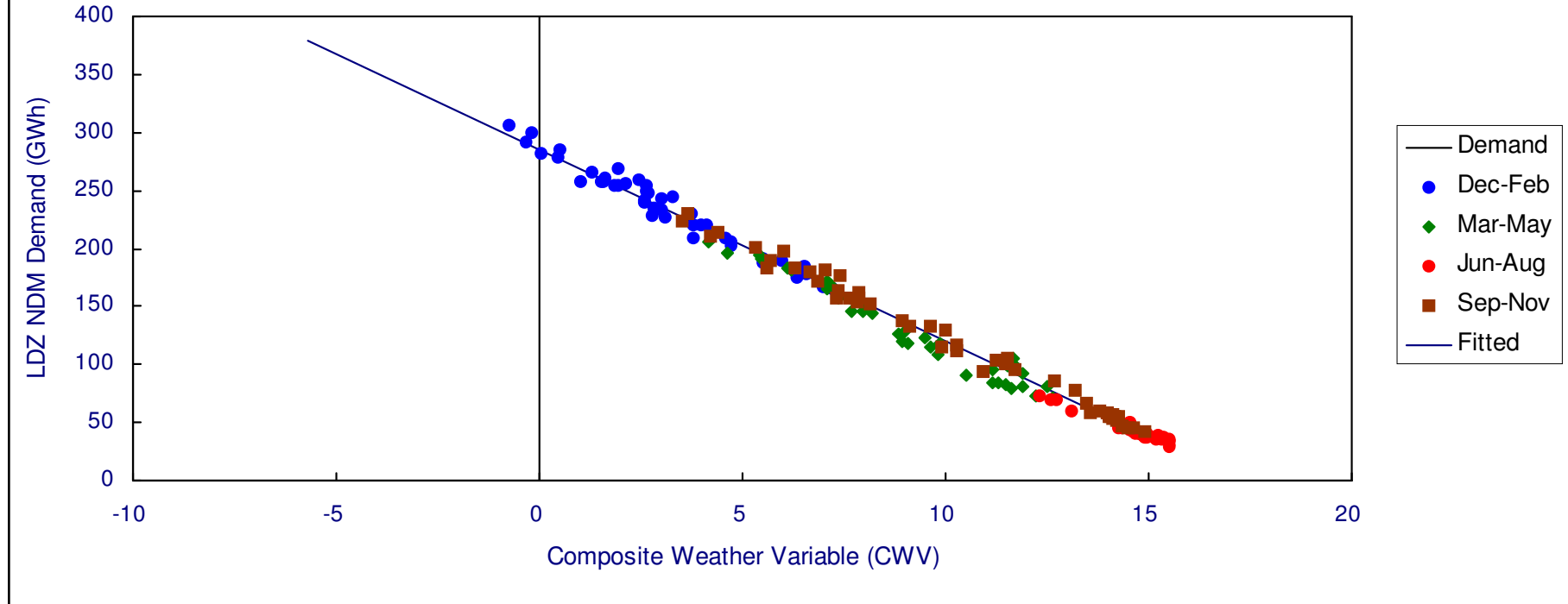
WM LDZ - example graphs - parameters & statistics

Gas Year	CWV	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Adj. RMSE (MWh)
2008/09	Current	278.18	-15.72	4.18%	99.16%	7,289
2008/09	Revised	284.90	-16.51	3.90%	99.28%	6,751

- Parameters and fit statistics for most recent gas year 2008/09 - Monday to Thursday (non-holiday) models.

- 2008/09 had a fairly cool autumn and a relatively cold winter followed by a warm spring and a wet summer.

- Coldest day in January.

SW LDZ - example graph for current CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using current CWV, 2008/09, SW LDZ

SW LDZ - example graph for revised CWV (2008/09)

Actual and fitted consumption, Monday to Thursday (excl. holidays), modelled using revised CWV, 2008/09, SW LDZ
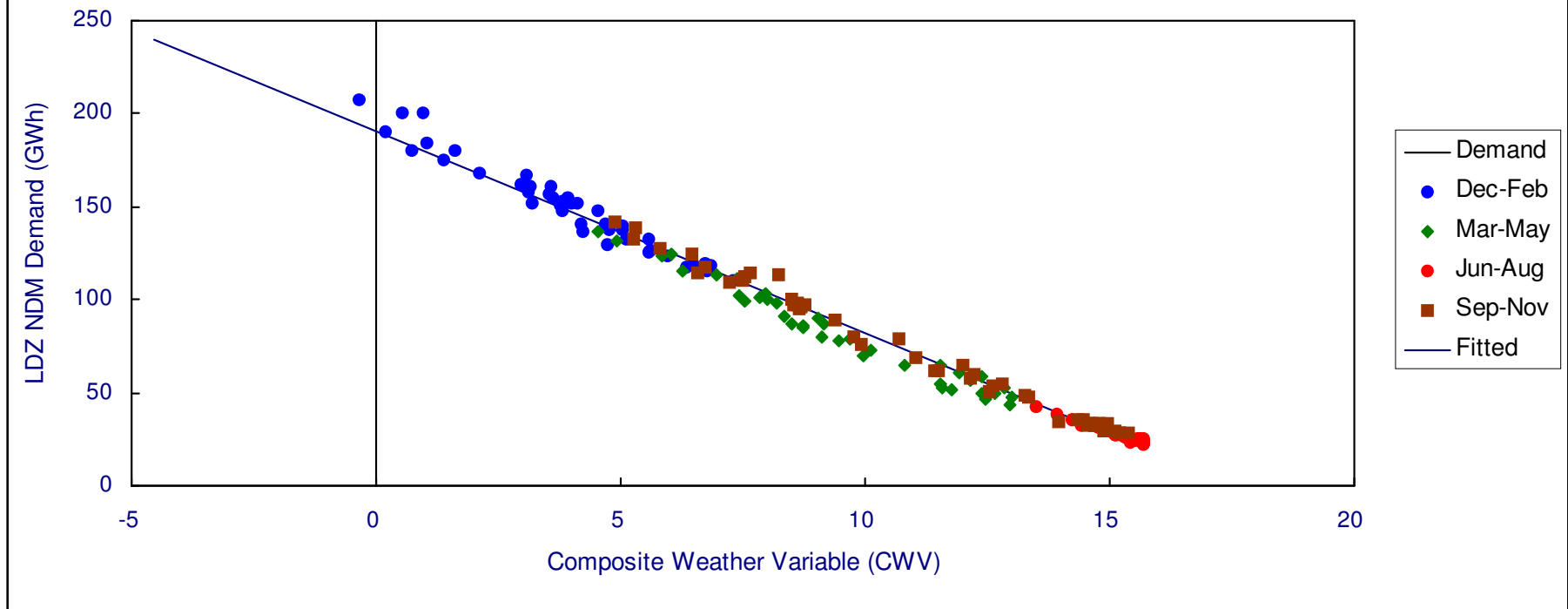
SW LDZ - example graphs - parameters & statistics

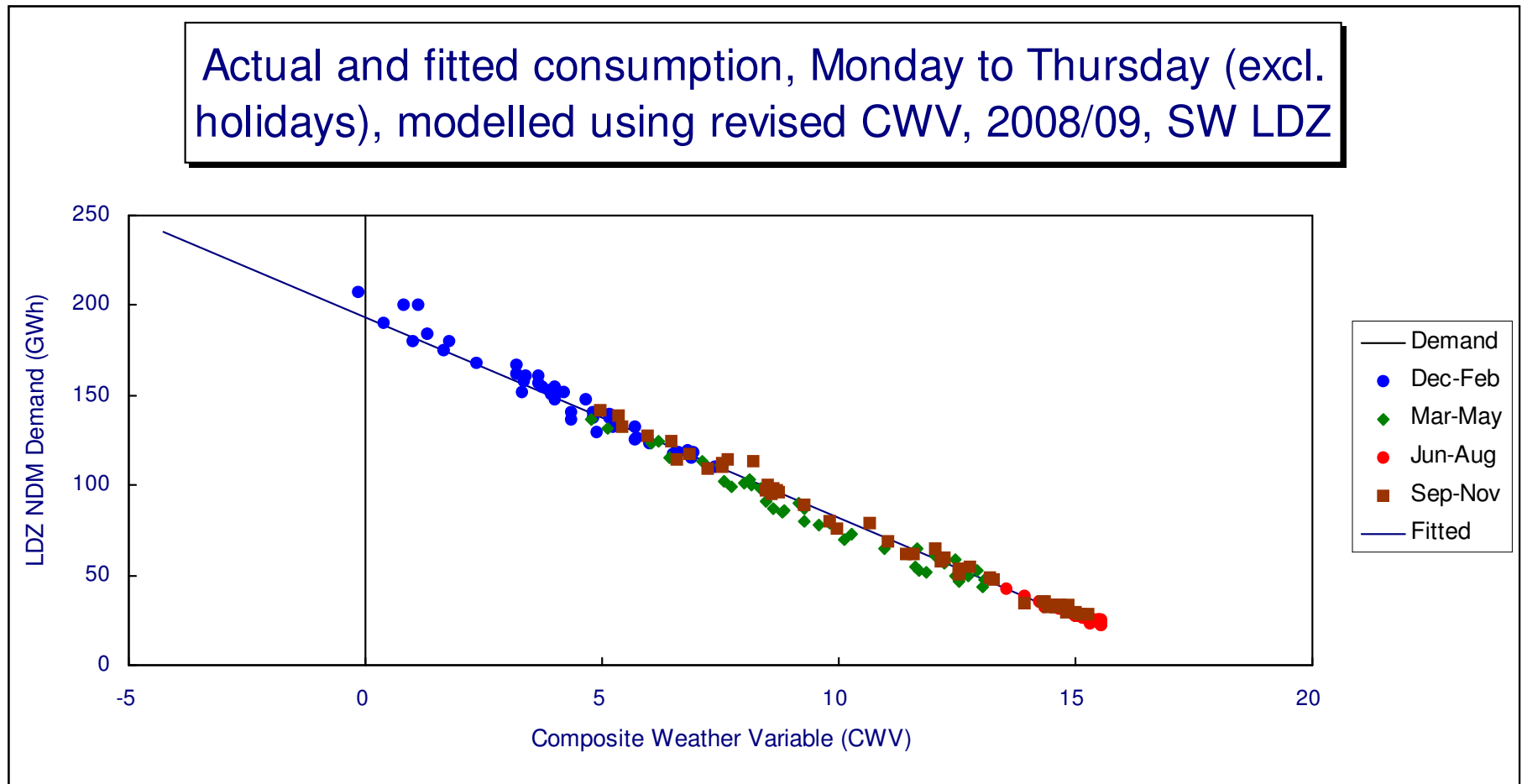| Gas Year	CWV	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Adj. RMSE (MWh)
2008/09	Current	191.02	-10.88	4.57%	99.00%	5,097
2008/09	Revised	193.76	-11.13	4.20%	99.13%	4,754

- Parameters and fit statistics for most recent gas year 2008/09 - Monday to Thursday (non-holiday) models.

- 2008/09 had a fairly cool autumn and a relatively cold winter followed by a warm spring and a wet summer.

- Coldest day in January.

Summary and Conclusions

Summary of results

- For all LDZs (except WN), the revised CWVs produced a better fit to aggregate NDM demand *on average* than the current CWV over the 13 gas years modelled, particularly for the most recent 5 gas years.

- For WN LDZ, which uses the same CWV definition as NW LDZ, the revised CWV produced a better fit than the current CWV for the most recent 5 gas years.

- The revised CWVs did not significantly change the estimated 1 in 20 peak aggregate NDM demand.

- Models based on the revised CWVs showed little seasonal bias *on average* and displayed a better seasonal fit to aggregate NDM demand *on average* than the current CWV, particularly for the most recent 5 gas years.

Conclusions

- The revised CWV definitions produce:

  - **An improved average fit to aggregate NDM demand, particularly in the 5 most recent gas years**

  - **Demand models display little seasonal bias in all but a few instances in the most exceptional seasons**

- The revised CWVs are scheduled for implementation as planned on 1st October 2010 and to be used in the Spring 2010 NDM analysis.

Appendices

NW (&WN) LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-3.99	0.661	0.0157	0.25	3	15.5	18.4	0.44
Revised	-3.75	0.661	0.0149	0.26	3	15.5	18.5	0.41

- WN LDZ uses the same CWV definition as NW LDZ.

- Parameters derived from NW demand data (and Hulme Library weather data).

- Similar CWV parameter values for current and revised CWV.

- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

NW (&WN) LDZ - comparison of pseudo SNET profiles
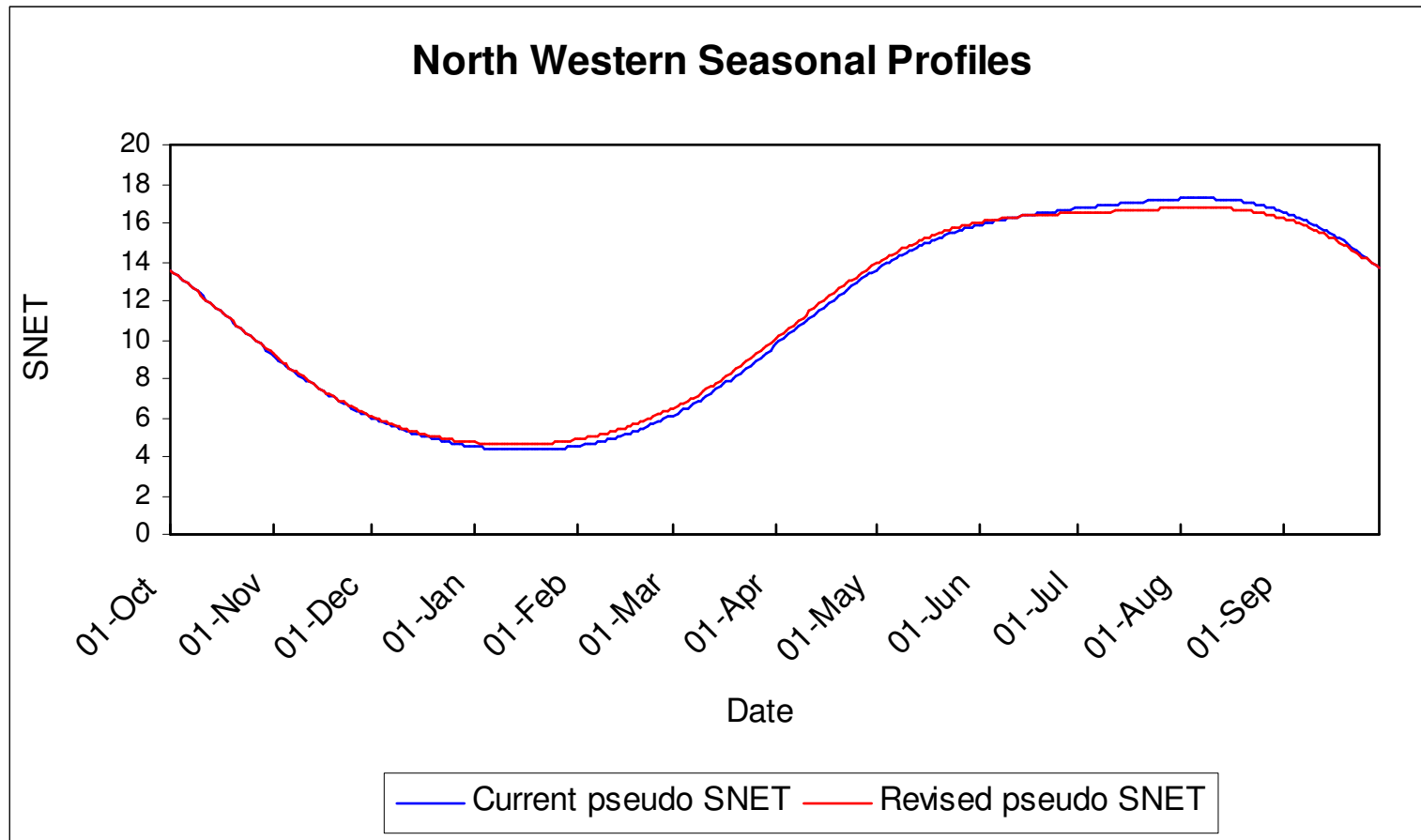
North Western Seasonal Profiles

- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter and lower in summer.

NW LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97	3.65%	99.10%	9,339	0.21%
Revised	- 2008/09	3.65%	99.11%	9,293	
Current	2004/05	3.89%	99.10%	9,390	0.22%
Revised	- 2008/09	3.82%	99.15%	9,161	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

NW LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.50%	0.10%	4.72%	-0.51%	5.98%	-0.12%	3.70%	0.35%
Revised		2.44%	0.07%	4.75%	0.19%	6.06%	-0.63%	3.73%	-0.09%
Current	2004/05-2008/09	2.75%	0.04%	4.87%	-1.58%	6.86%	0.99%	3.87%	1.11%
Revised		2.65%	-0.01%	4.80%	-0.86%	6.82%	0.47%	3.80%	0.66%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for all quarters in 5 most recent gas years.

WN LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	4.65%	98.36%	1,061	0.20%
Revised		4.66%	98.35%	1,062	
Current	2004/05 - 2008/09	4.77%	98.50%	1,053	0.22%
Revised		4.72%	98.52%	1,045	

- WN LDZ uses the same CWV definition as NW LDZ.

- Good fit for both CWVs on average.

- Slightly worse fit for revised CWV on average over 13 gas years.

- Slightly better fit for revised CWV on average for the 5 most recent gas years.

- No significant change in estimated peak demand.

WN LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97- 2008/09	3.37%	0.25%	5.70%	-0.11%	7.59%	0.21%	4.56%	-0.35%
Revised		3.32%	0.22%	5.70%	0.55%	7.63%	-0.22%	4.65%	-0.76%
Current	2004/05- 2008/09	3.23%	0.15%	5.88%	-1.04%	7.45%	1.00%	5.24%	0.42%
Revised		3.17%	0.10%	5.77%	-0.37%	7.37%	0.55%	5.25%	0.00%

- WN LDZ uses the same CWV definition as NW LDZ.

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

NE LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-5.84	0.703	0.0153	0.00	0	14.7	17.7	0.46
Revised	-5.58	0.692	0.0150	0.00	0	14.8	17.9	0.43

- Similar CWV parameter values for current and revised CWV.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

NE LDZ - comparison of pseudo SNET profiles
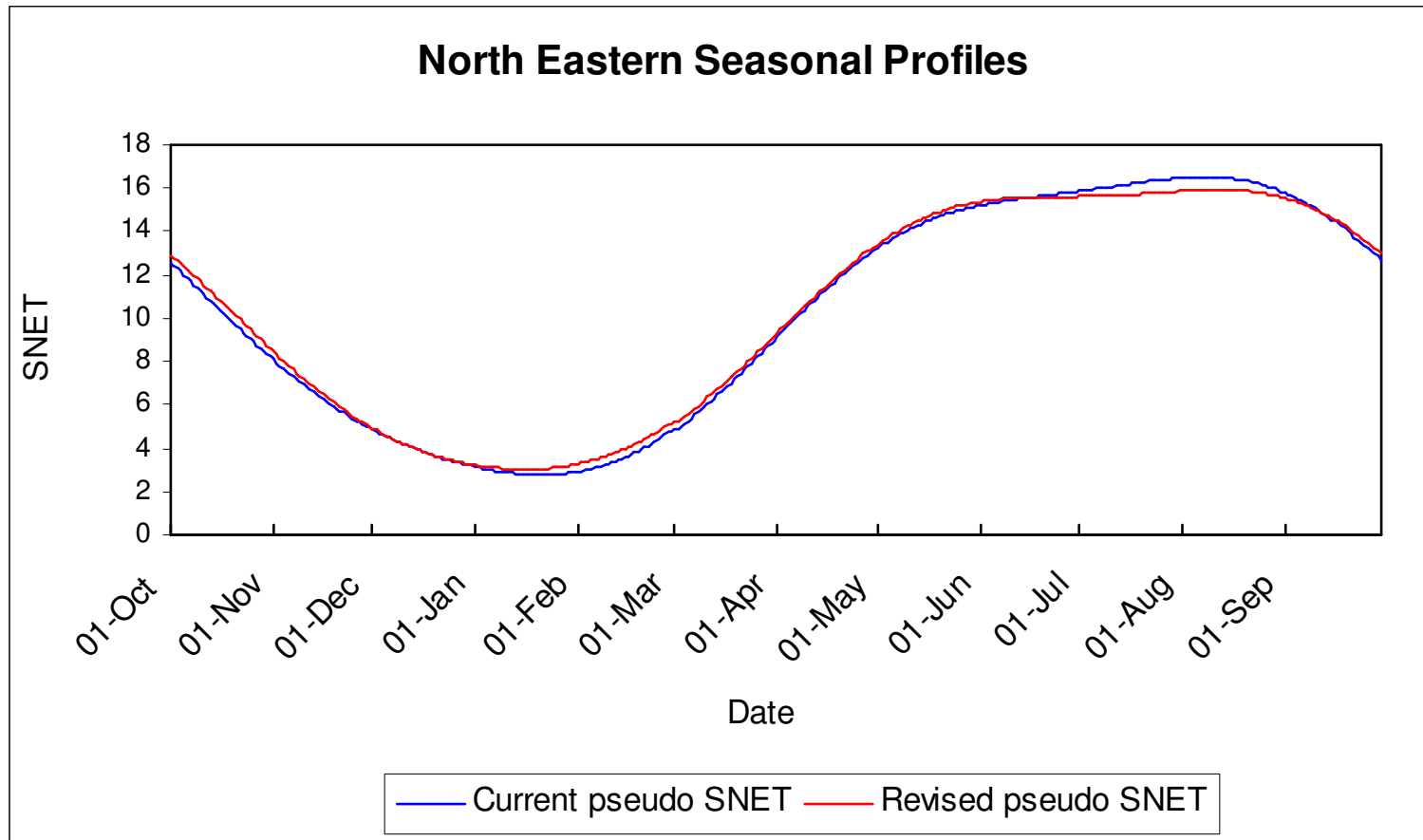
North Eastern Seasonal Profiles

- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter and lower in summer.

NE LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	4.50%	98.59%	5,876	-0.37%
Revised		4.48%	98.60%	5,851	
Current	2004/05 - 2008/09	4.56%	98.69%	5,849	-0.37%
Revised		4.48%	98.72%	5,774	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

NE LDZ - comparison of seasonal fit and bias

| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	3.26%	0.41%	5.41%	-0.15%	6.99%	0.49%	4.74%	-0.64%
Revised		3.21%	0.23%	5.41%	0.11%	7.02%	-0.34%	4.73%	-0.35%
Current	2004/05-2008/09	3.27%	0.46%	5.46%	-0.53%	7.32%	1.15%	4.87%	-0.57%
Revised		3.18%	0.27%	5.43%	-0.24%	7.20%	0.30%	4.79%	-0.28%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters.

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EM LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-5.38	0.716	0.0134	0.00	0	14.6	17.3	0.43
Revised	-4.86	0.687	0.0131	0.00	0	13.8	16.9	0.52

- Similar CWV parameter values for current and revised CWV.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

EM LDZ - comparison of pseudo SNET profiles

East Midlands Seasonal Profiles

Legend: Current pseudo SNET — Revised pseudo SNET
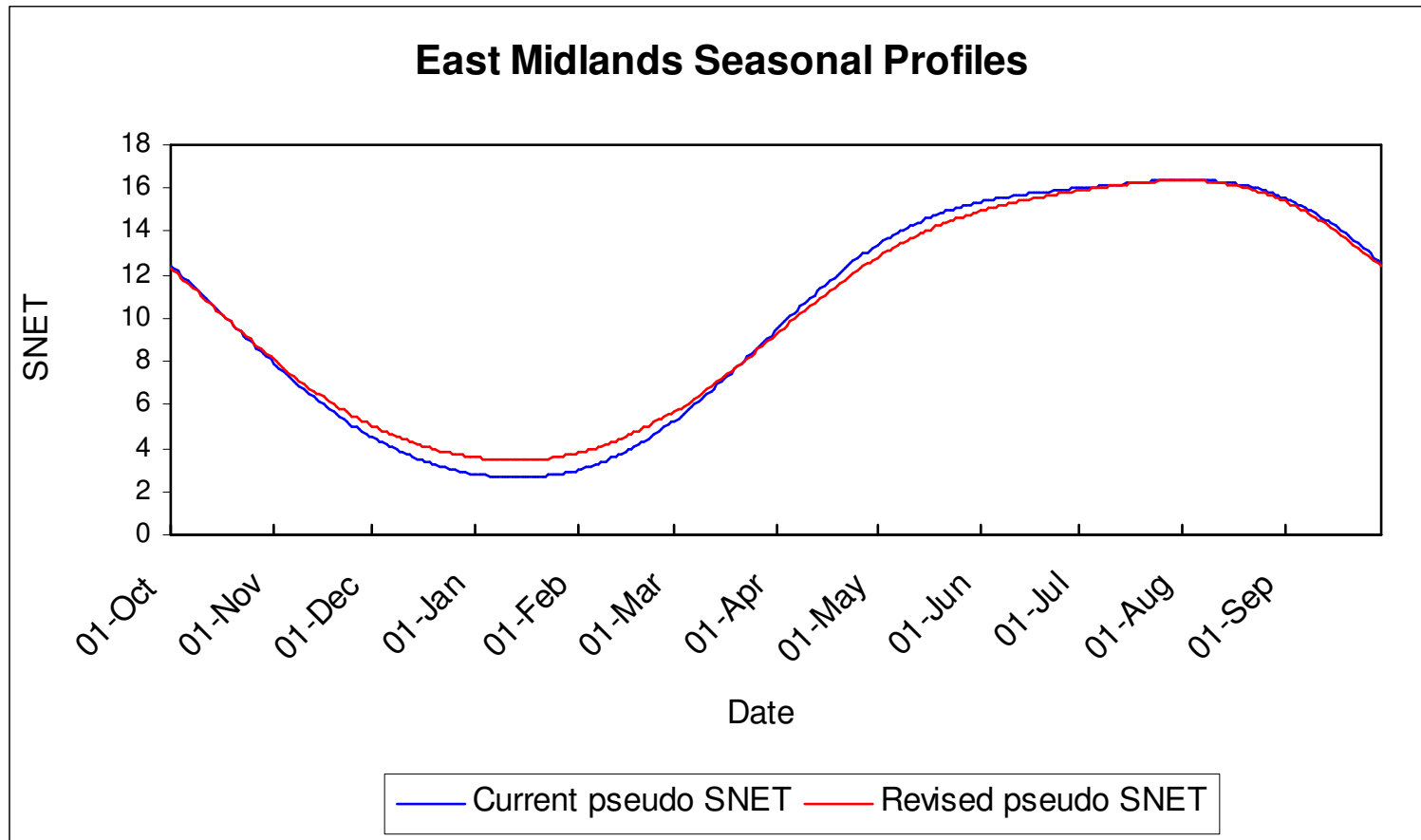
- Revised pseudo SNET profile is similar to current profile, but slightly higher in winter.

EM LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.73%	99.11%	7,908	0.16%
Revised		3.74%	99.12%	7,876	
Current	2004/05 - 2008/09	3.87%	99.11%	8,008	0.21%
Revised		3.82%	99.15%	7,859	

- Good fit for both CWVs on average.
- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.
- No significant change in estimated peak demand.

EM LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.40%	0.18%	4.84%	-0.28%	6.39%	0.44%	3.94%	-0.16%
Revised		2.40%	0.16%	4.81%	-0.09%	6.51%	0.15%	3.95%	-0.20%
Current	2004/05-2008/09	2.37%	0.41%	4.94%	-1.20%	7.25%	2.88%	4.26%	-0.38%
Revised		2.37%	0.38%	4.84%	-0.95%	7.12%	2.54%	4.21%	-0.47%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters.

WS LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.17	0.625	0.0117	0.18	2	14.9	18.2	0.45
Revised	-4.01	0.634	0.0111	0.15	2	14.9	17.9	0.47

- Some years in the 1980s had suspect MPD data and were excluded from the cold weather upturn analysis.

- Some data points (25/11/96, 26/01/97, 28/10/97, 04/11/97 and 04/10/08) were also excluded from the analysis.

- CWV parameter values broadly similar.

- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

WS LDZ - comparison of pseudo SNET profiles

Wales South Seasonal Profiles
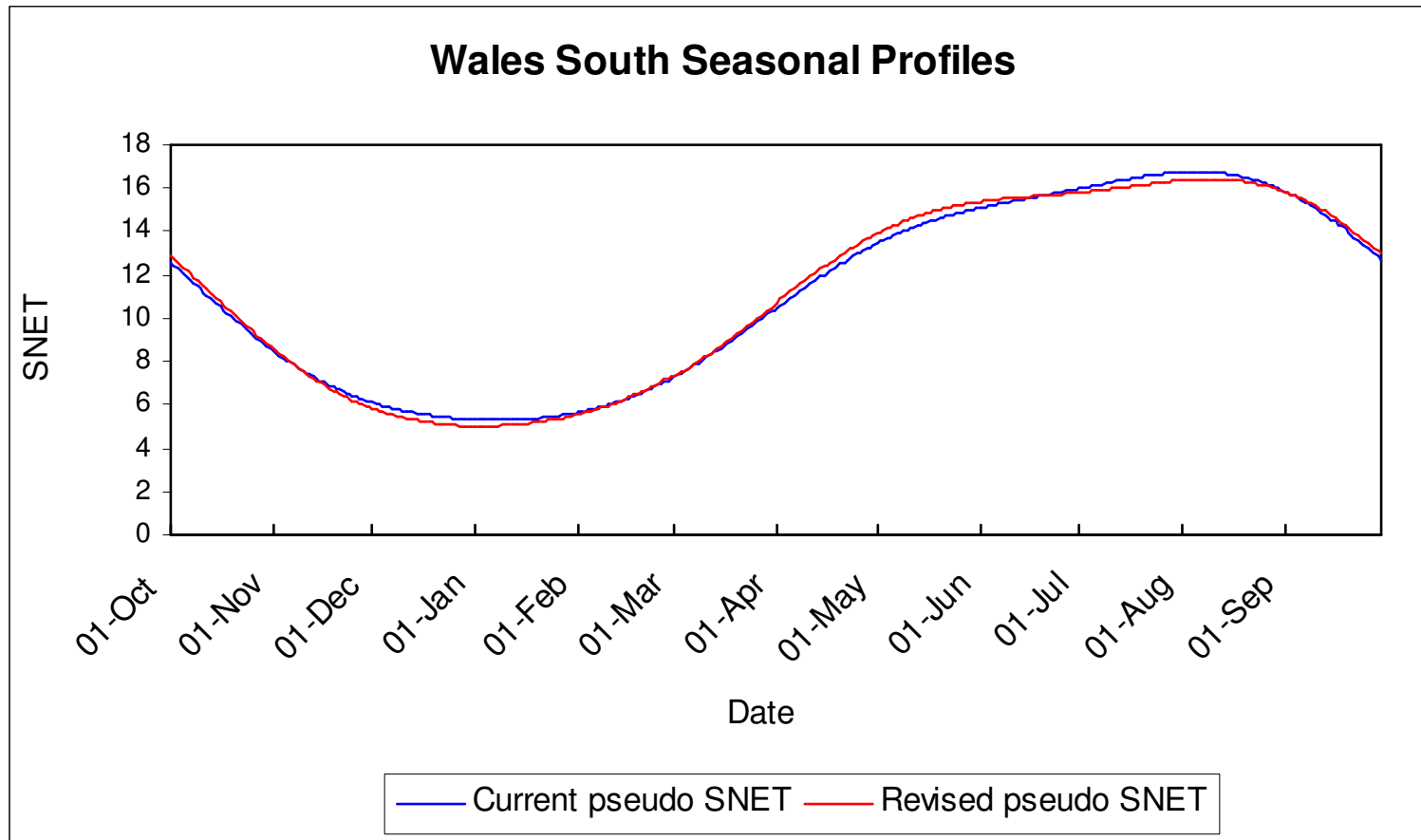
- Revised pseudo SNET profile is similar to current profile, but slightly different shape in winter and summer.

WS LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	4.76%	98.44%	3,565	-0.68%
Revised		4.77%	98.44%	3,560	
Current	2004/05 - 2008/09	5.02%	98.45%	3,623	-0.68%
Revised		4.90%	98.54%	3,526	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- No significant change in estimated peak demand.

WS LDZ - comparison of seasonal fit and bias

| CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	3.14%	0.18%	6.20%	-0.77%	7.39%	1.14%	5.02%	0.06%
Revised		3.15%	-0.08%	6.17%	0.41%	7.40%	-0.30%	5.05%	-0.16%
Current	2004/05-2008/09	3.39%	0.25%	6.79%	-2.14%	8.92%	3.22%	4.71%	0.62%
Revised		3.32%	-0.04%	6.45%	-0.90%	8.80%	1.65%	4.71%	0.39%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

EA LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-3.82	0.680	0.0111	0.00	0	15.2	19.2	0.35
Revised	-4.12	0.690	0.0118	0.00	0	15.1	19.1	0.37

- Some years in the 1980s had suspect MPD data and were excluded from the cold weather upturn analysis.
- Correction applied to aggregate NDM demand data from Oct. to Dec. 2002.
- 2005/06 was excluded from the analysis to derive the pseudo SNET profile because effective temperature was consistently high from May to September.
- CWV parameter values broadly similar.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

EA LDZ - comparison of pseudo SNET profiles

Eastern Seasonal Profiles
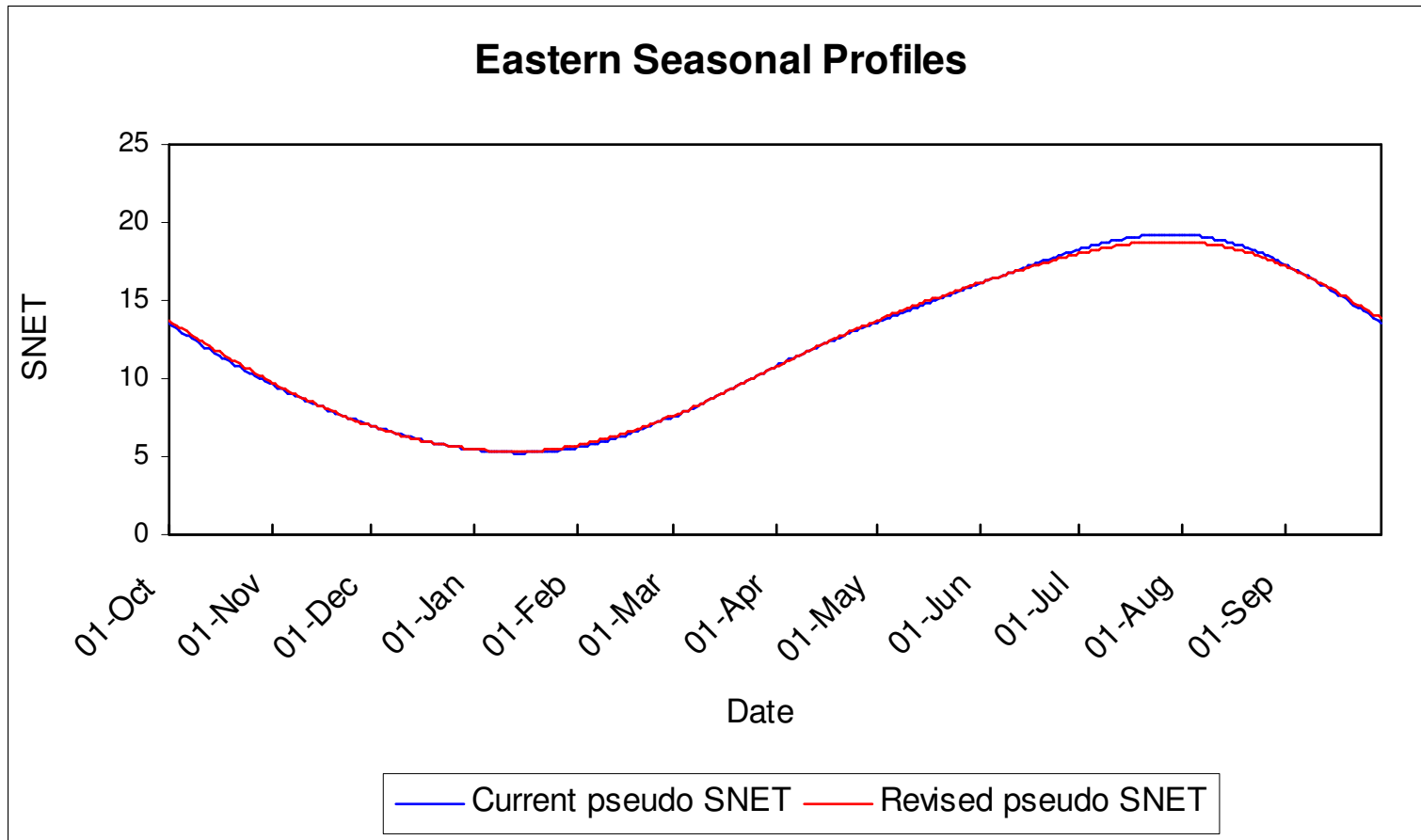
- Revised pseudo SNET profile is similar to current profile, but slightly lower in summer.

EA LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.93%	99.07%	6,414	1.11%
Revised		3.91%	99.09%	6,376	
Current	2004/05 - 2008/09	3.94%	99.16%	6,257	1.12%
Revised		3.86%	99.19%	6,174	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- Relatively small change in estimated peak demand.

EA LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov..	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	2.91%	0.08%	4.83%	0.26%	5.48%	1.72%	4.27%	-0.88%
Revised		2.91%	0.12%	4.78%	0.12%	5.40%	0.47%	4.25%	-0.45%
Current	2004/05-2008/09	2.78%	-0.03%	4.75%	-0.05%	6.00%	4.11%	4.47%	-1.13%
Revised		2.76%	0.01%	4.67%	-0.21%	5.76%	2.81%	4.36%	-0.66%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.

SE LDZ - Comparison of CWV parameters

CWV	1 in 20 Peak CWV	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	-4.24	0.688	0.0113	0.04	3	14.9	18.8	0.39
Revised	-4.90	0.704	0.0125	0.05	3	15.1	19.0	0.37

- Some data points (06/08/09, 10/08/09, 11/08/09) were excluded from the analysis.
- 2005/06 was excluded from the analysis to derive the pseudo SNET profile because effective temperature was consistently high from May to September.
- CWV parameter values broadly similar.
- Differences in 1 in 20 peak CWV due to slightly different pseudo SNET profile and other parameter values.

SE LDZ - comparison of pseudo SNET profiles
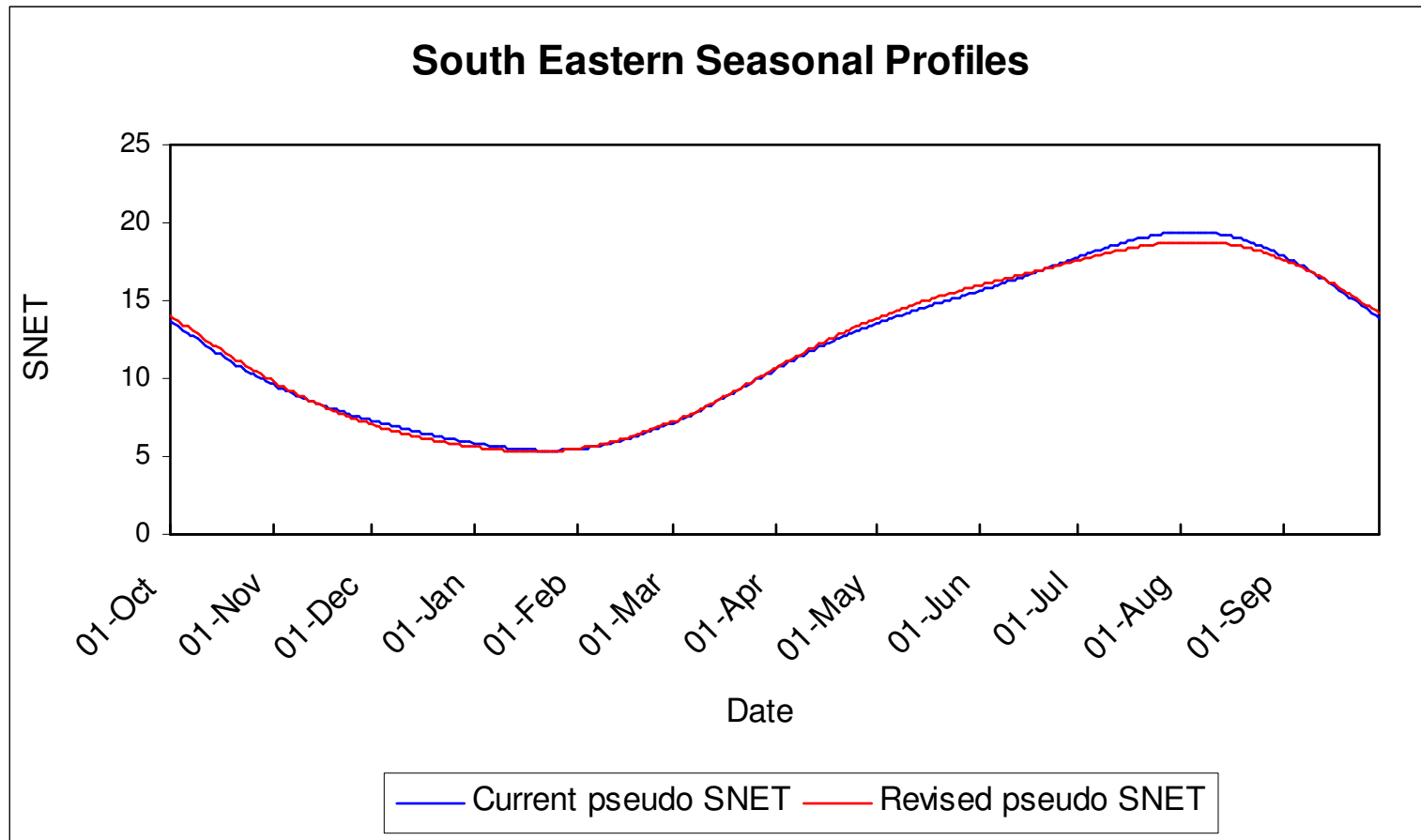
- Revised pseudo SNET profile is similar to current profile, but slightly lower in summer.

SE LDZ - comparison of average fit to demand

CWV	Gas Years	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	1996/97 - 2008/09	3.97%	99.12%	8,336	1. 56%
Revised		3.92%	99.14%	8,255	
Current	2004/05 - 2008/09	4.05%	99.16%	8,236	1.61%
Revised		3.97%	99.19%	8,094	

- Good fit for both CWVs on average.

- Slightly better fit for revised CWV on average, particularly for the 5 most recent gas years.

- Small change in estimated peak demand.

SE LDZ - comparison of seasonal fit and bias

CWV	Gas Years	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Nov.	
		MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE
Current	1996/97-2008/09	3.00%	0.10%	4.85%	0.15%	6.09%	1.39%	4.10%	-0.71%
Revised		2.93%	0.10%	4.80%	0.26%	5.91%	0.25%	4.13%	-0.49%
Current	2004/05-2008/09	3.01%	0.14%	4.93%	-0.50%	6.10%	3.16%	4.36%	-0.66%
Revised		2.92%	0.14%	4.91%	-0.42%	5.71%	1.92%	4.34%	-0.37%

- On average, neither the current nor revised CWV show much seasonal bias.

- Slightly better seasonal fit on average for revised CWV for most quarters in 5 most recent gas years.