Demand Estimation Sub Committee

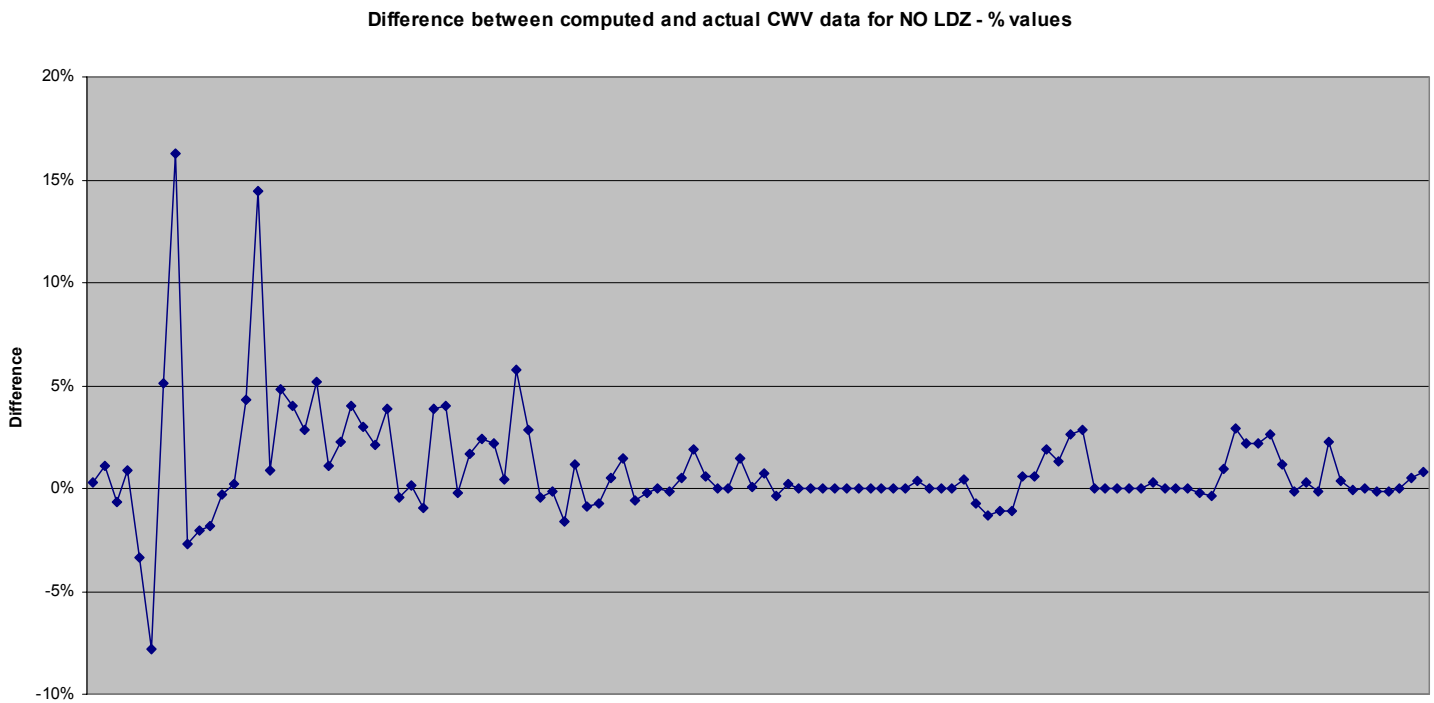
December 12th 2005

Review of Actions

- Previous weather station changes:

October 2005	Albermarle for Newcastle Tyneside
October 2003	Hulme Library for Manchester Ringway
October 2002	Southampton Oceanographic Institute for Southampton Weather Centre
October 2002	Filton for Bristol Weather Centre

Variability of derived weather CWV



Gas Year 2004/05 Performance Evaluation

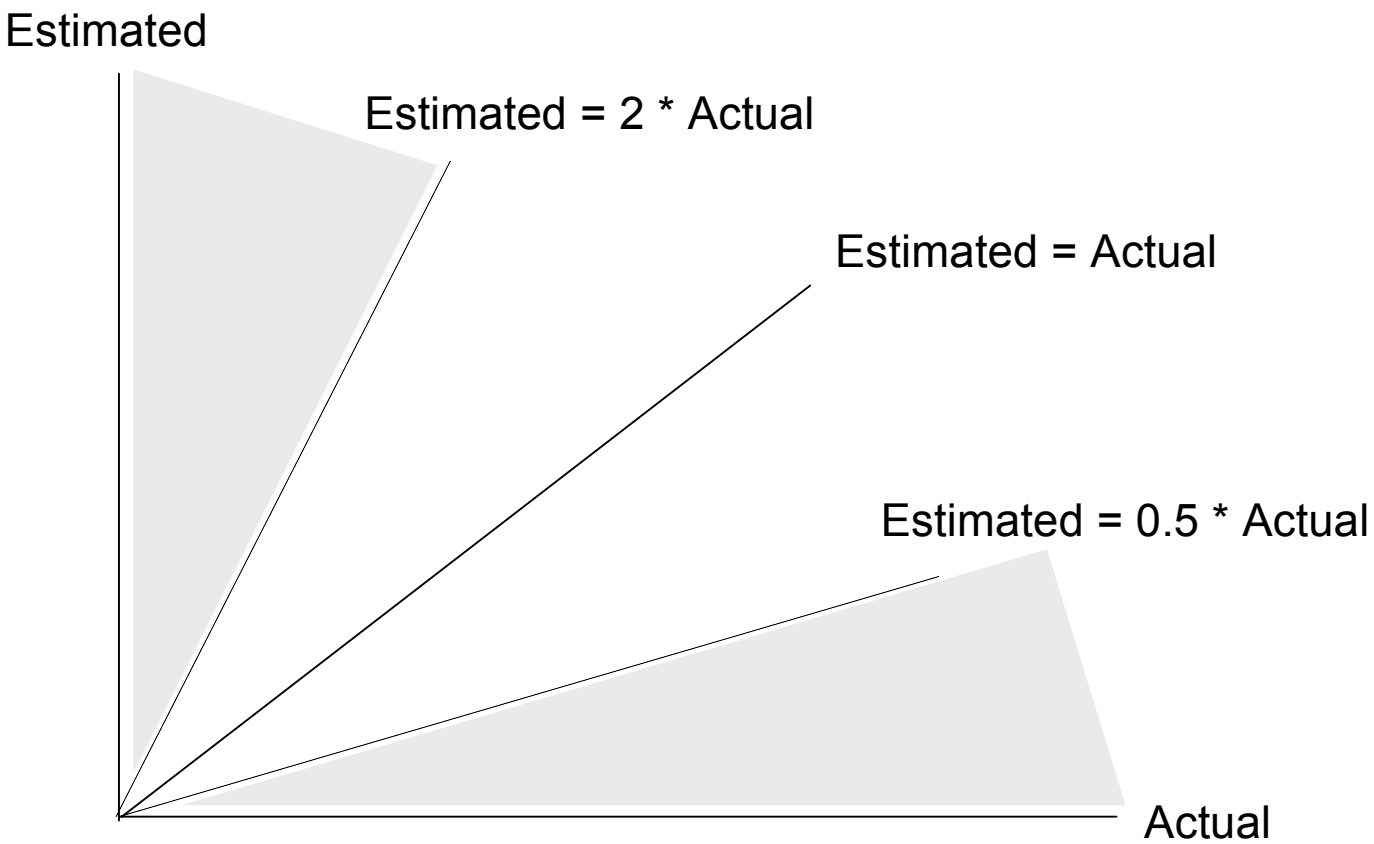
- Reconciliation Variance (RV) Analysis

RV Analysis - Data Validation

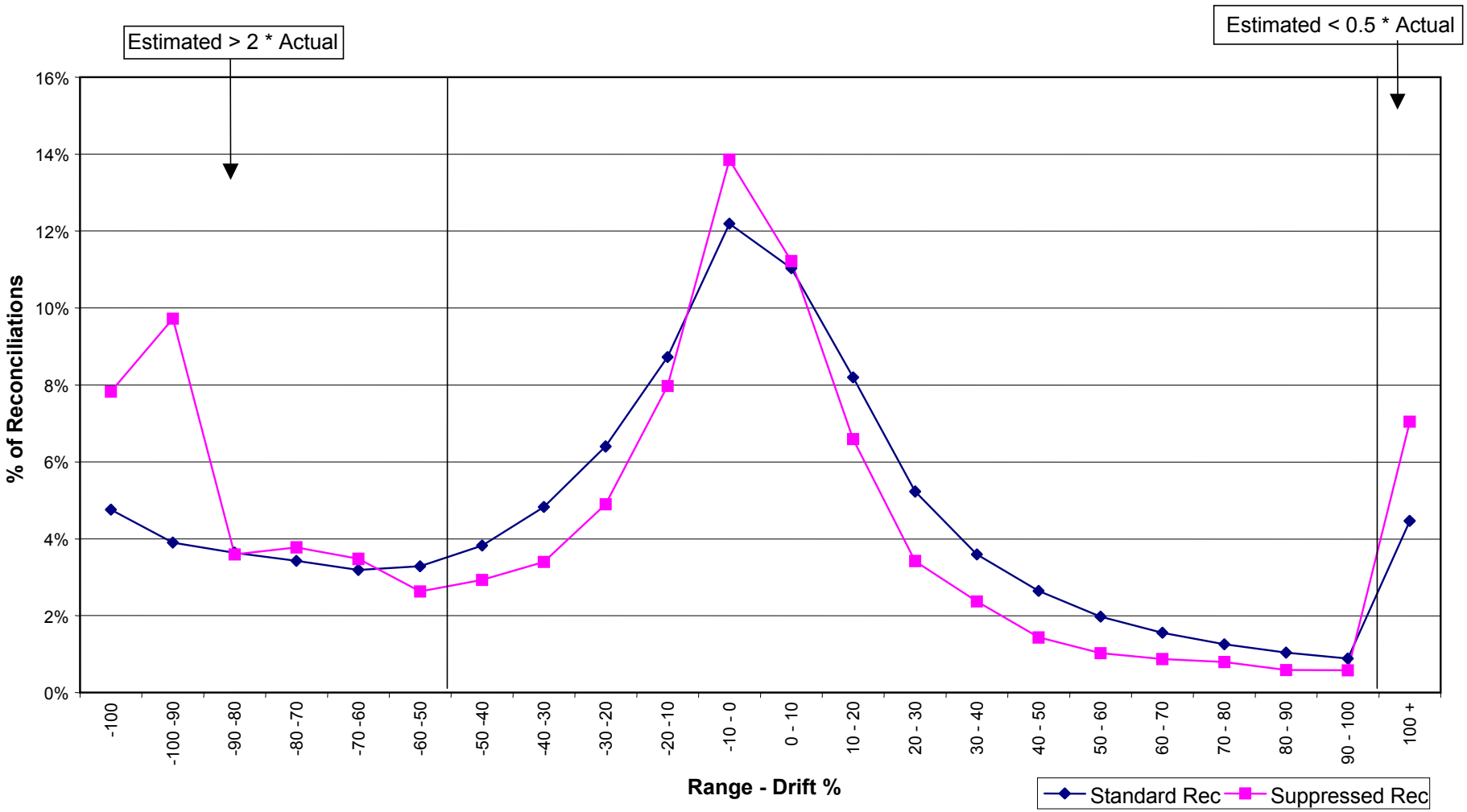
Starting with all available meter point reconciliations, the following rejection criteria are applied:

- AQ of meter point <= 3 kWh pa
- Actual Demand over period < 0
- Actual Demand over period = 0
- Actual demand over period > 0 and Allocated > 2 * Actual
- Actual demand over period > 0 and Allocated < 0.5 * Actual

RV Analysis - Data Envelope

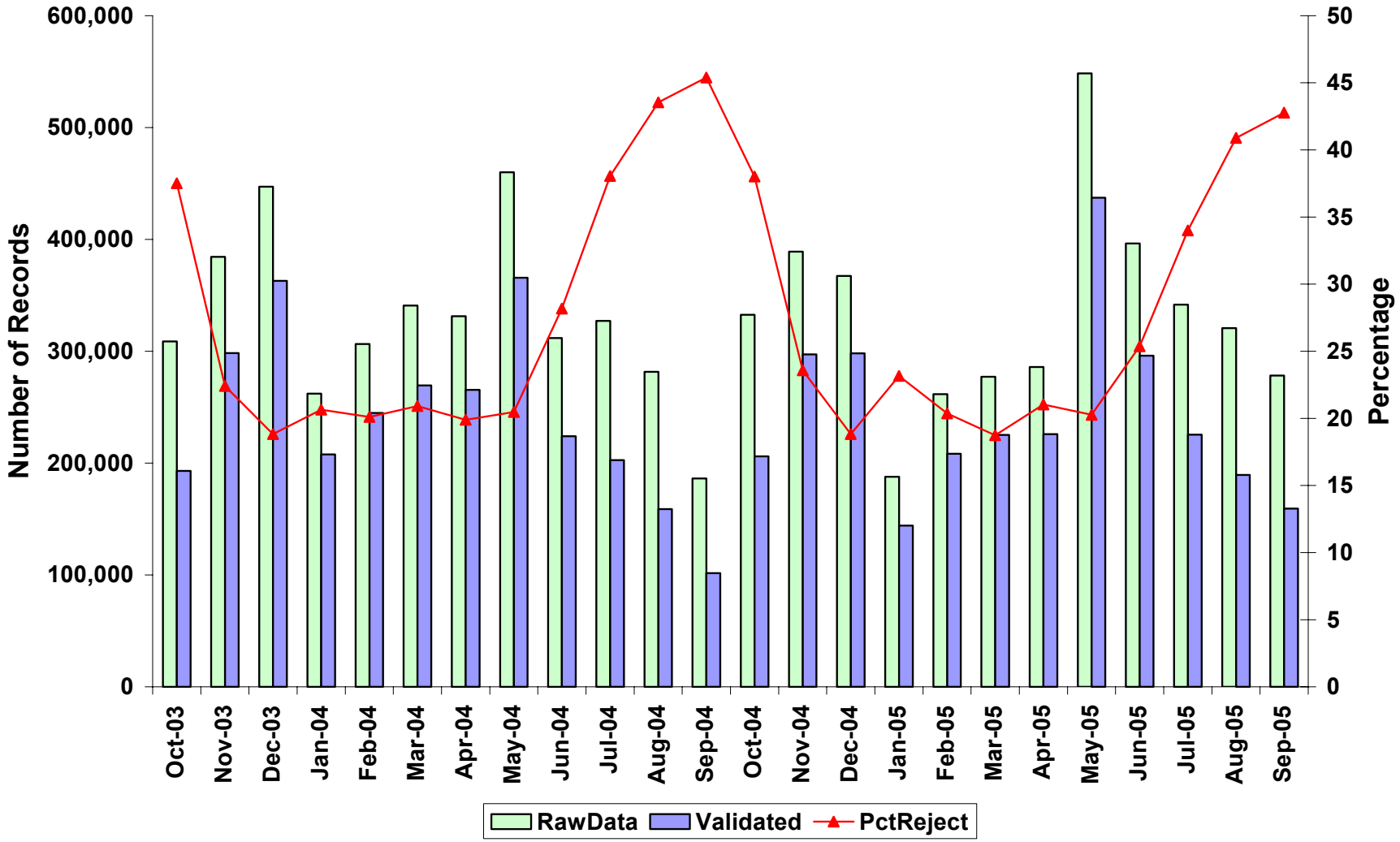


Assessment of Standard and Suppressed Reconciliation
(based on reconciliations during May to October 2005)



RV Data Validation

Gas Years 2003/04 & 2004/05

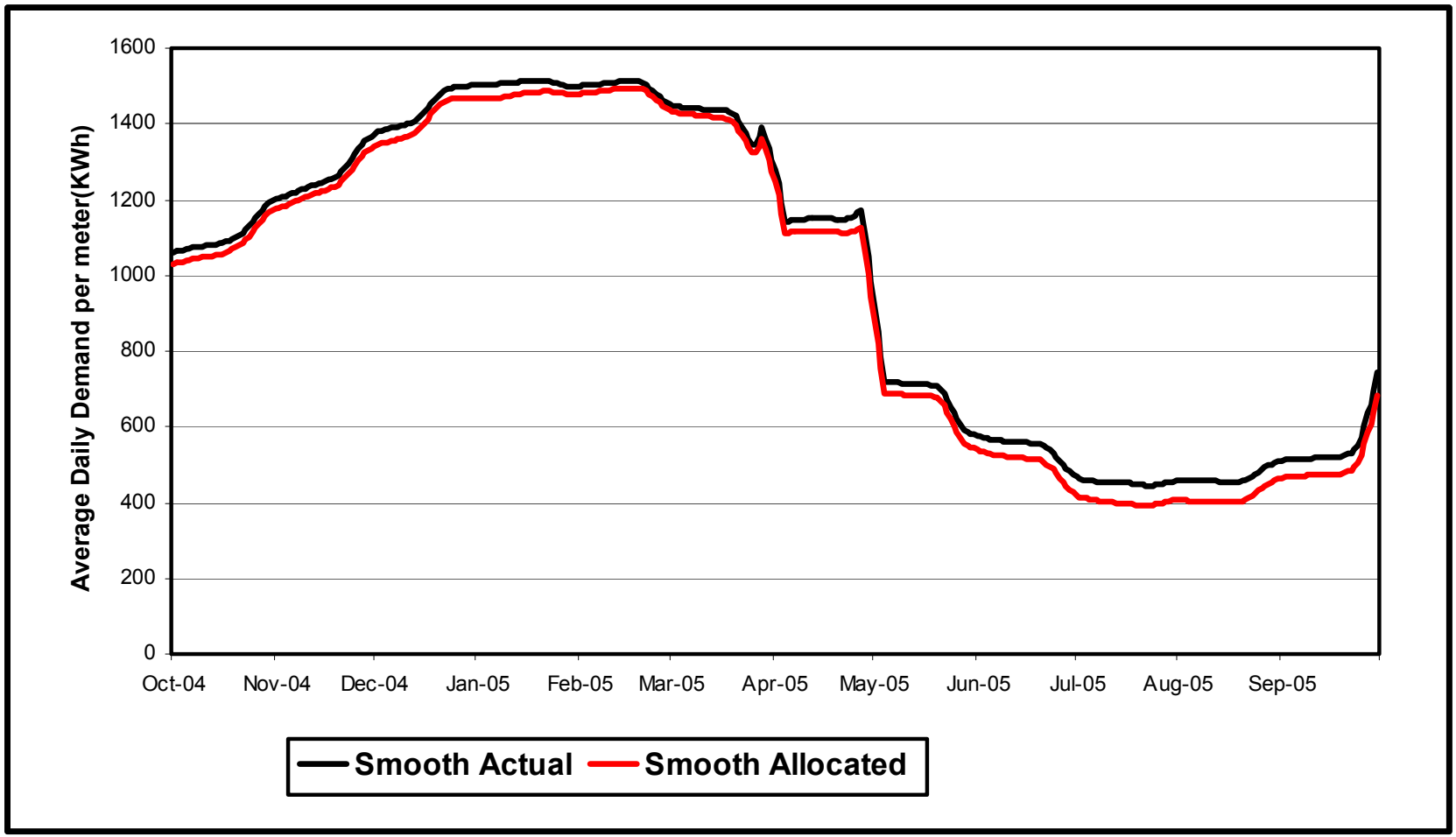


RV rejections – approx. breakdown

Rejection category	Minimum 18.7%	Maximum ~ 42.8%
AQ <= 3 kWh pa	1.0%	0.9%
Actual < 0	2.4%	3.1%
Actual = 0	2.6%	6.7%
Actual > 0 and Allocated > 2 * Actual	9.3%	21.0%
Actual > 0 and Allocated < 0.5 * Actual	3.4%	11.1%

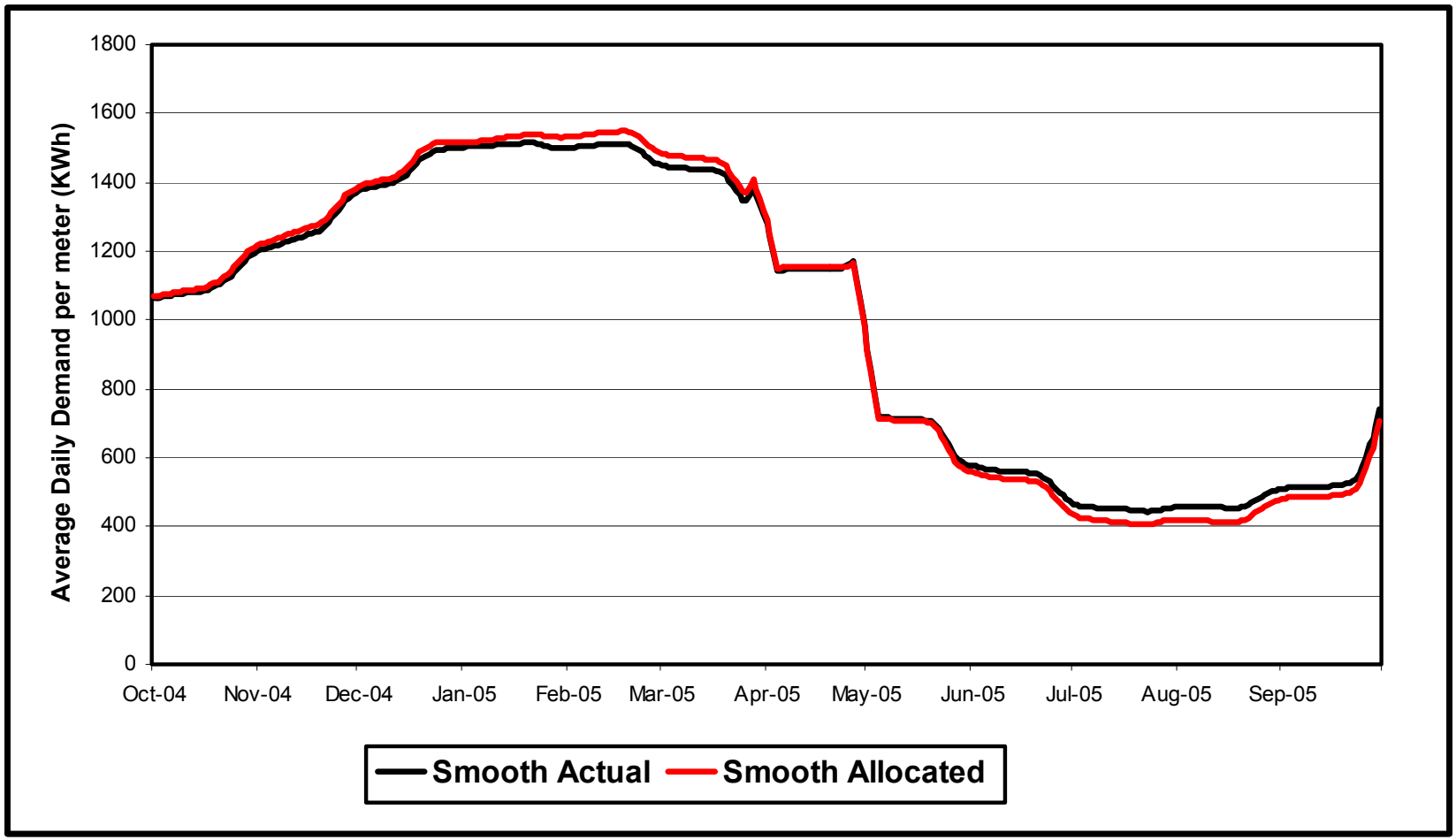
SC : Consumption Band 03

RV Analysis



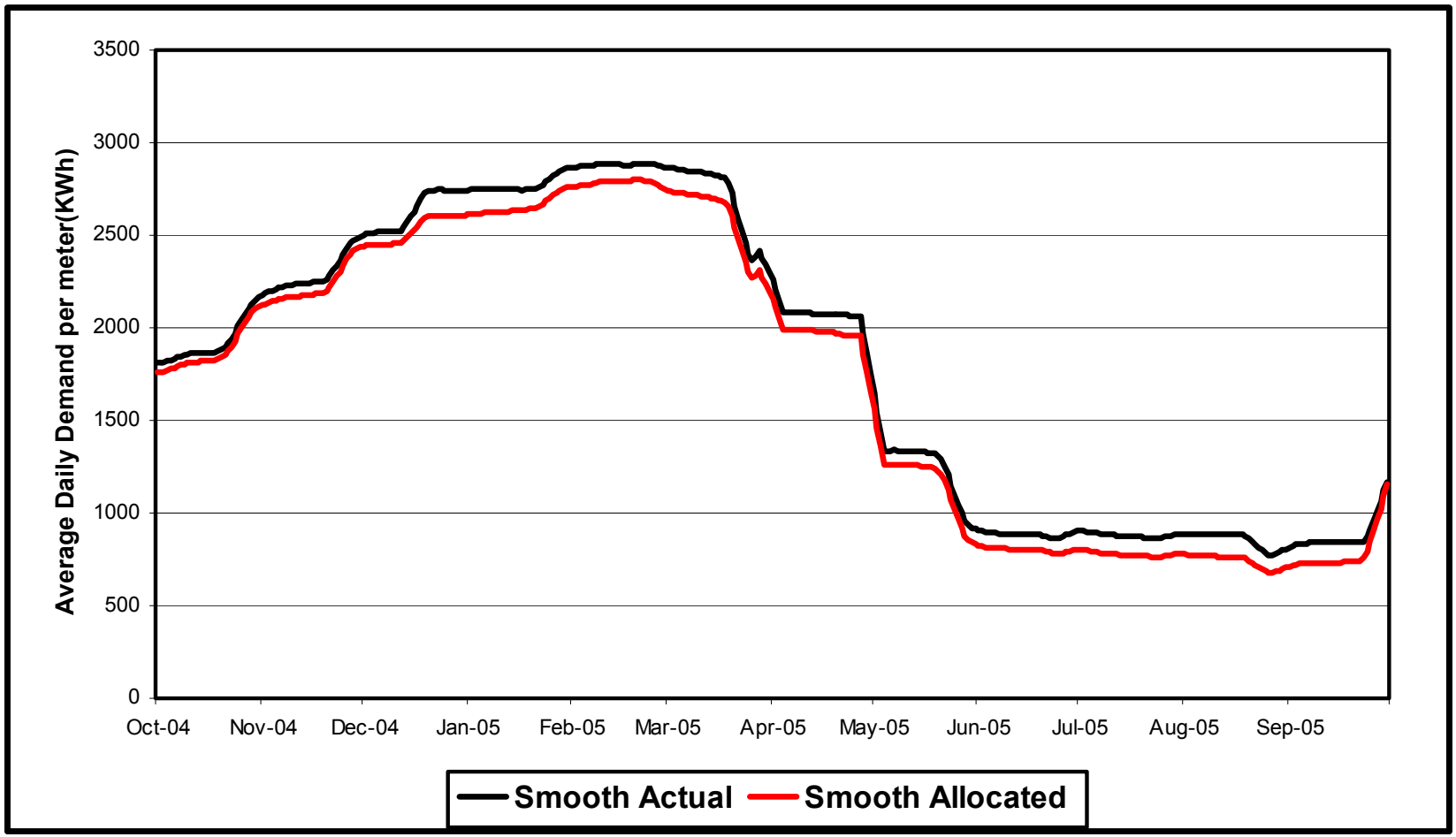
SC : Consumption Band 03

RV Analysis (After Scaling)



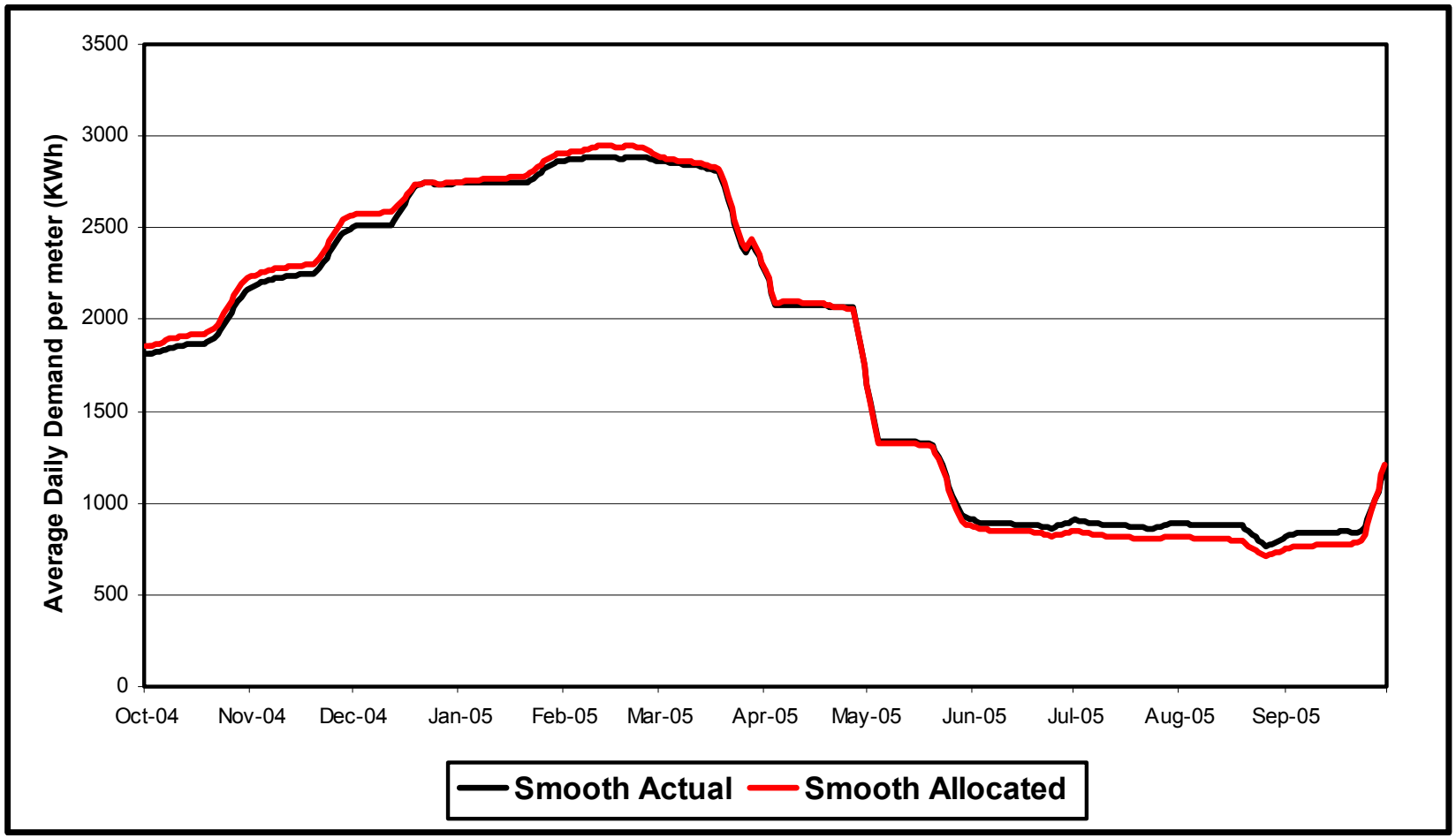
WM : Consumption Band 04

RV Analysis



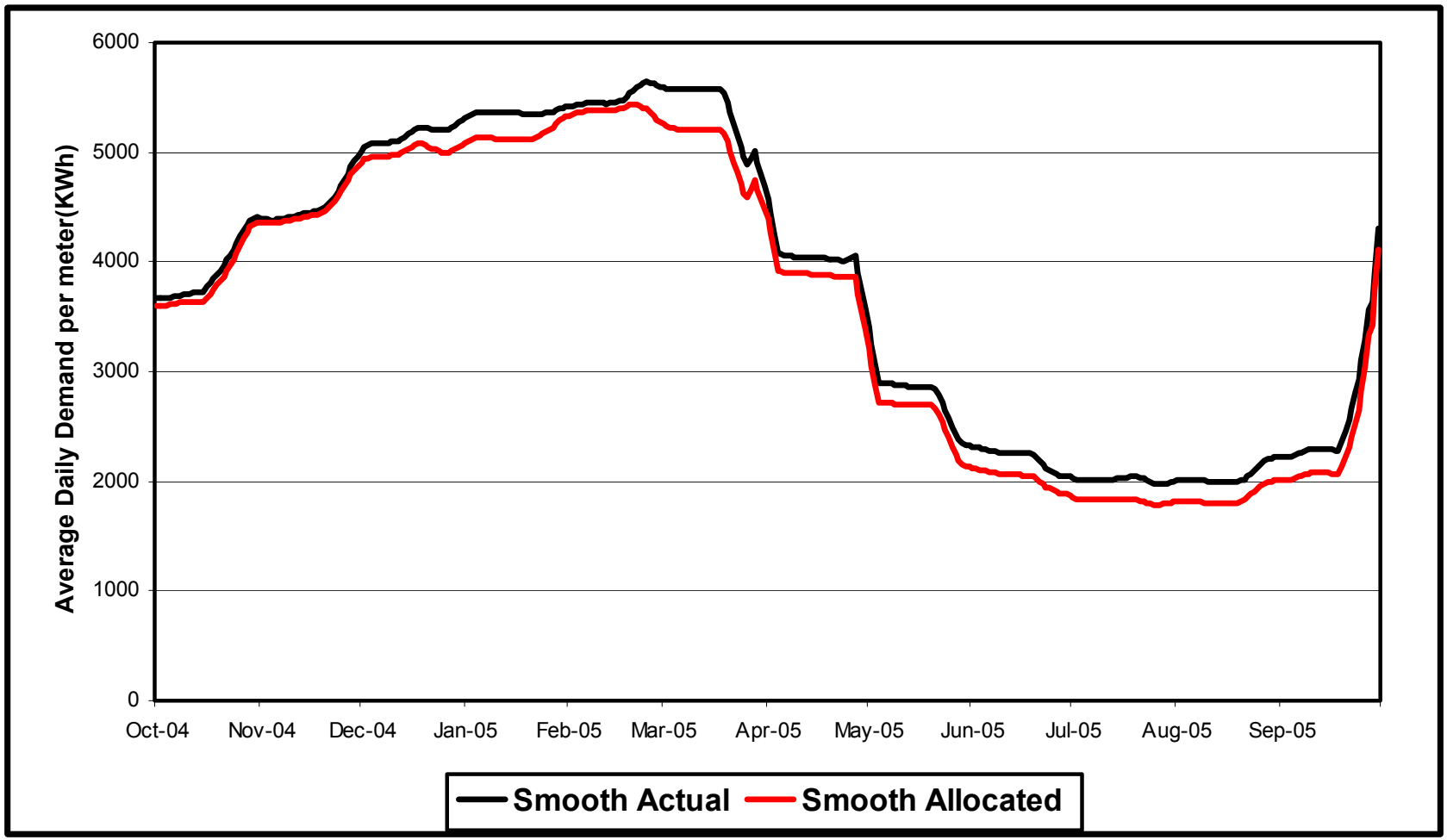
WM : Consumption Band 04

RV Analysis (After Scaling)



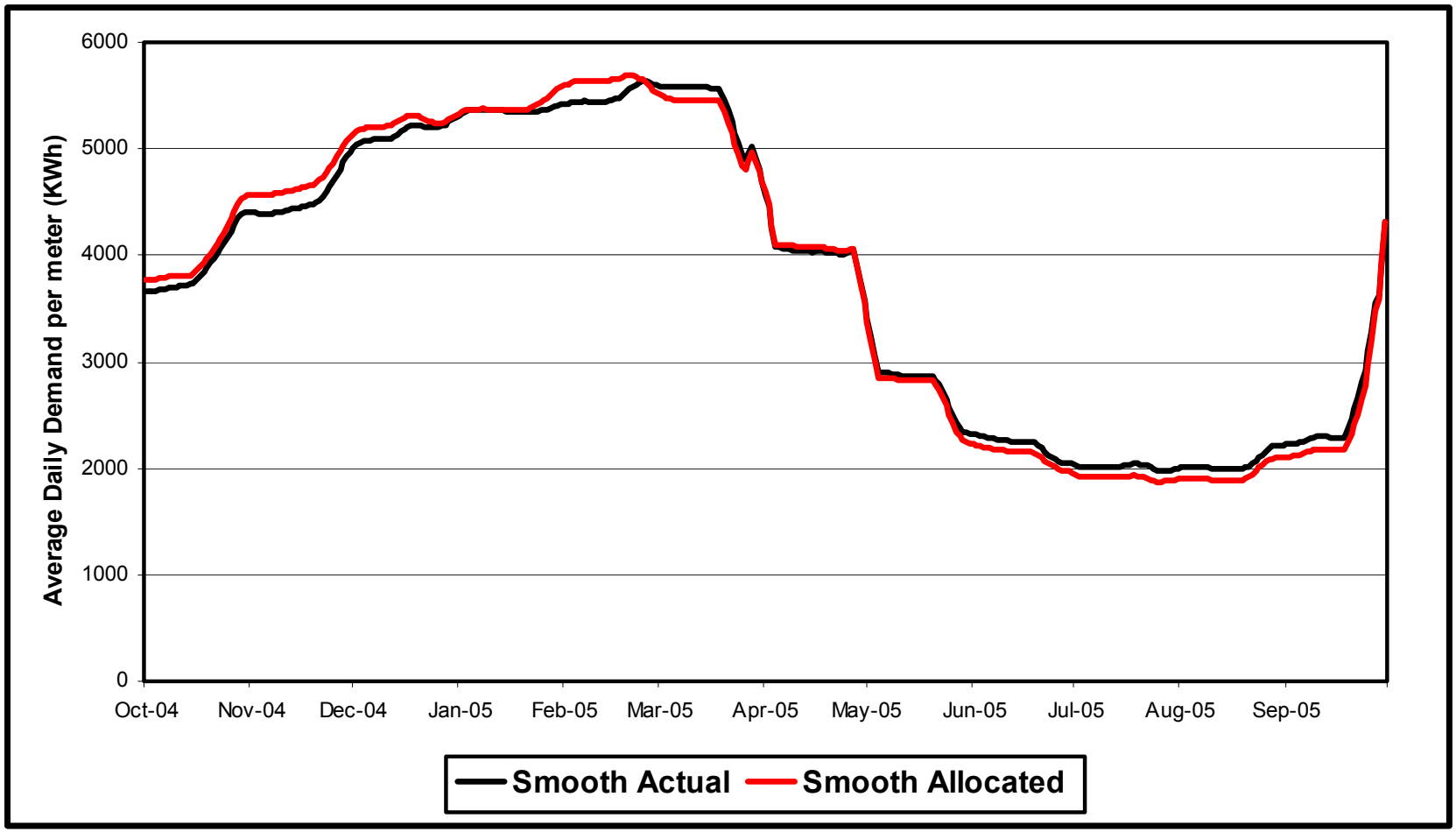
EM : Consumption Band 05

RV Analysis



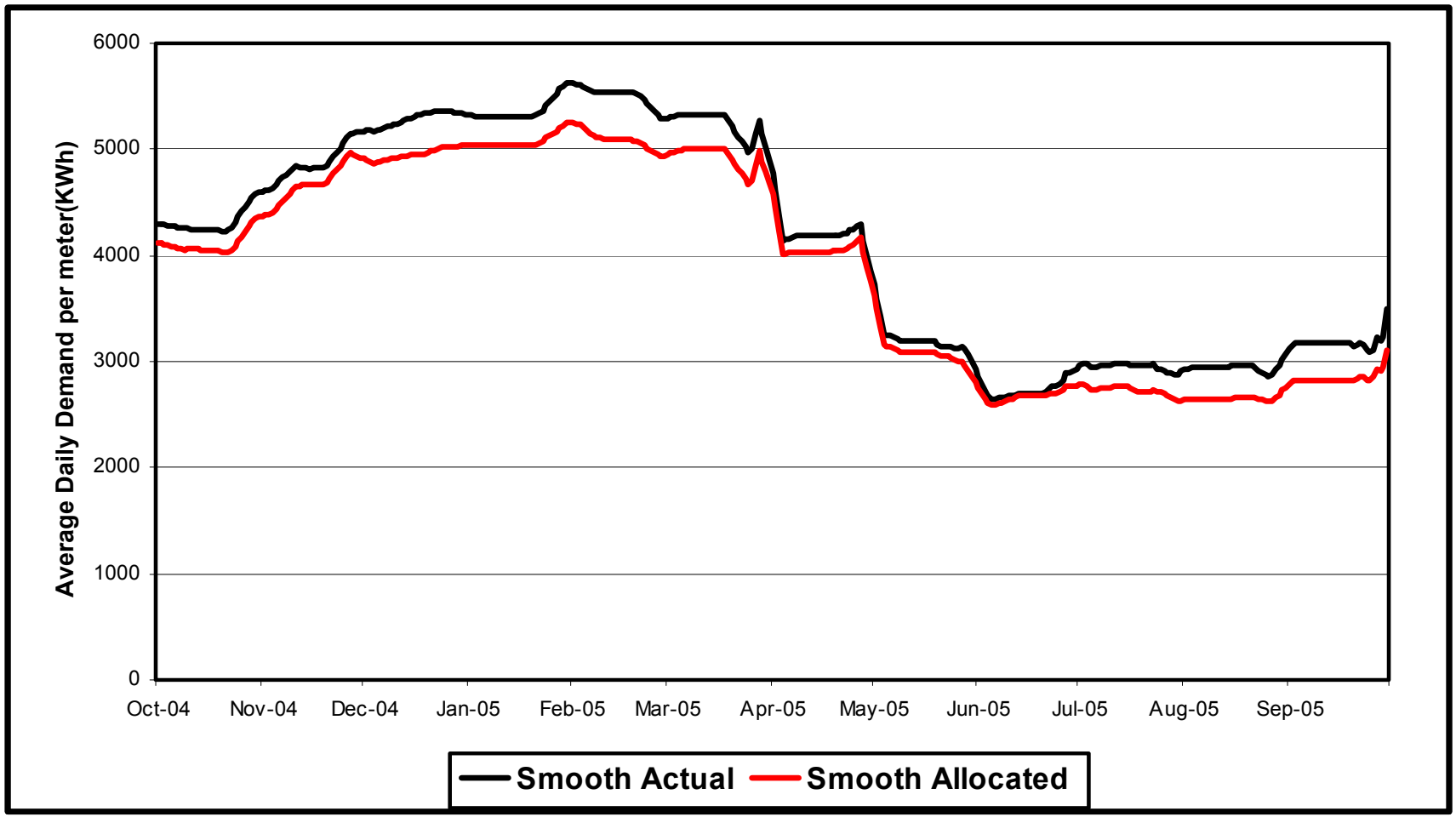
EM : Consumption Band 05

RV Analysis (After Scaling)



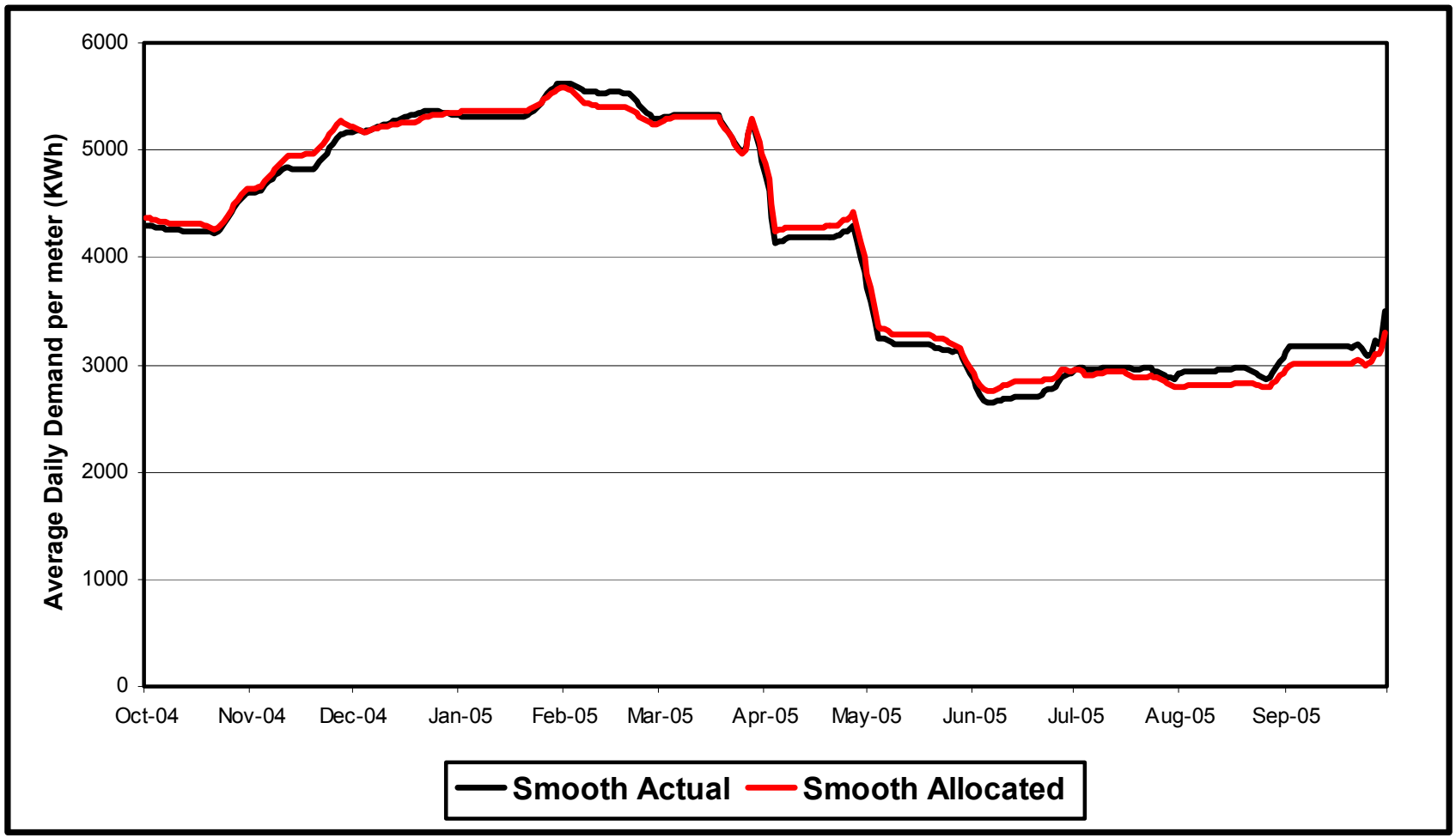
SE : Consumption Band 06

RV Analysis



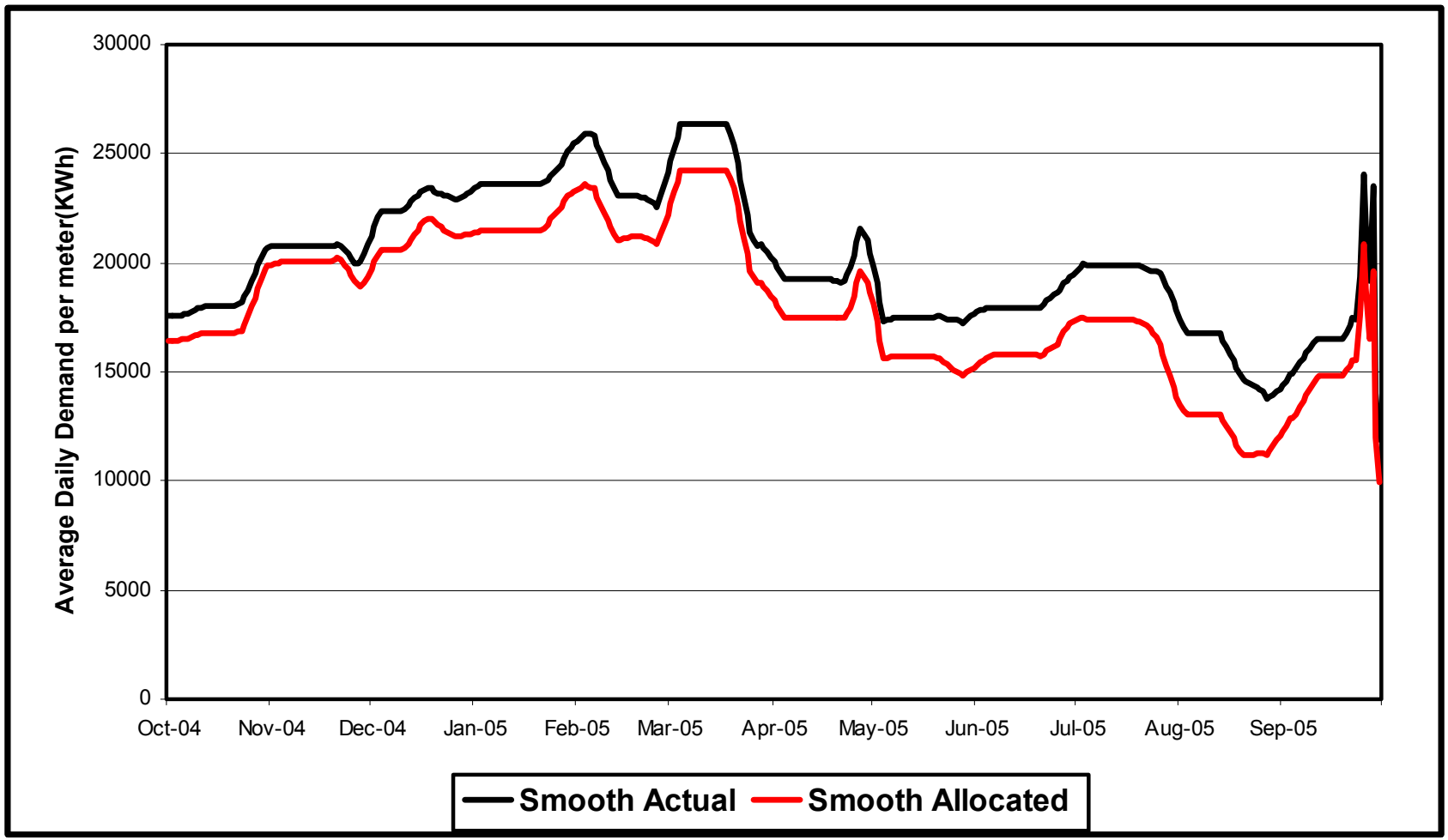
SE : Consumption Band 06

RV Analysis (After Scaling)



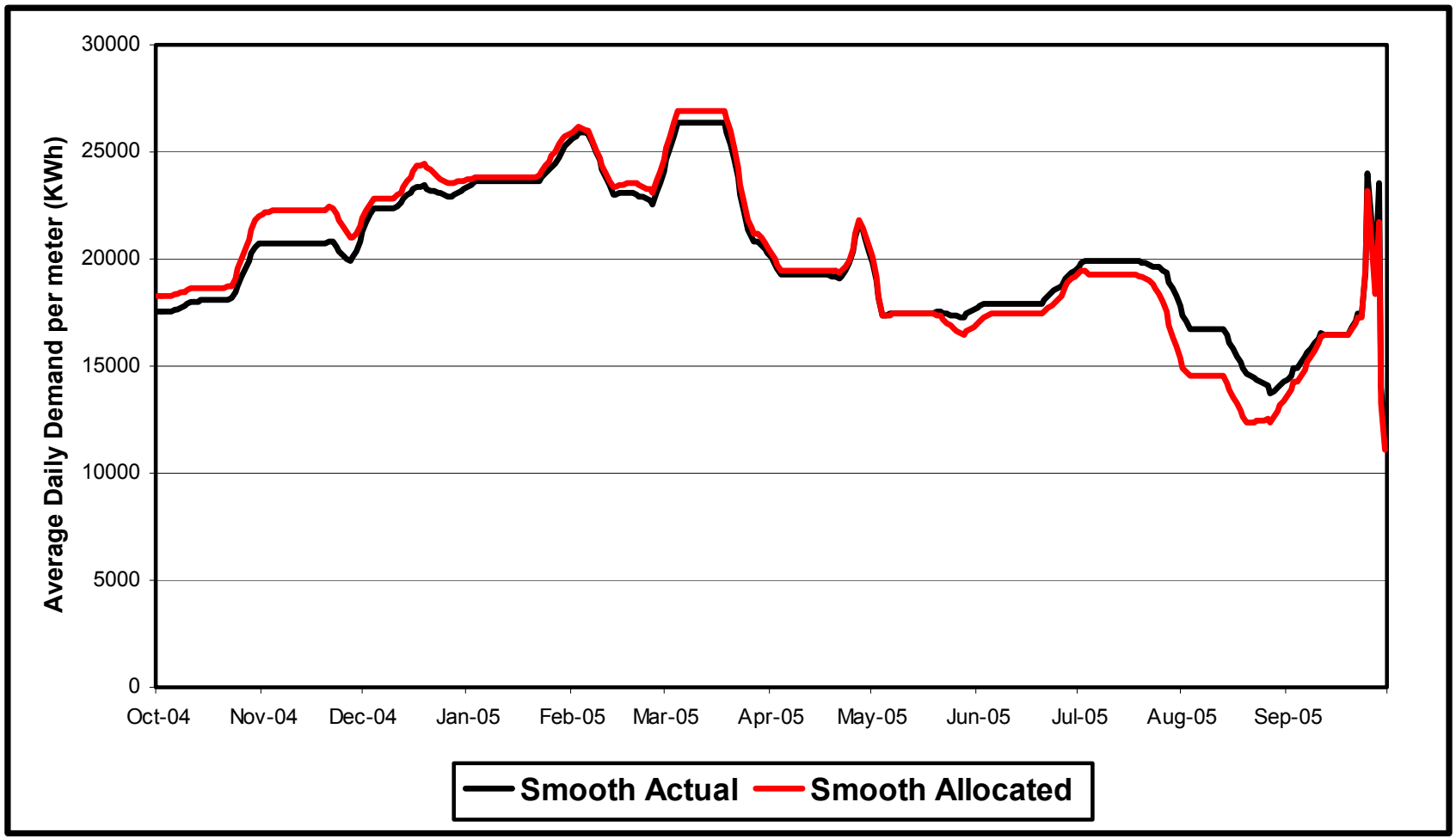
SW : Consumption Band 07

RV Analysis



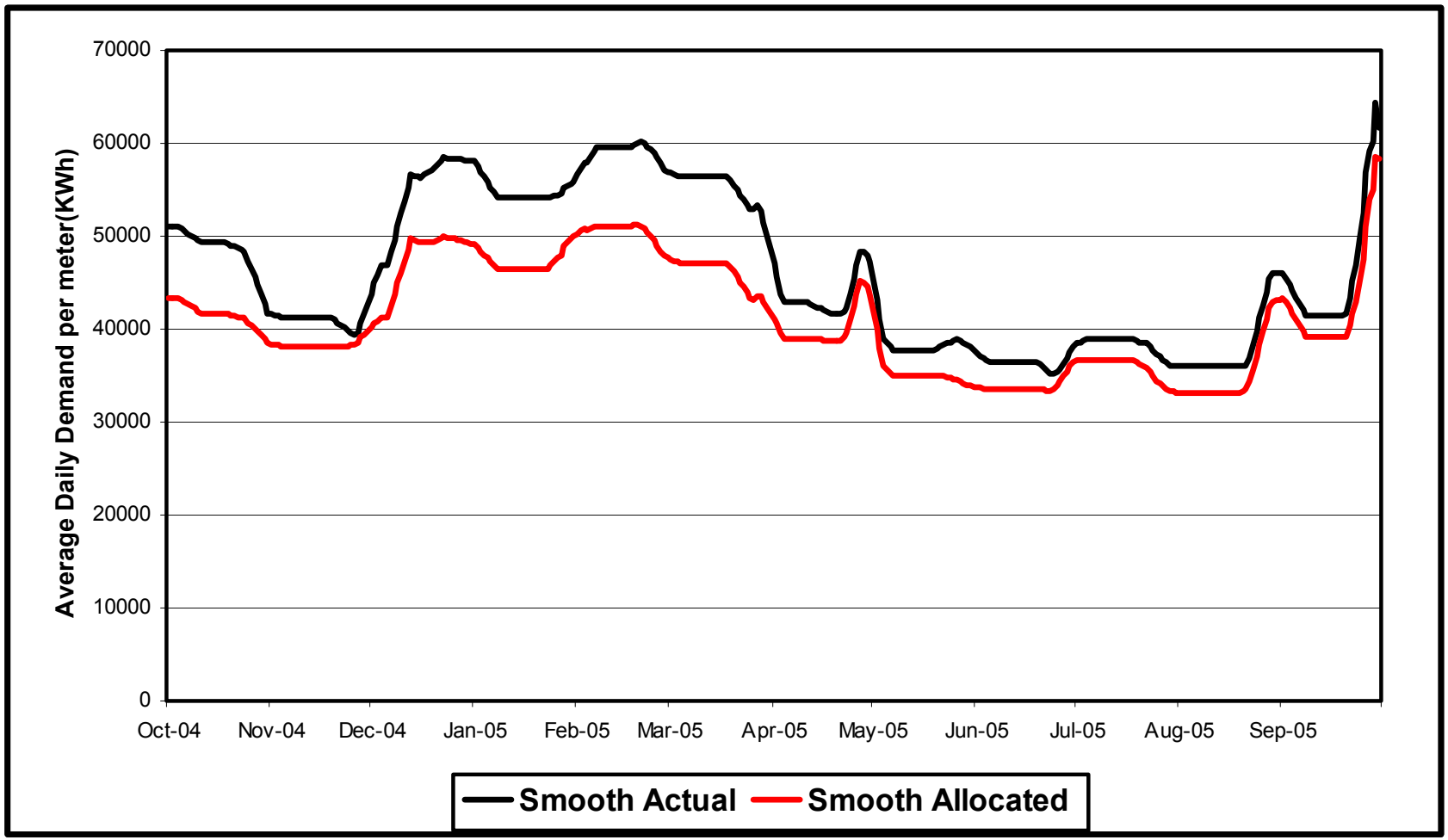
SW : Consumption Band 07

RV Analysis (After Scaling)



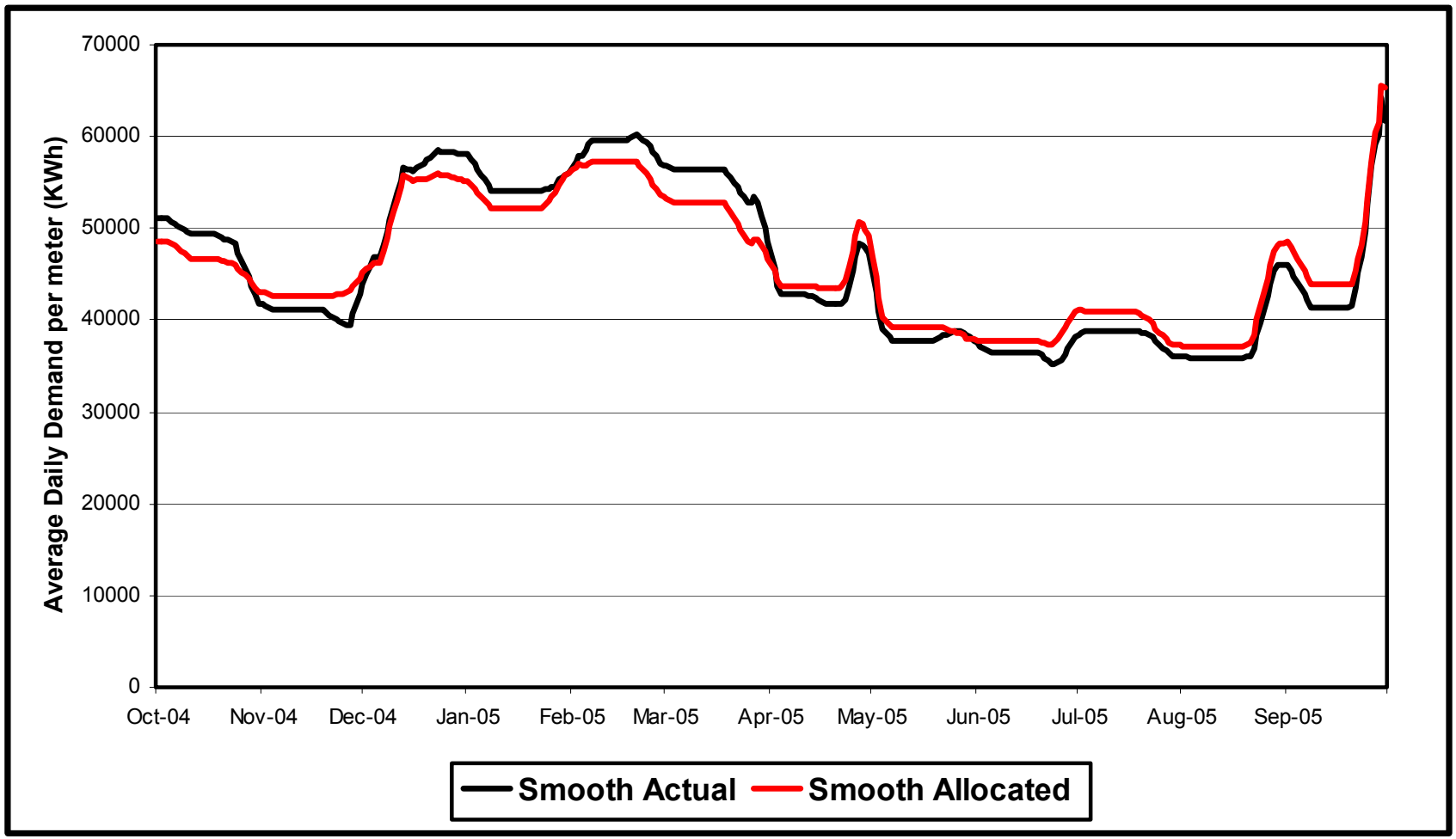
EA : Consumption Band 08

RV Analysis



EA : Consumption Band 08

RV Analysis (After Scaling)



RV Categorisation : Annual Scaling

Gas Year 2004/05

Statistics are total actual over the full year divided by the total allocated over the full year

EUC	BAND	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
02	B	1.01	1.02	1.01	1.01	1.01	1.01	0.94	1.01	1.00	1.02	1.01	0.99	1.01
03	B	1.04	1.02	1.02	1.02	1.03	1.05	0.97	1.01	1.03	1.04	1.04	1.01	1.03
04	B	1.03	1.04	1.03	1.04	1.02	1.05	0.92	1.02	1.02	1.04	1.04	1.01	1.05
05	B	1.00	1.01	1.03	1.04	1.05	1.04	1.01	1.04	1.04	1.04	1.03	0.99	1.02
06	B	1.00	1.02	1.00	1.10	1.02	1.08	1.05	0.98	1.05	1.03	1.06	0.98	1.05
07	B	1.00	1.10	1.04	0.96	1.07	0.98	0.90	1.02	1.02	1.05	1.01	1.04	1.11
08	B	1.00	1.00	1.04	0.98	0.97	1.02	0.94	0.94	1.12	1.09	1.05	1.01	1.02
09	B	0.93	0.94			0.97	0.96			0.99	0.94		0.98	

RV Categorisation : Profile

Gas Year 2004/05

Based on average errors (after scaling) over the period as a percentage of average actual over the full year

EUC	BAND	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
02	B	~	~	~	↑	↑	↑	↑	↑	~	~	~	↑	↑
03	B	~	↑	~	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
04	B	~	~	~	~	~	~	↑	~	↑	~	~	~	~
05	B	~	↑	↑	↑	~	↑	⇑	~	↑	~	~	↑	~
06	B	~	~	~	↑	~	~	⇑	~	~	~	~	~	~
07	B	~	⇑	↑	⇑	⇑	↓	~	↑	~	~	~	~	↑
08	B	~	↓	~	~	⇑	↑	⇑	⇑	↓	↓	⇑	↓	⇓
09	B	⇓	⇓			⇑	~			⇑	⇓		⇓	

5% level	↑	too peaky	10% level	⇑	too peaky
	↓	too flat		⇓	too flat

Average Number of Meters

During the Full Period of Gas Year 2004/05

EUC BAND	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
02 B	15870	8837	23910	12853	16920	16990	1970	5065	15227	25875	22432	14124	10932
03 B	1080	767	1837	1005	1612	1291	157	460	1443	2530	2088	1421	1059
04 B	522	455	744	453	667	586	80	175	805	1482	1165	908	550
05 B	290	208	415	300	397	375	35	99	463	710	768	559	361
06 B	122	116	175	155	177	171	31	52	176	364	226	238	157
07 B	26	26	35	26	99	36	16	18	67	73	82	96	37
08 B	31	10	14	19	14	19	3	6	16	11	4	7	18
09 B	4	3			2	8			3	2		3	

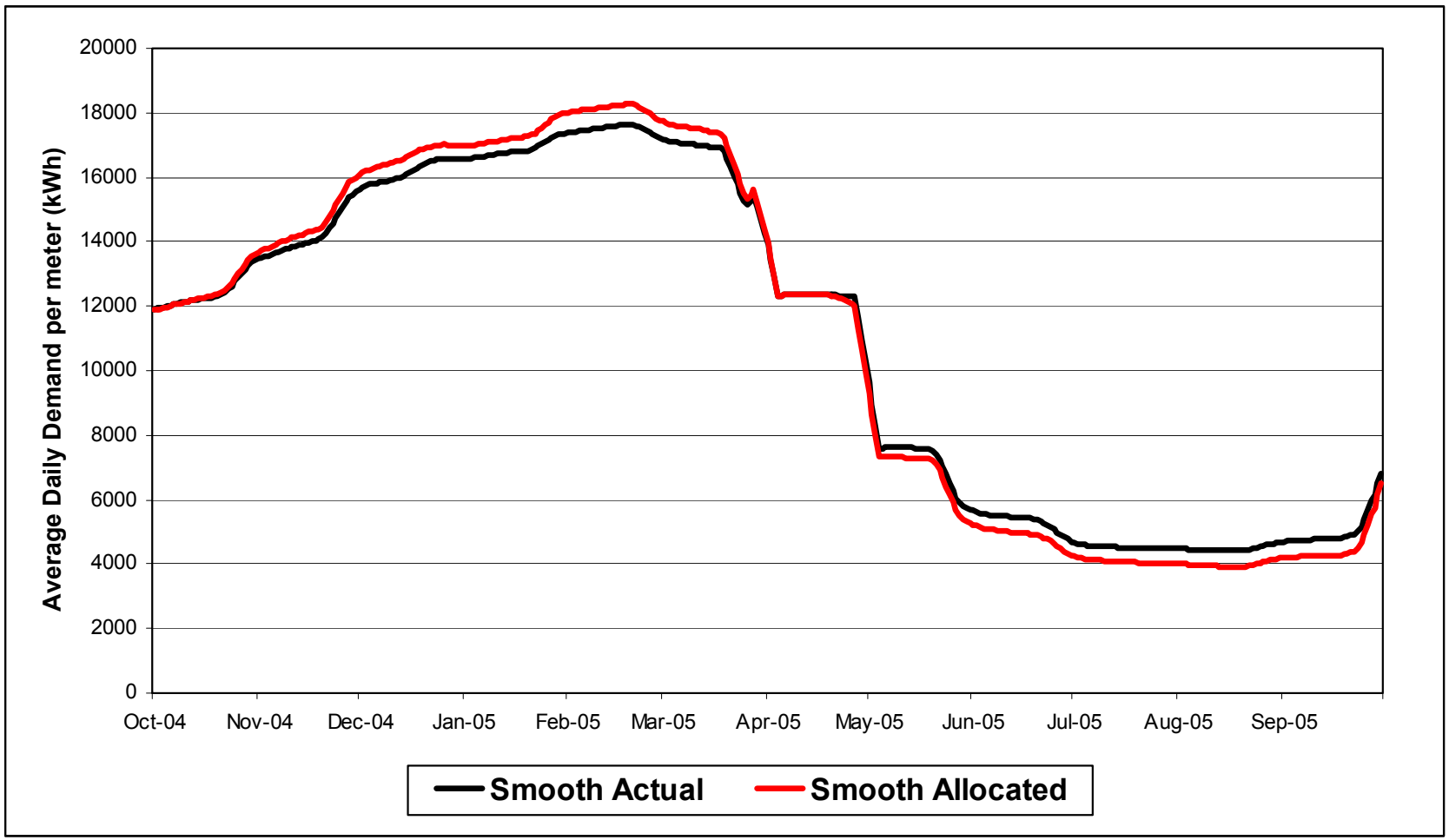
5% level too peaky too flat

10% level too peaky too flat

[Based on average errors (after scaling) over the period as a percentage of average actual over the full year]

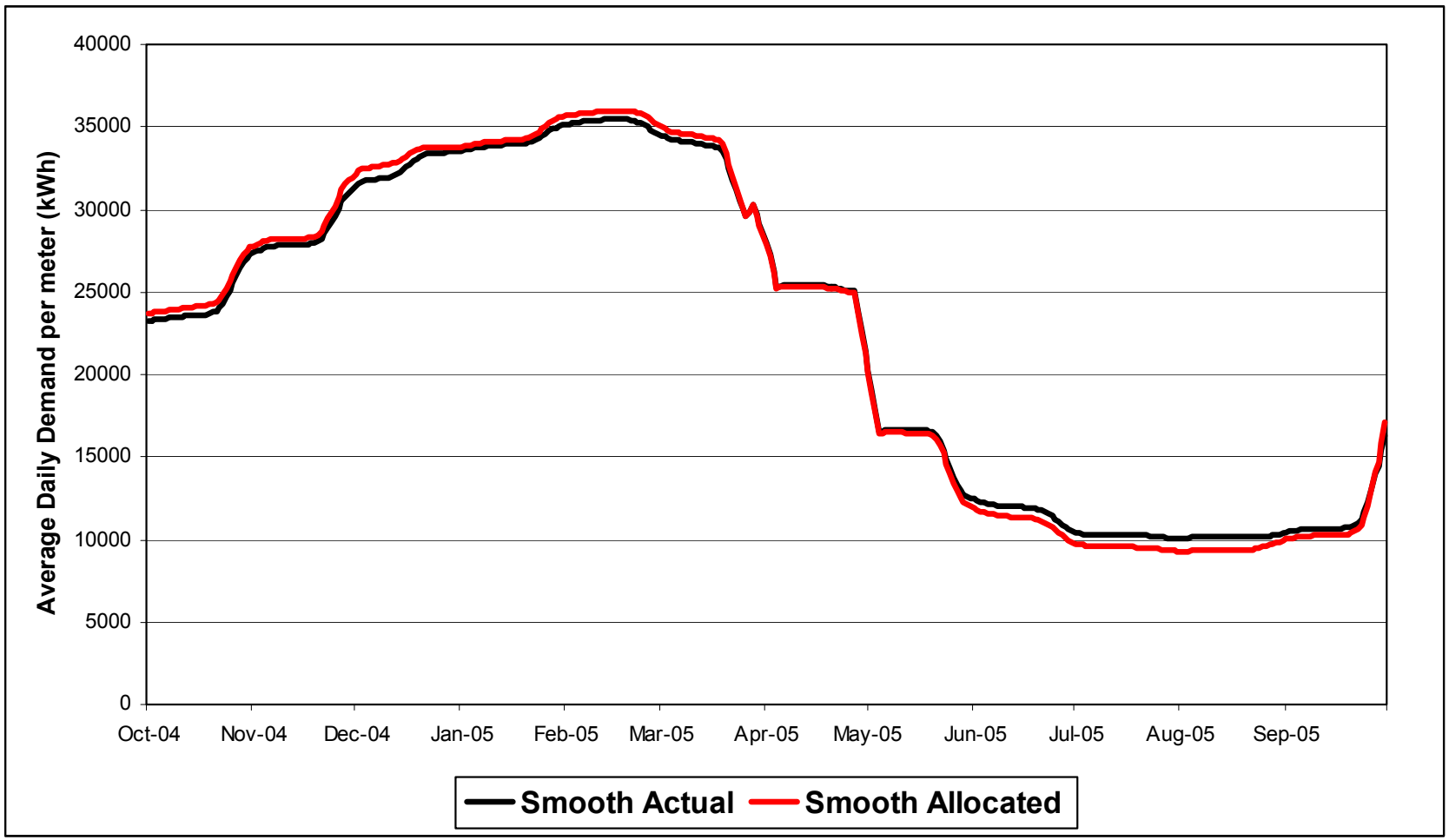
All LDZs : Consumption Band 03

RV Analysis (After Scaling)



All LDZs : Consumption Band 04

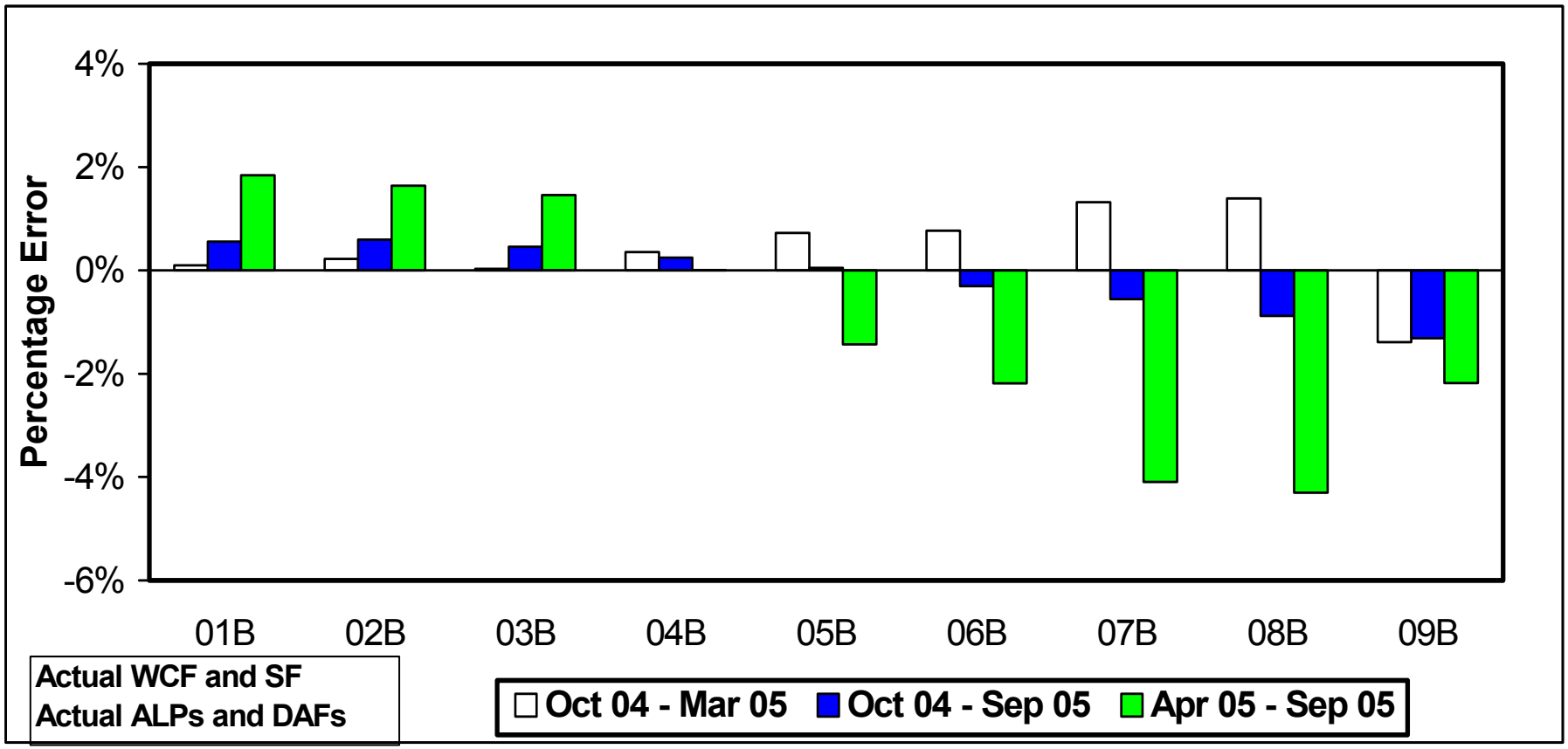
RV Analysis (After Scaling)



NDM Sample Analysis

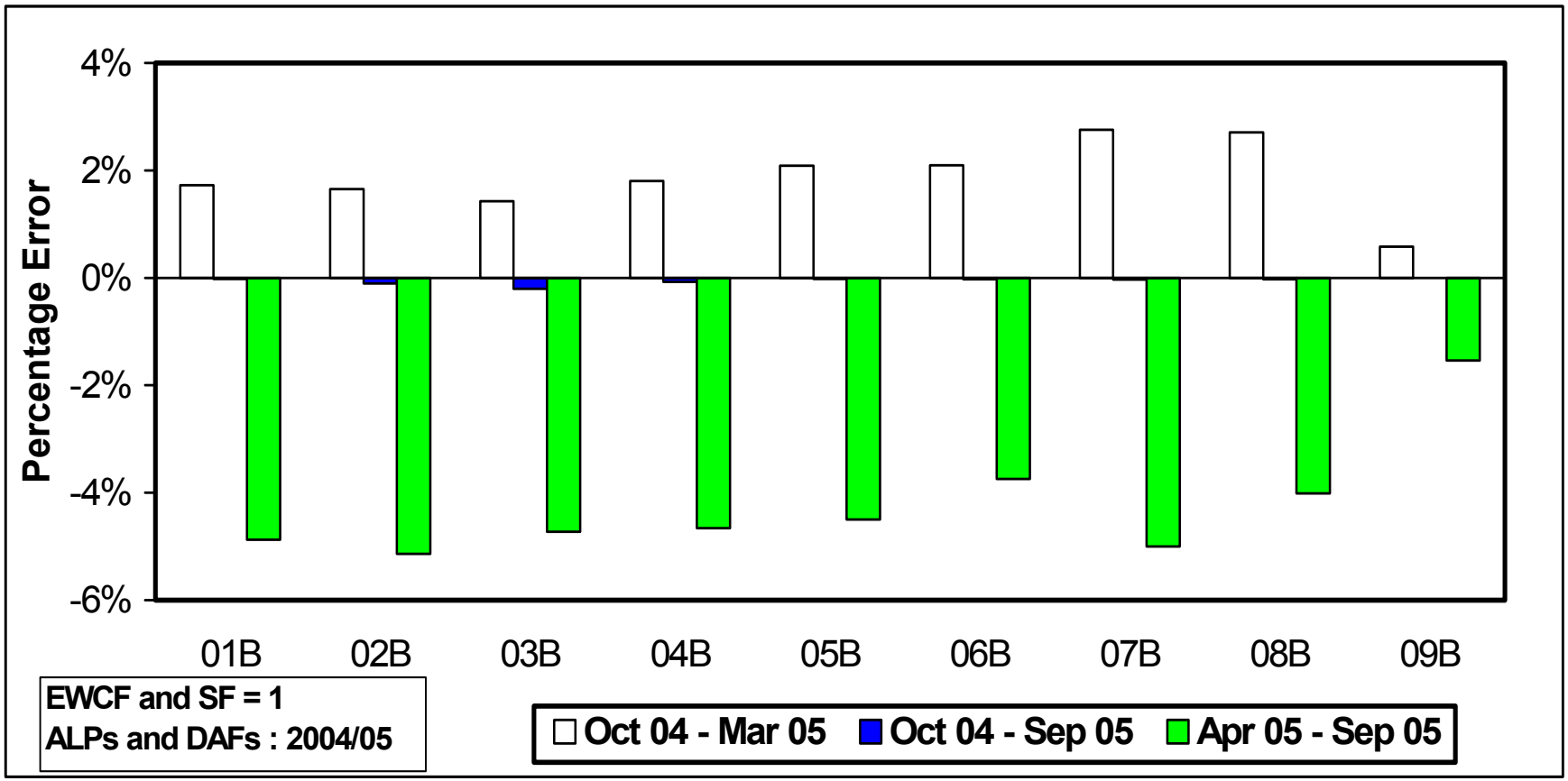
Error as a Percentage of Demand

Weighted average across LDZs. 'As Used'



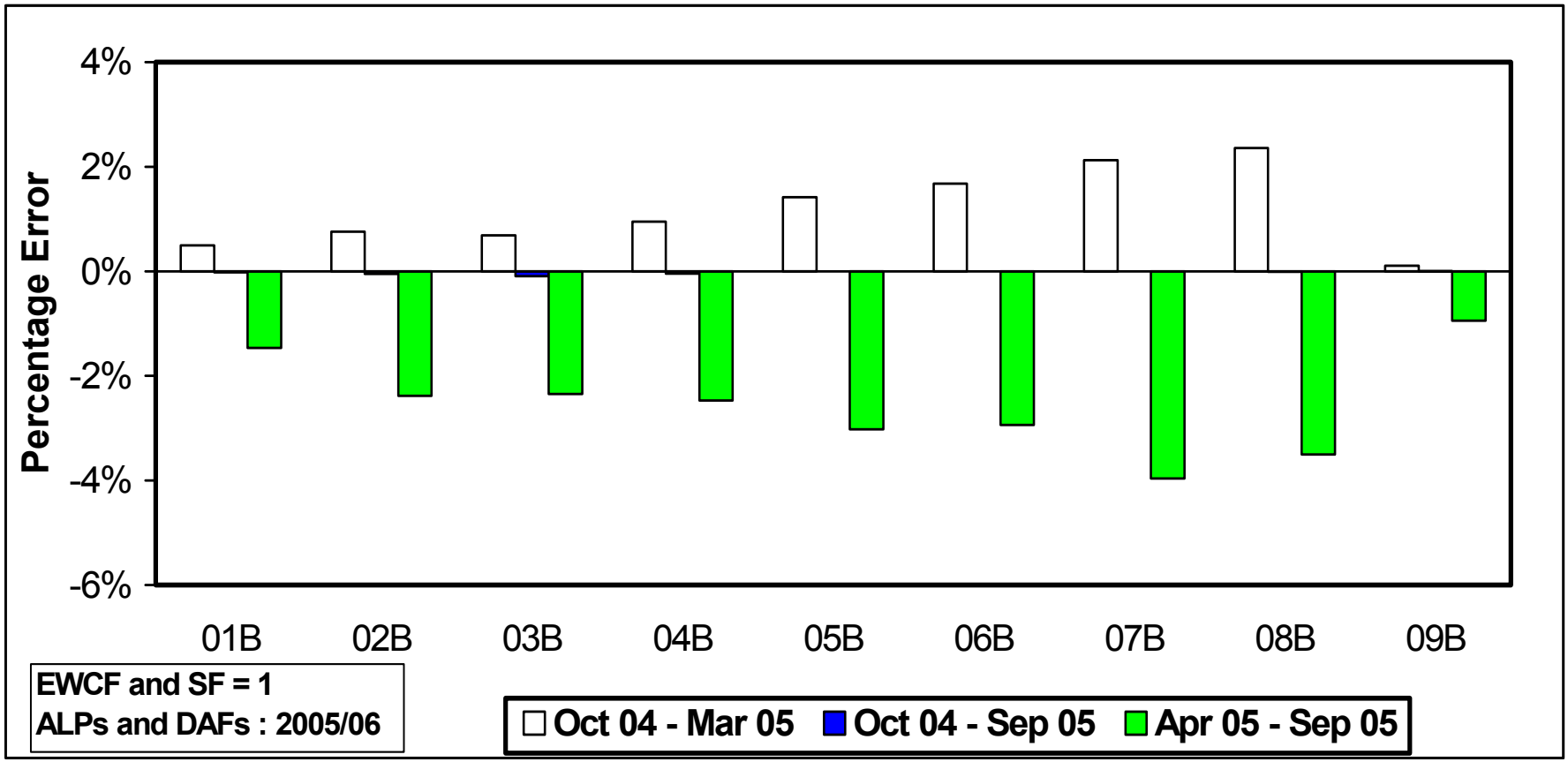
Error as a Percentage of Demand

Weighted average across LDZs. 'Best Estimate 04'



Error as a Percentage of Demand

Weighted average across LDZs. 'Best Estimate 05'



Tables 3.10 & 3.11 – Effect of April & May 2005

Table 3.10 **Apr 05 - Sep 05** **EWCF, with SF=1: 2004/05 ALPs and DAFs 'Best Estimate 04'**

Analysis of Daily Percentage Error: Statistic is Total Errors as Percentage of Full Period Demand

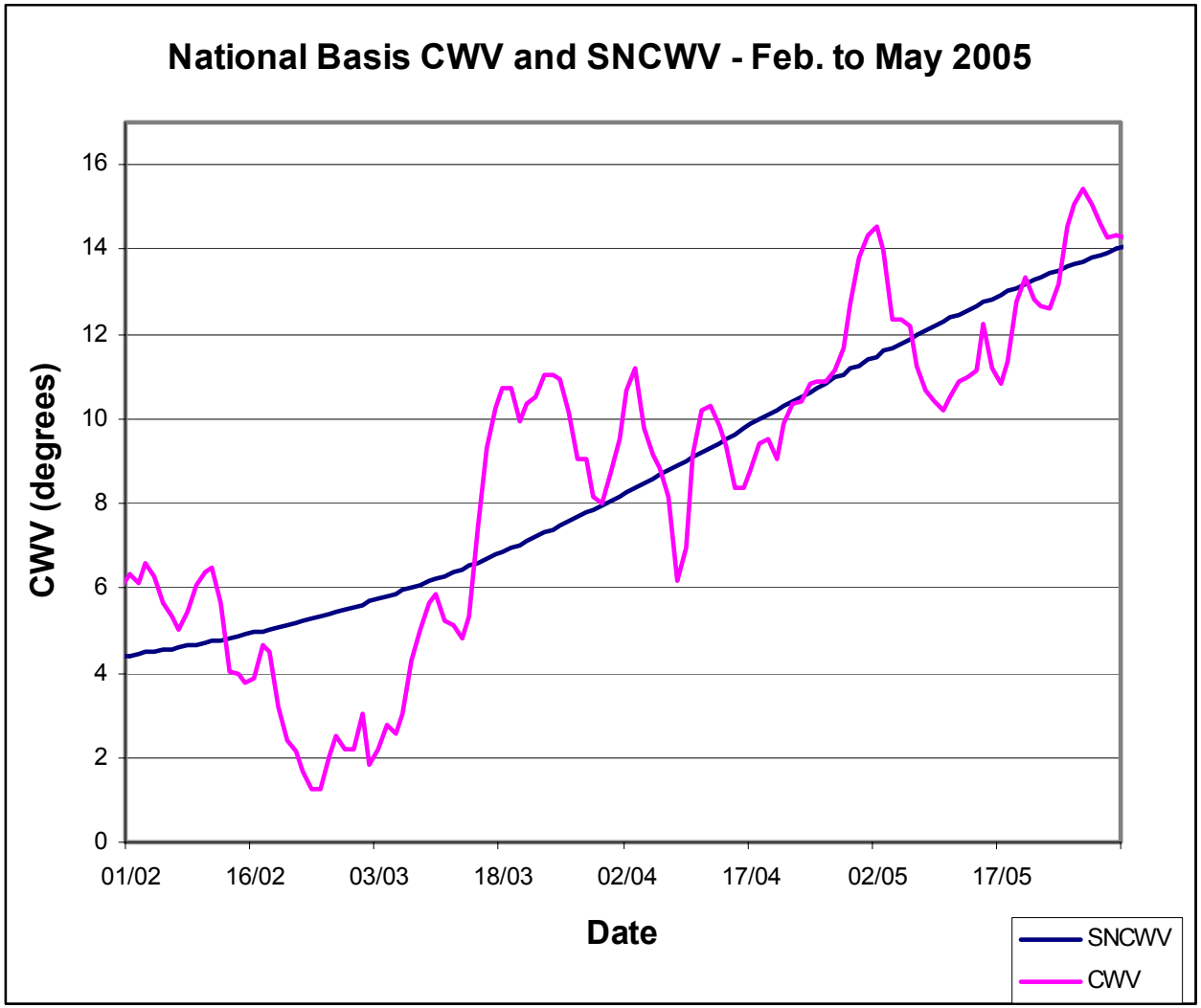
01B	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
Apr 05 - May 05	-3.8%	-7.0%	-4.8%	-3.6%	-4.5%	-4.8%	-	-6.6%	-3.7%	-4.4%	-5.0%	-6.7%	-7.0%
Jun 05 - Sep 05	1.9%	-0.6%	0.2%	1.4%	-2.9%	1.0%	-	0.8%	-0.3%	0.7%	-0.9%	0.6%	1.0%

Table 3.11 **Apr 05 - Sep 05** **EWCF, with SF=1: 2004/05 ALPs and DAFs 'Best Estimate 04'**

Analysis of Daily Percentage Error: Statistic is Total Errors as Percentage of Actual Demand

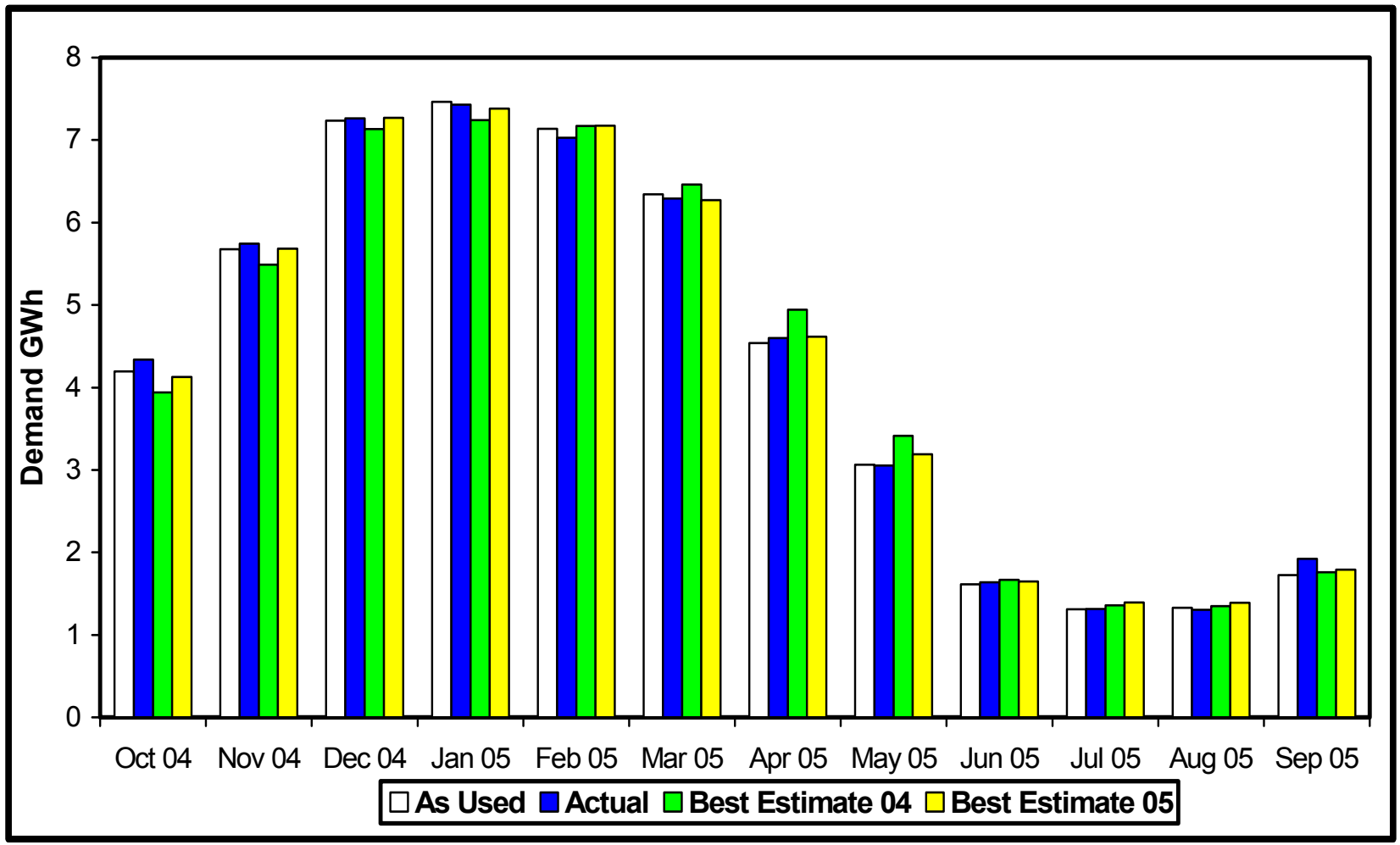
All LDZs	01B	02B	03B	04B	05B	06B	07B	08B	09B
Apr 05 - May 05	-9.2%	-7.8%	-6.5%	-4.4%	-3.5%	-2.6%	-1.5%	-0.5%	0.3%
Jun 05 - Sep 05	0.6%	-1.4%	-2.5%	-5.0%	-5.5%	-4.7%	-7.9%	-6.5%	-3.2%

National Basis CWV and SNCWV – February to May 2005



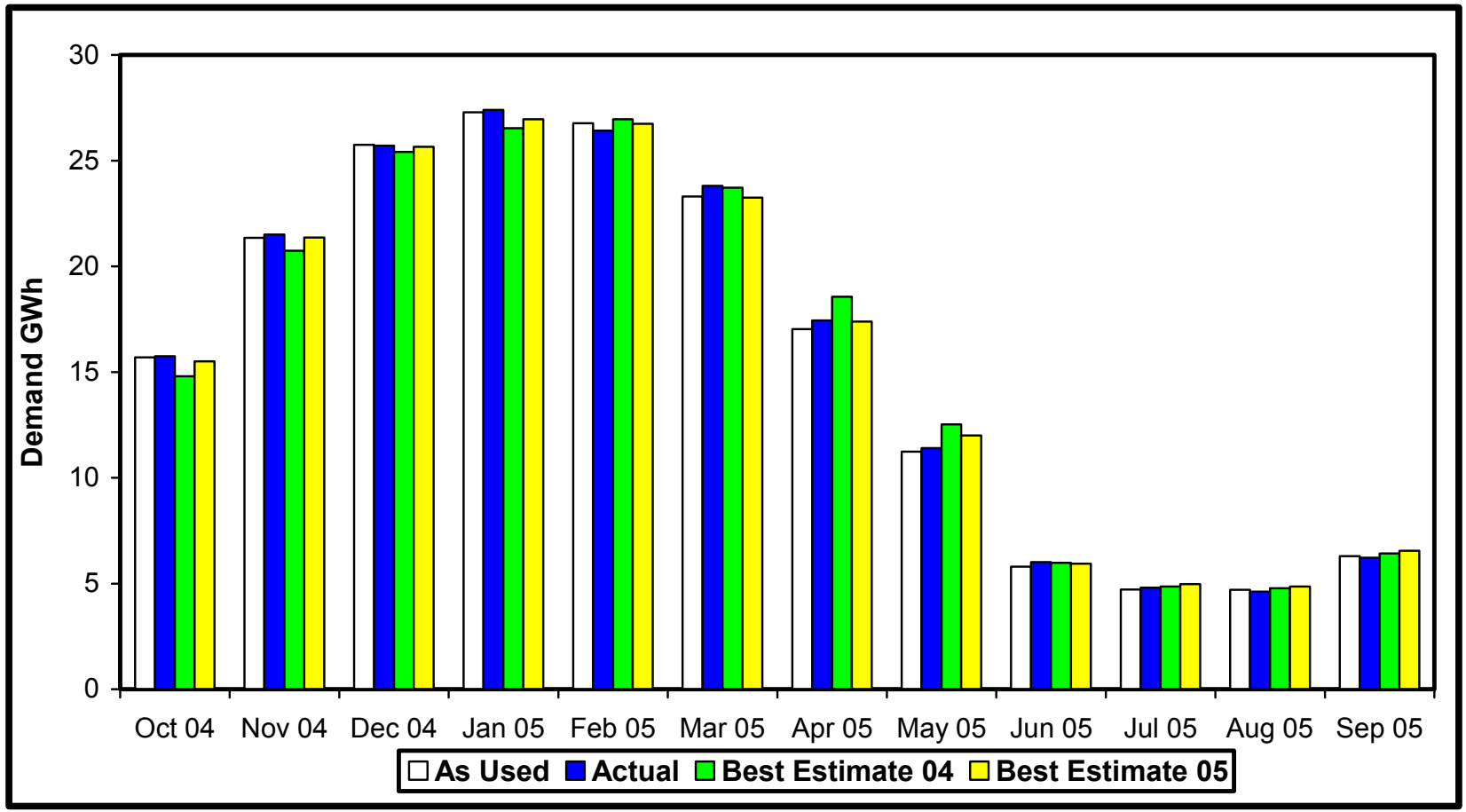
Monthly Actual & Deemed Demand

01B (All LDZs)



Monthly Actual & Deemed Demand

02B (All LDZs)



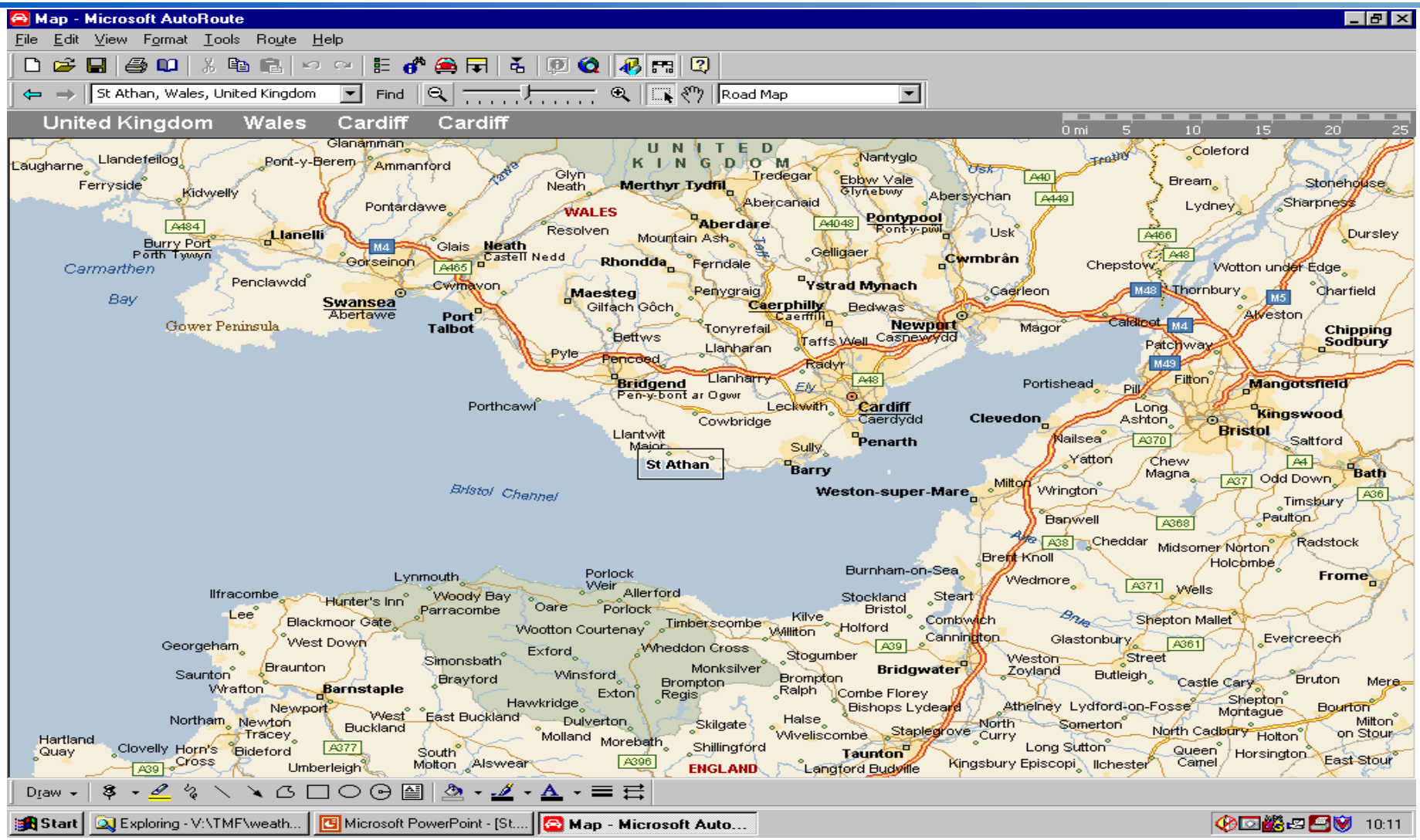
A revised composite weather variable for Wales South

DESC 12th December 2005

Background

- The current composite weather variable (CWV) for Wales South (WS) LDZ is based on temperatures and wind speeds from Cardiff weather station.
- Cardiff weather station will probably close in 2006.
- R.A.F. St. Athan is the nearest weather station to Cardiff.
- St. Athan is located near the coast away from the major population centres in Wales South.
- If Cardiff weather station closes before the end of the current gas year, the Met. Office will compute pseudo Cardiff observations from St. Athan weather data for the rest of the gas year.
- A revised CWV based on St. Athan data has been derived.
- Unless the Met. Office decides by March 2006 that Cardiff will stay open, the revised CWV will need to be used in the spring 2006 NDM analysis and implemented on 1st October 2006.

Location of St. Athan



Backfilling equations (from November DESC)

- Used to create St. Athan weather history back to 1928.
- Daily Temperatures:

  St.Athan = - 0.2009 + 0.9679 * Cardiff
  - 0.0587 * max(0 , 7.5 - Cardiff)
  - 0.1438 * max(0 , Cardiff - 15.6)

- Daily Wind Speeds:

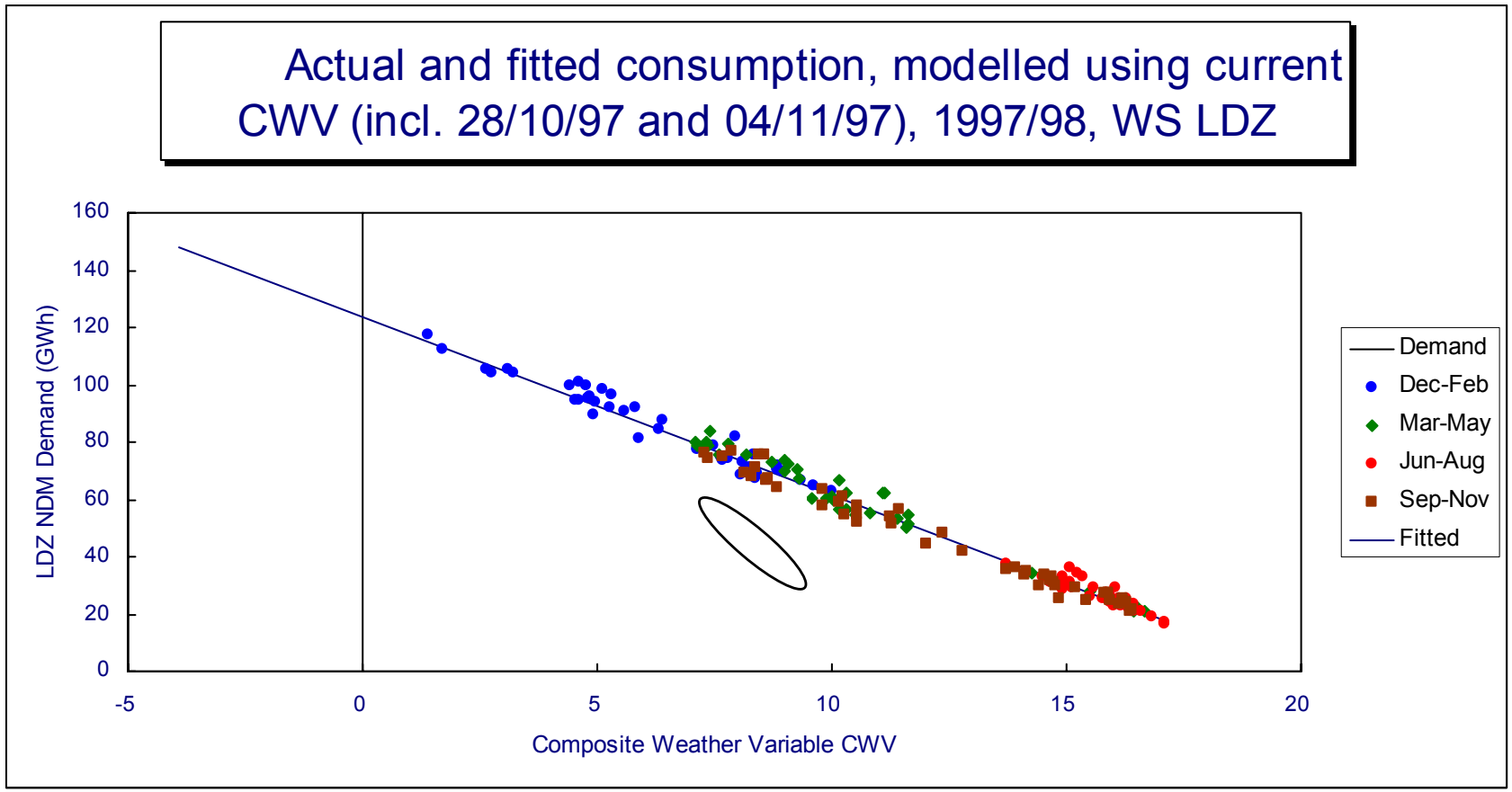
  St.Athan = 1.8638 + 0.9512 * Cardiff
  - 0.0846 * max(0 , 6 - Cardiff)

- At St. Athan, daily temperatures are generally lower than at Cardiff.
- At St. Athan, daily wind speeds are generally higher than at Cardiff.

Approach used to derive revised CWV

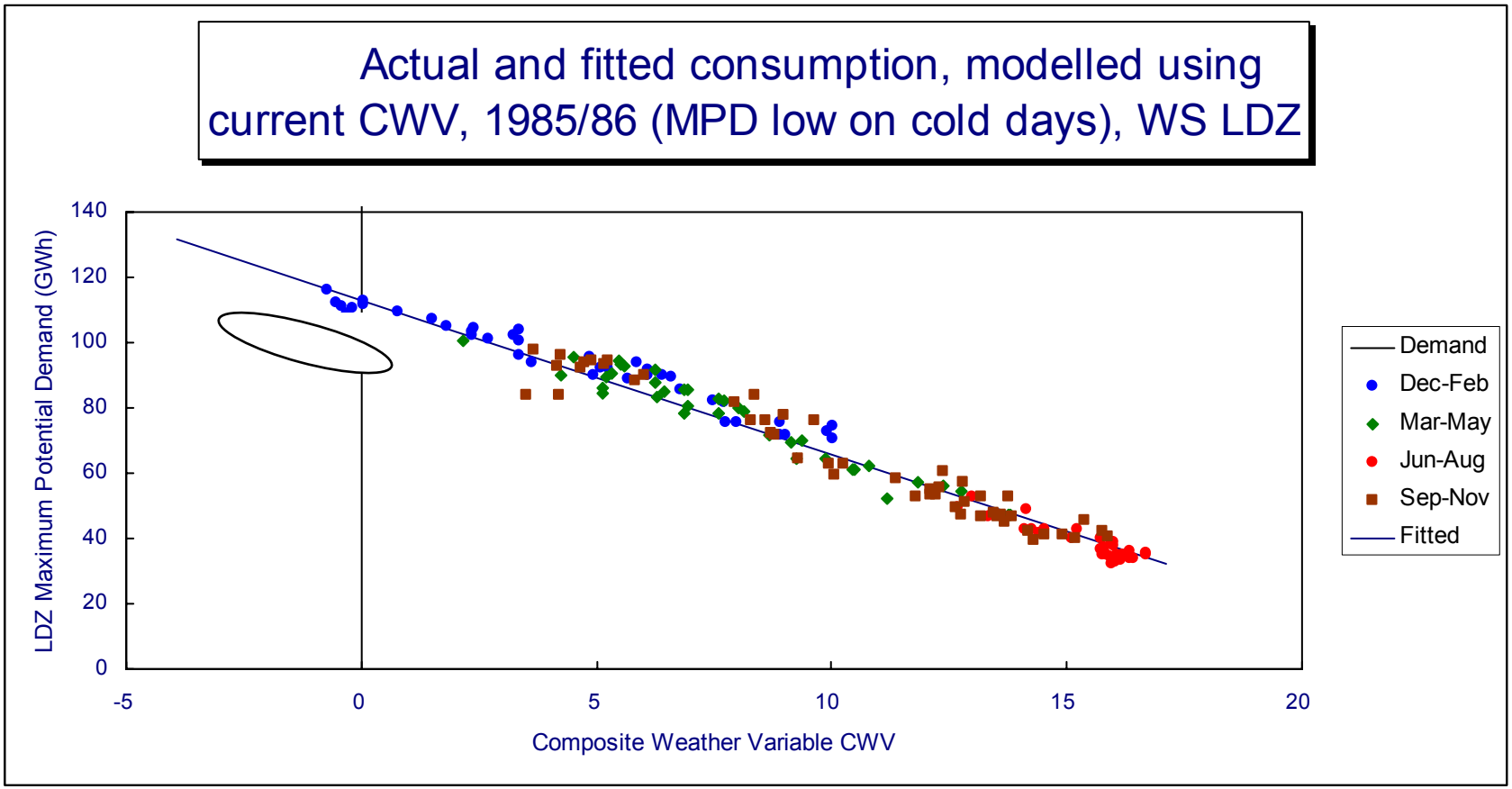
- The same methodology was used as for the comprehensive CWV review carried out in 2004 with the addition of an extra gas year of demand and weather data.
- Most CWV parameters were derived using aggregate NDM demand data (9 gas years 1996/97 to 2004/05).
- Maximum potential demand (MPD) data prior to 1996/97 was included in the derivation of cold weather parameters.
  - Aggregate NDM data for 4 days and MPD data for 5 gas years (1981/82 to 1985/86) was excluded from the analysis.
- A pseudo seasonal normal effective temperature (SNET) profile was used.

Data exclusions example – graph for 1997/98 (showing 2 days excluded from analysis)



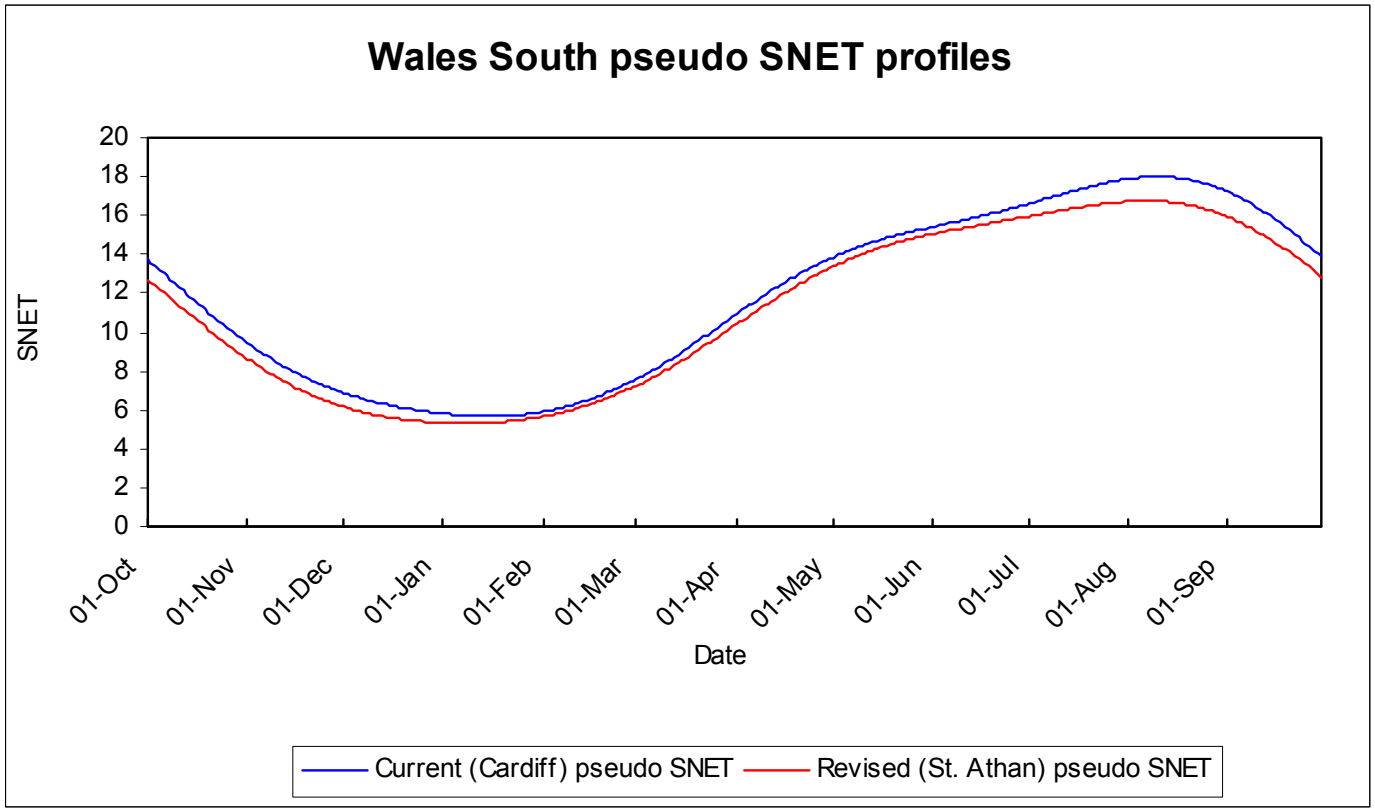
- Aggregate NDM appeared to be too low on the excluded days possibly due to errors in DM demand on those days.

Data exclusions example – graph for 1985/86 (excluded from cold weather parameter analysis)



- MPD appeared to be too low on some cold days possibly due to interruption estimates not being included.

Comparison of pseudo SNET profiles



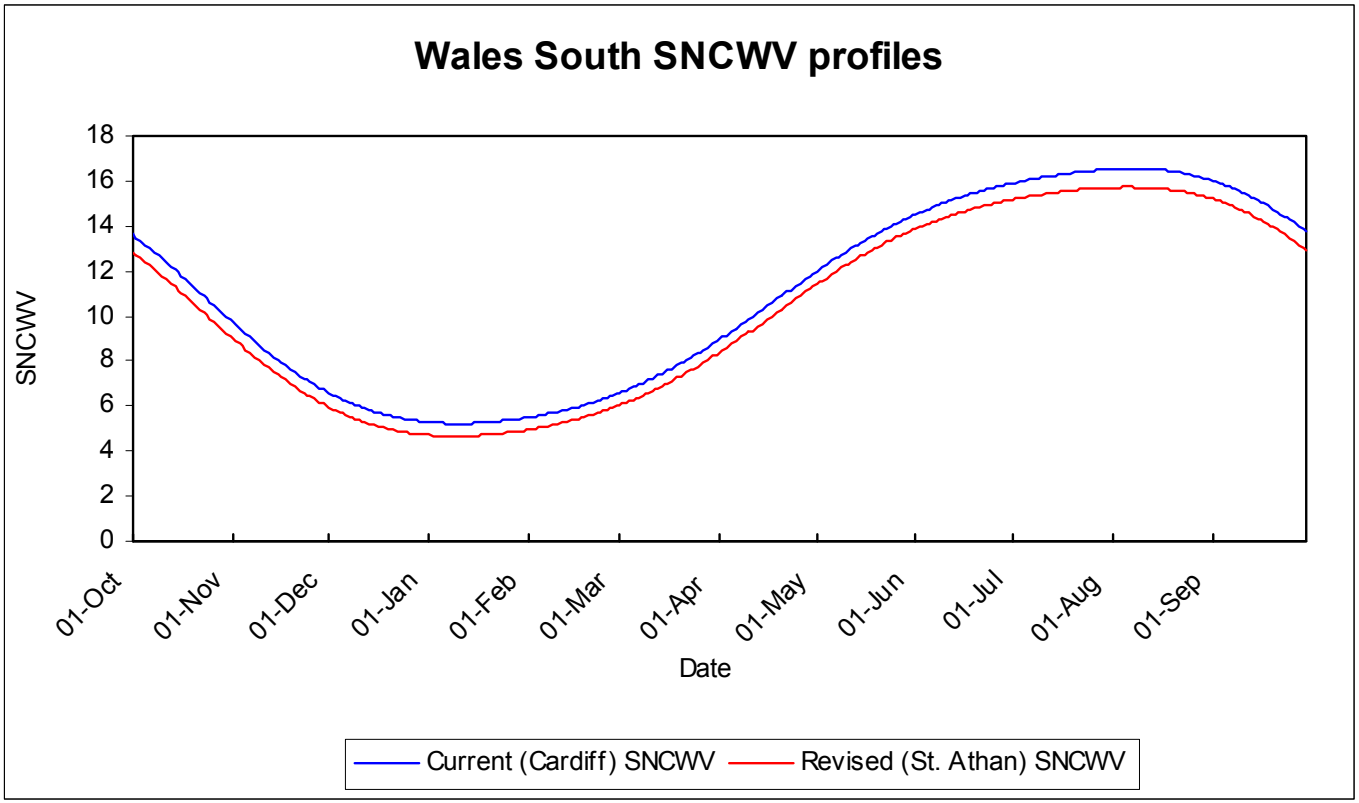
- Values for the revised (St. Athan based) pseudo SNET are lower than the current (Cardiff based) pseudo SNET, especially in the summer and autumn.

Comparison of CWV parameters

CWV	Weather Station	I_1	I_2	I_3	V_0	V_1	V_2	Q
Current	Cardiff	0.663	0.0133	0.18	2	15.7	19.3	0.39
Revised	St. Athan	0.625	0.0117	0.18	2	14.9	18.2	0.45

- The warm weather cut-offs (V_1 and V_2) are lower for the revised CWV than the current CWV because of the lower summer temperatures and pseudo SNET values at St. Athan.
- The cold weather parameters (V_0 and I_3) are the same for both CWVs.
- The differences in the other parameters are the result of differences in temperatures, wind speeds and pseudo SNET profiles.
- CWV values are generally lower for the revised CWV than the current CWV.

Comparison of Seasonal Normal CWV profiles



- SNCWV values based on 17 gas years (1987/88 to 2003/04).
- Values for the revised (St. Athan based) SNCWV are lower than for the current (Cardiff based) SNCWV.

Comparison of average fit and peaks

CWV	Weather Station	1 in 20 peak CWV	Avg. Mean Abs. % Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)	Avg. % diff. in est. 1 in 20 peak demand
Current	Cardiff	-3.93	3.96%	98.86%	3,021	-
Revised	St. Athan	-4.26	4.61%	98.45%	3,540	-0.05%

- The average statistics were calculated from Monday to Thursday models of aggregate NDM demand (excluding holidays) for 1996/97 to 2004/05.
- The 1 in 20 peak CWV values were calculated from 77 gas years of weather data (1928/29 to 2004/05).
- Estimated 1 in 20 peak aggregate NDM demands were calculated from the demand models and the 1 in 20 peak CWV values.
- The revised CWV produced a good fit to aggregate NDM demand, but not quite as good as the current CWV.
- The revised CWV did not significantly alter the estimated 1 in 20 peak aggregate NDM demand.

Comparison of seasonal fit

CWV	Weather Station	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Oct.	
		MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE
Current	Cardiff	0.04%	2.85%	-0.02%	4.80%	-0.21%	5.78%	0.03%	4.24%
Revised	St. Athan	0.02%	3.03%	0.15%	5.91%	0.13%	6.70%	-0.23%	5.08%

- The average statistics by seasonal quarter were calculated from Monday to Thursday models of aggregate NDM demand (excluding holidays) for 1996/97 to 2004/05.
- MPRE = Mean Percentage Residual Error for seasonal quarter

$$= 100 * \frac{\text{(avg. actual demand – avg. fitted demand)}}{\text{avg. actual demand}}$$

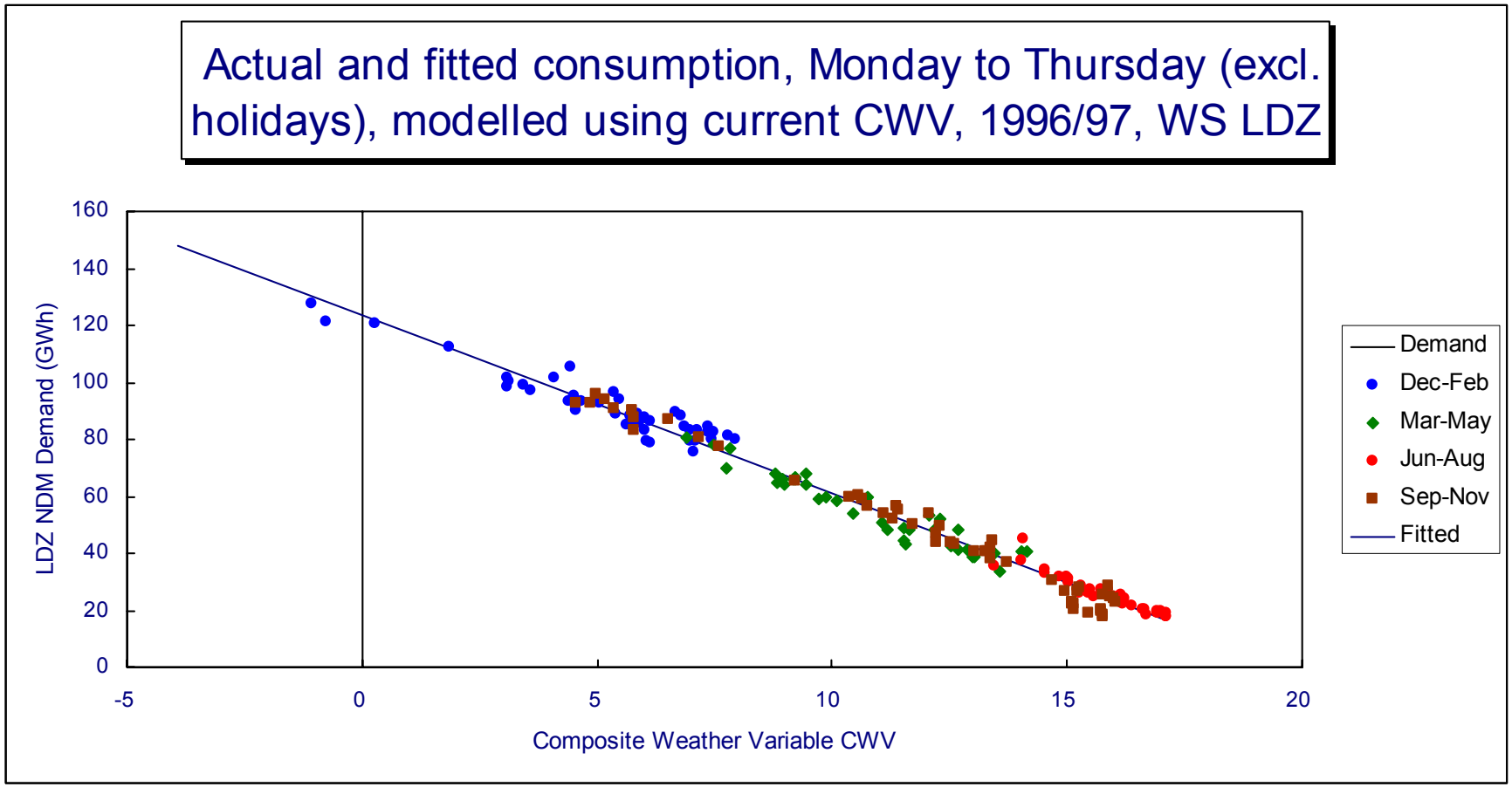
- MAPE = Mean Absolute Percentage Error for seasonal quarter.
- Like the current CWV, the revised CWV displayed very little seasonal bias (average MPRE close to 0 for all seasonal quarters).
- The seasonal fit for the revised CWV was good, but not quite as good as the current CWV.

Example graphs – parameters & statistics

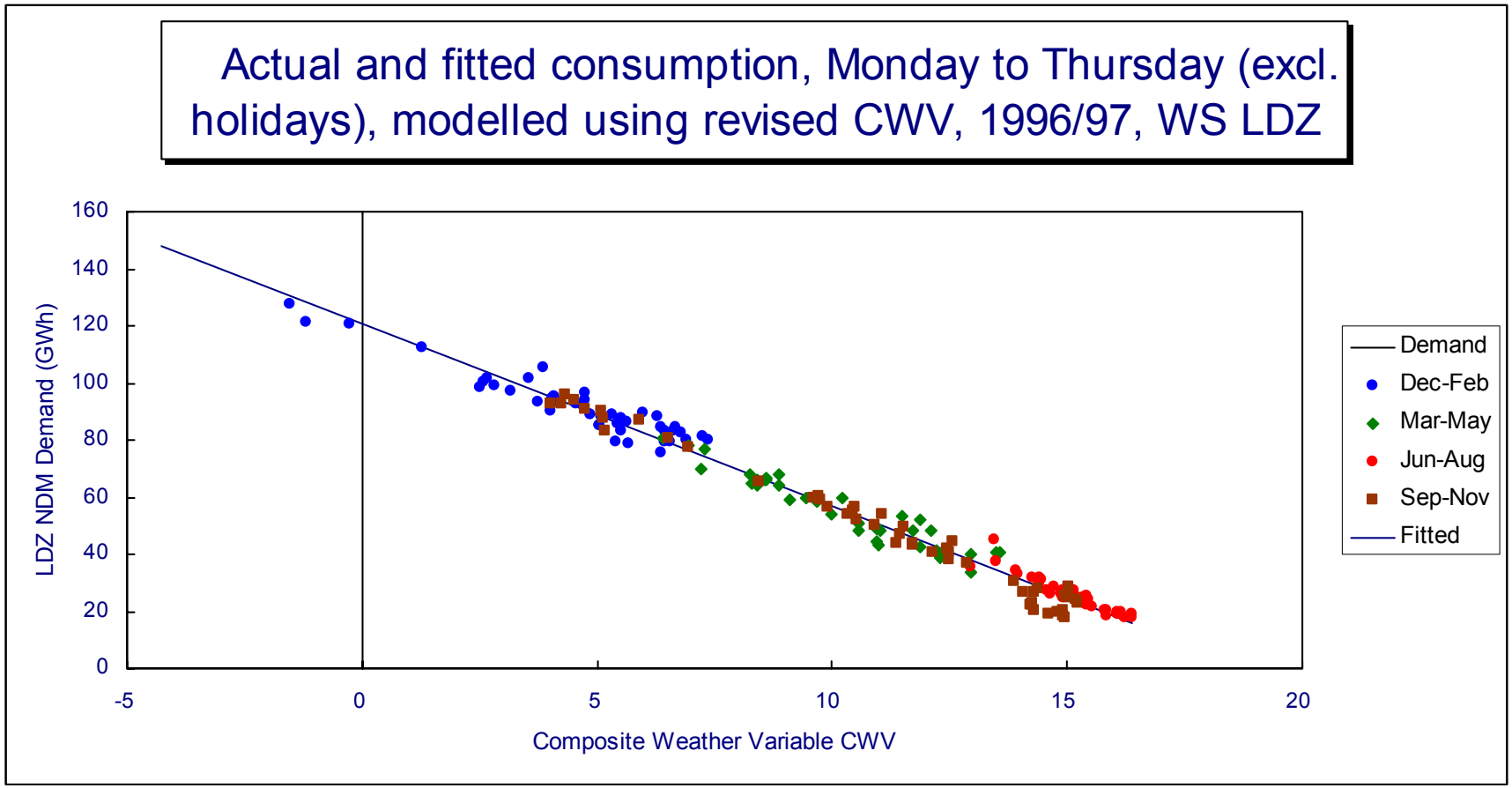
Gas Year	CWV	Weather Station	Demand Intercept (GWh)	CWV Param. (GWh/º)	Mean Abs.% Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)
1996/97	Current	Cardiff	123.51	-6.26	4.93%	98.42%	3,570
1996/97	Revised	St. Athan	120.58	-6.37	4.98%	98.35%	3,644
2004/05	Current	Cardiff	134.52	-7.00	4.35%	98.77%	3,325
2004/05	Revised	St. Athan	131.47	-7.14	4.73%	98.55%	3,620

- Two gas years were chosen as examples: 1996/97 (contained an average winter for WS including some cold days), and 2004/05 (contained a warm winter for WS without any significantly cold days).
- Two days (25/11/96 and 26/01/97) were omitted from 1996/97 because aggregate NDM demand appeared to be incorrect on those days.

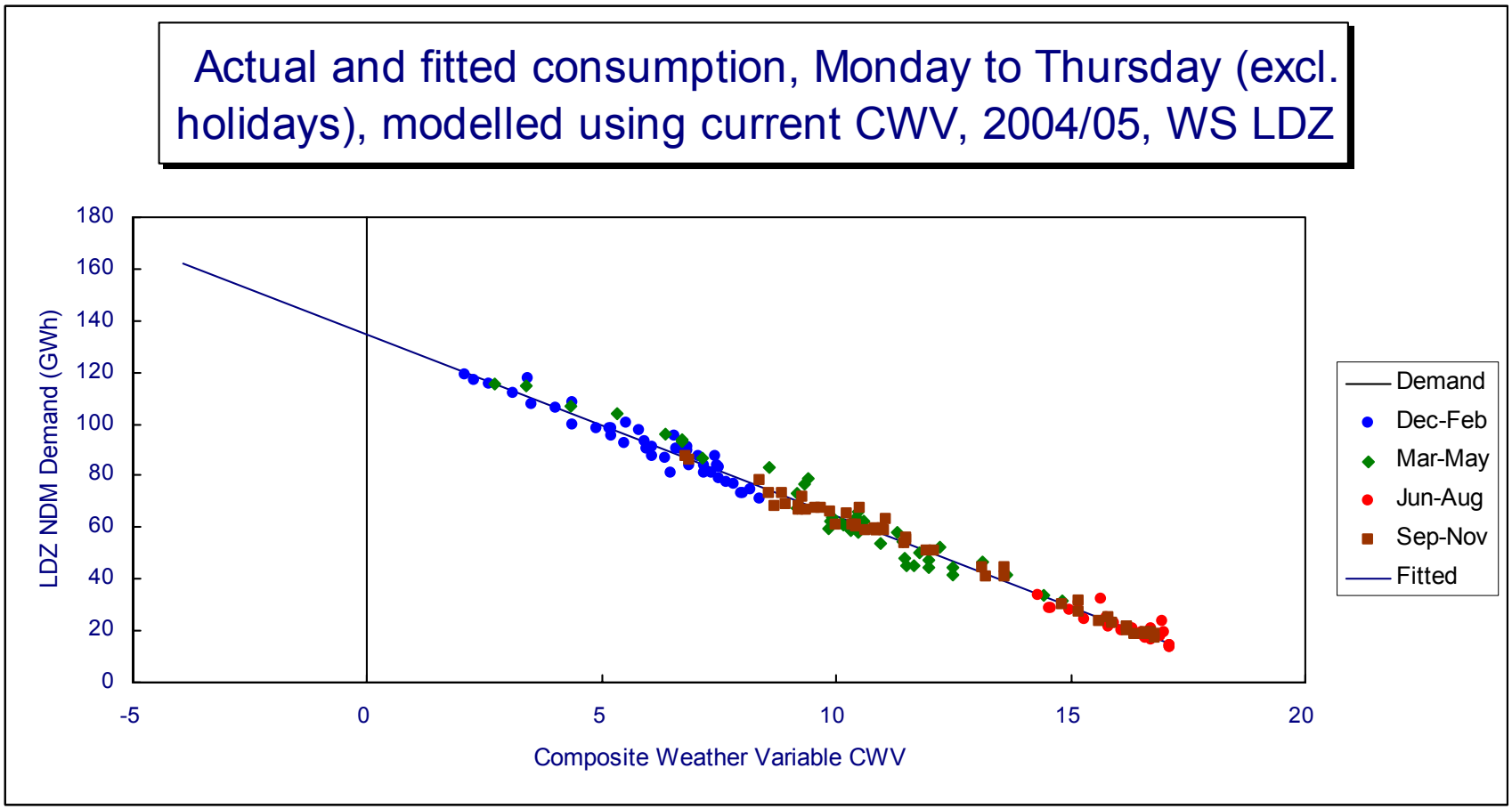
Example graph for current CWV – 1996/97



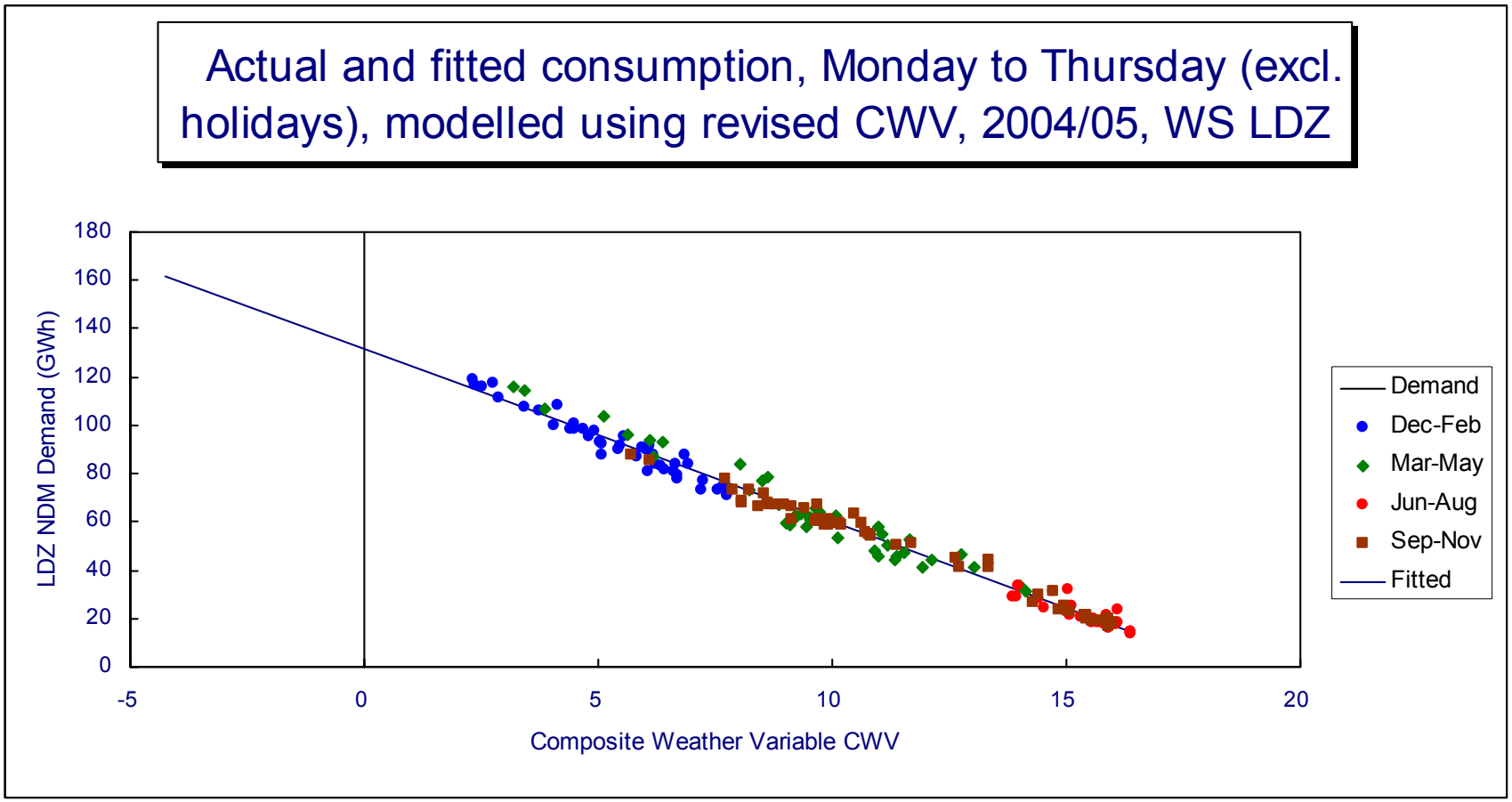
Example graph for revised CWV – 1996/97



Example graph for current CWV – 2004/05



Example graph for revised CWV – 2004/05



Summary

- A revised CWV based on St. Athan data has been derived.
  - good fit to aggregate NDM demand, but not quite as good as the current CWV
  - did not significantly alter the estimated 1 in 20 peak aggregate NDM demand
  - very little seasonal bias
- The difference in fit between the CWVs may indicate that at Cardiff, the weather is slightly more representative than at St. Athan of the conditions experienced by the main centres of demand in Wales South
- Unless the Met. Office decides by March 2006 that Cardiff will stay open, the revised CWV will need to be used in the spring 2006 NDM analysis and implemented on 1st October 2006.