DESC - 16th January 2007

Action: Modelling of Summer Base Load

CWV Trends: Summer 2006 – EA, NT SE LDZs

Background: Review of Summer Base Load

- Summer 2006 exceptionally warm

    - May:Sept warmest extended summer period in UK on record (93 yrs)
    - July warmest month on record (warmest 36.5°C 19th July)
    - September 2006 was the warmest September on record

- NDM weather corrected demand was well below Seasonal Normal Demand (SND) in June to September 2006 in all LDZs – SND too high

- Max CWV values MAY be too low in periods of exceptionally warm weather

- Also possible that multiplicative holiday factors were too high – did not reduce demand enough

- The fit of the current CWV to demand in NT, SE & EA LDZs in 2005/06 examined as part of the recent review of CWVs (LWC)

NDM Weather Corrected Demand as % of NDM Seasonal Normal Demand (Gas Year 05/06)

LDZ	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SC	100.99	100.47	95.31	97.88	97.89	100.30	95.80	96.33	90.50	81.03	89.44	90.68
NO	102.90	100.16	99.15	97.83	97.61	103.53	94.70	94.11	88.89	87.66	92.93	91.43
NW	99.95	99.01	97.66	98.19	95.03	99.38	94.77	98.49	96.32	90.41	89.95	95.90
NE	101.19	99.21	97.50	96.97	94.53	99.45	97.79	99.30	94.26	87.05	85.92	91.90
EM	97.85	99.29	97.68	97.50	96.30	98.23	96.57	94.51	90.95	82.69	82.39	88.97
WM	97.62	97.93	95.81	95.05	93.18	95.40	93.58	90.78	88.80	85.02	83.52	89.55
WN	100.18	88.14	96.03	98.84	96.60	99.53	93.13	96.26	90.60	86.64	90.76	95.22
WS	96.75	97.59	97.40	97.17	96.59	100.70	93.61	91.53	88.04	92.07	91.12	96.88
EA	93.99	96.68	96.44	95.62	93.96	97.44	93.80	93.00	90.86	84.49	86.72	88.63
NT	96.40	95.26	95.96	95.24	93.86	95.99	93.47	93.51	91.37	87.54	87.37	89.47
SE	94.30	96.96	97.47	96.89	95.13	97.66	94.31	93.91	91.03	84.53	86.96	88.57
SO	100.65	96.84	94.92	95.47	94.03	94.36	93.74	91.16	90.96	87.89	92.14	90.50
SW	97.32	95.63	97.65	95.60	96.14	99.59	91.13	90.68	86.97	84.55	84.47	87.98
AVG	98.21	97.80	96.83	96.64	95.19	98.17	94.51	94.27	91.17	85.98	87.48	90.81

- Weather corrected NDM Demand below SND
- Aggregate NDM SNDs too high

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Current CWV parameters for EA, NT & SE LDZs

LDZ	I_1	I_2	I_3	V_0	V_1	V_2	q	Max. CWV
EA	0.681	0.0125	0.00	0	15.9	19.5	0.37	17.23
NT	0.697	0.0125	0.05	3	16.0	20.1	0.30	17.23
SE	0.692	0.0120	0.09	3	15.6	19.3	0.38	17.01

- Max CWV too low - not necessarily optimum for extreme conditions
- The max CWV depends on the CWV parameters q, V1 and V_2 : Max CWV = V_2 + q * (V_2 – V_1) which is based on:
- Warm weather parameter values (V_1 , V_2 and q) determined by analysis of Mon:Thur (non-hol) aggregate NDM demand models
- Values chosen to give best fit on AVERAGE over all years with aggregate NDM data (96/97 to 03/04)

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Effective Temperatures for LWC in 2005/06

(max CWV reached E.T >20°)
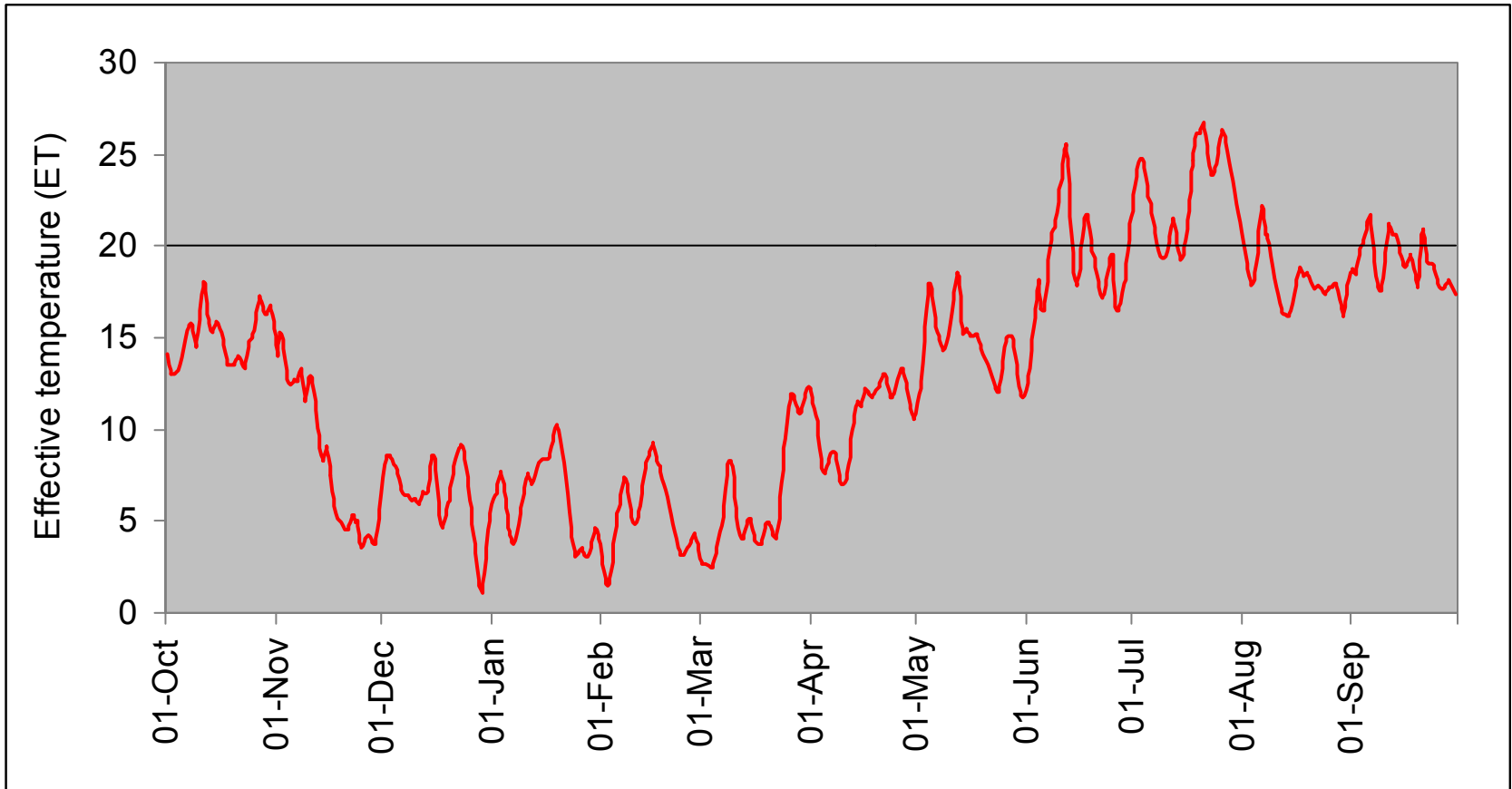
- LWC Effective Temperature peaked July 21st
- Maximum CWV reached on various days in June to September

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Parameters & Fit Statistics for 2005/06 Models

LDZ	1 in 20 peak CWV	Maximum CWV	Demand Intercept (GWh)	CWV Param. (GWh/°)	Mean Abs.% Error	Avg. Adj. R-sq.	Avg. RMSE (MWh)
EA	-3.03	17.23	303.93	-15.69	3.33%	99.44%	6,054
NT	-3.40	17.23	405.84	-20.83	3.03%	99.58%	6,930
SE	-3.49	17.01	404.24	-21.30	3.67%	99.46%	7,939

- Parameters / statistics from Mon:Thur models of aggregate NDM demand (excluding holidays) for 05/06
- 1 in 20 peak CWV values were calculated from 78 gas years of weather data (1928/29 to 2005/06)
- Very good fit to aggregate NDM demand over year as a whole in all 3 LDZs.

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Seasonal Fit of 2005/06 Demand Models

LDZ	Gas Year	Dec. to Feb.		Mar. to May		Jun. To Aug.		Sep. to Oct.	
		MPRE	MAPE	MPRE	MAPE	MPRE	MAPE	MPRE	MAPE
EA	2005/06	-0.84%	2.49%	1.29%	3.62%	0.07%	4.93%	0.02%	4.07%
NT	2005/06	-0.18%	2.12%	0.83%	3.60%	-1.55%	3.96%	-0.18%	3.71%
SE	2005/06	-0.22%	2.69%	0.86%	4.29%	-0.79%	5.58%	-0.37%	4.23%

- Average statistics by seasonal quarter calculated from Mon:Thur models of aggregate NDM demand (excluding holidays) for 2005/06.
- MPRE = Mean Percentage Residual Error for seasonal quarter

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

- MAPE = Mean Absolute Percentage Error for seasonal quarter.
- No significant seasonal error bias in 2005/06 (including summer)
- Possible that negative errors on days of max
- CWV balanced out by positive errors on other days in summer

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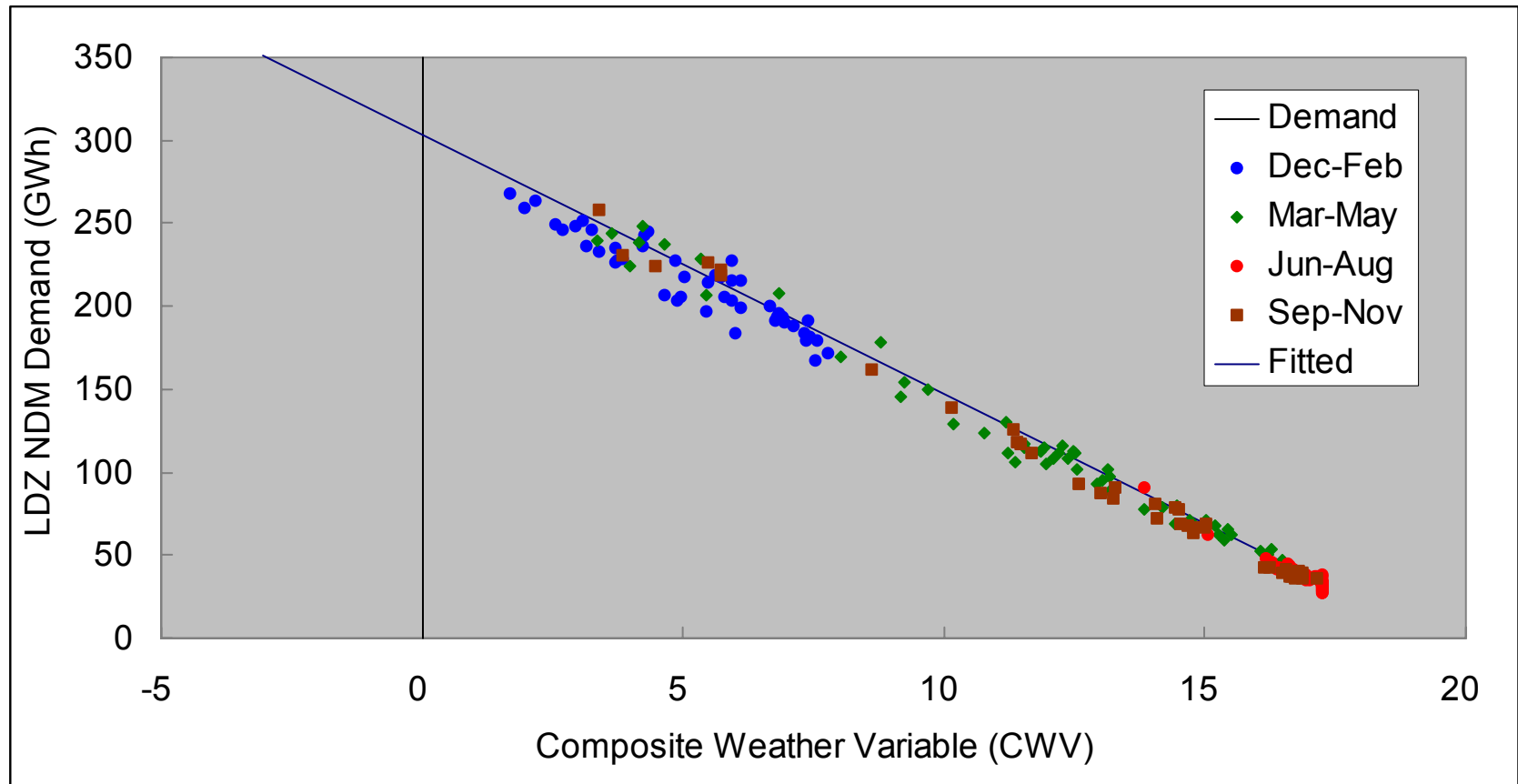
EA LDZ – Mon:Thu Non-Hol Demand (2005/06)
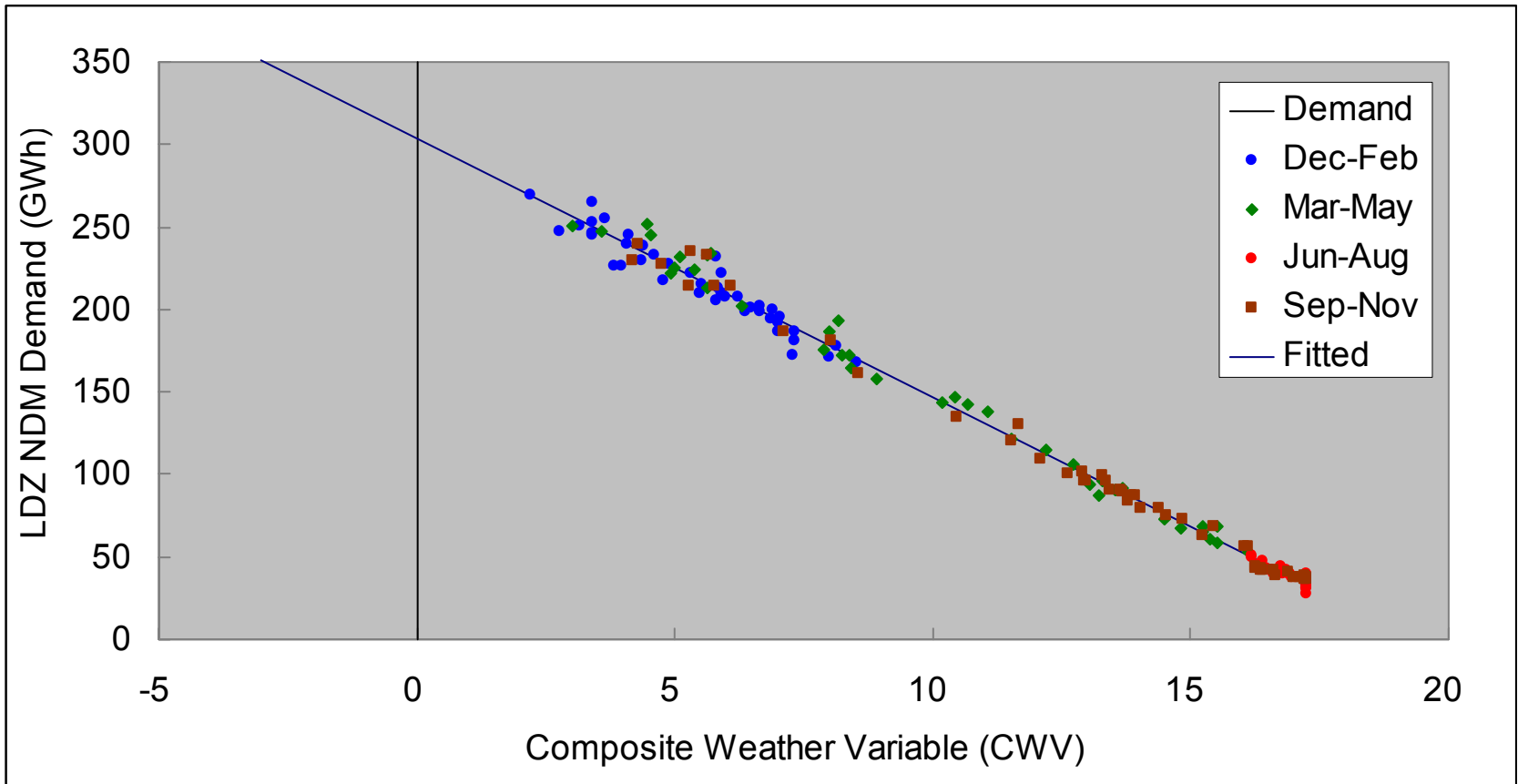
- Fit aggregate NDM demand model Mon:Thu against CWV - EA
- Fit on summer days (shown in red) is reasonable (actual demand close to fitted line)

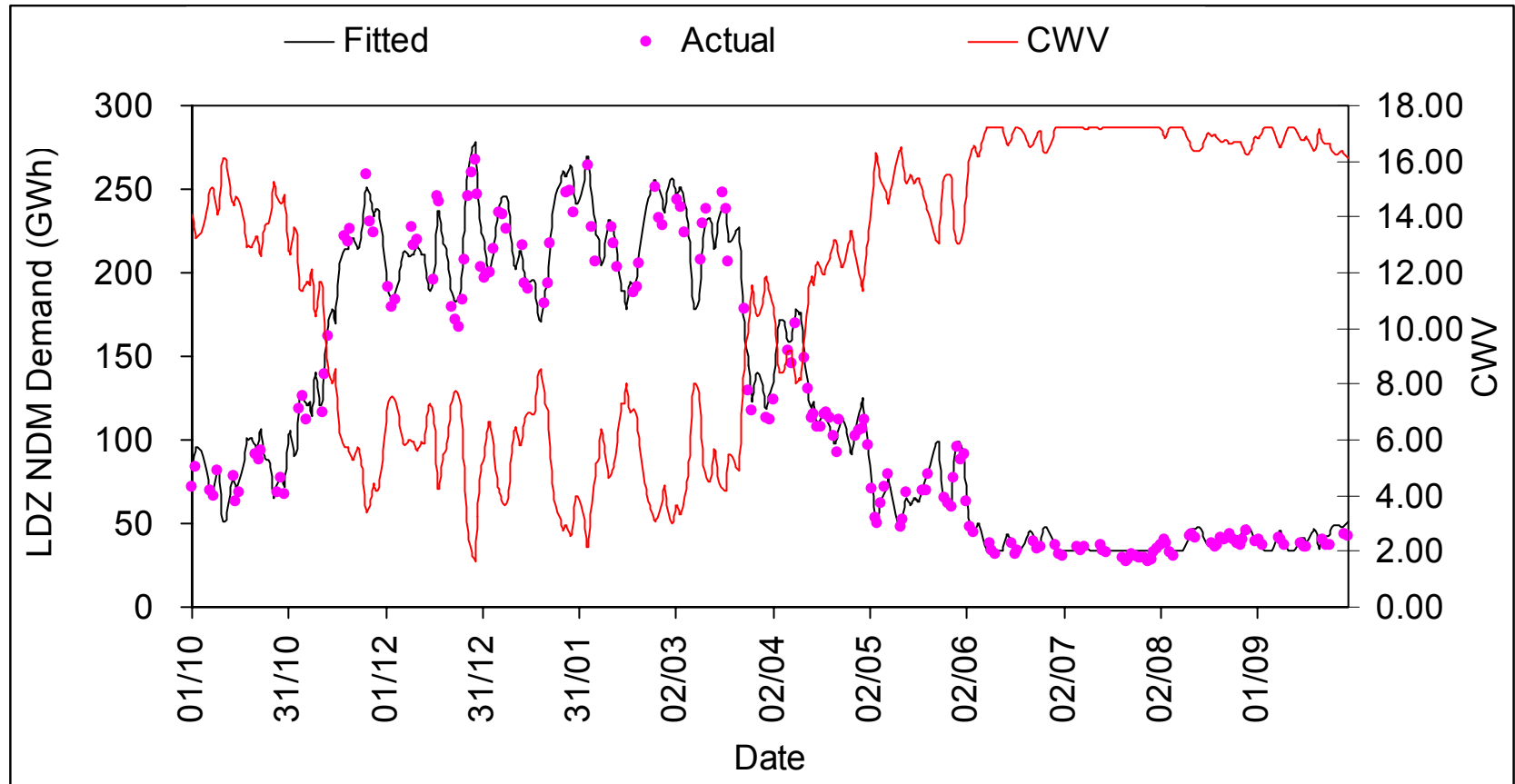# EA LDZ – Time Series Mon:Thu Non-Hol. 2005/06
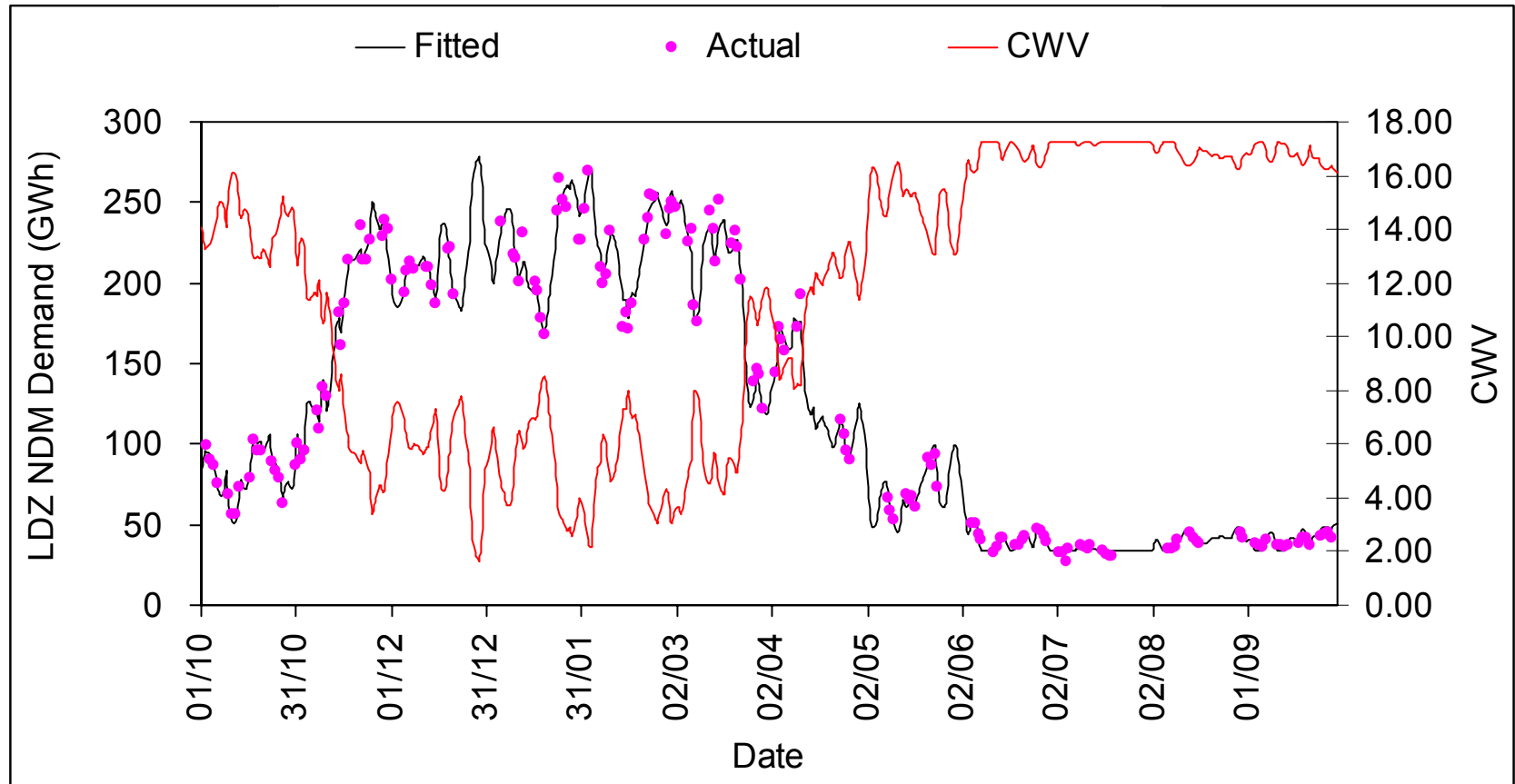
- Time series of previous: NDM aggregate demand, fitted demand, CWV
- Fit is reasonable

EA LDZ – Weekend / Holiday Demand (2005/06)

- Actual aggregate NDM demands for weekends and holiday periods fitted against Mon:Thu demands
- Below Mon:Thu demands as expected

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EA LDZ – Time series Weekend / Holiday, 2005/06

- Time series of previous: weekend & holiday demand, fitted (Mon:Thu) demand, CWV
- Again, weekend and holiday demand below Mon:Thu demand as expected

Summary: 2006 Summer Base Load

- Summer 2006 was an exceptionally warm

- Good fit current CWVs to Mon:Thu (non-hol) Agg.NDM demand in 05/06

- No significant seasonal bias in Mon:Thu (non-holiday) models in 05/06 (including summer)

  - But possible negative errors on days of max. CWV balanced out by positive errors on other days in summer

- Max CWV calculated from warm weather parameter values
  - chosen to give best fit on average over all years with Agg.NDM data
  - May not be optimum for EXTREME summers

- Agg.NDM demand lowest in the summer holiday period

- NDM weather corrected demand was well below SND in June to Sept 2006 in all LDZs – possibly caused by SND values and multiplicative holiday factors being too high as well as max. CWV being too low

- Summer 2006 was included in the derivation of the revised CWVs for the 3 LDZs and will be included in holiday factor calculations in next year's (smoothed 3 year) demand models

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# Gas Year 2005/06 Performance Evaluation Strand 2

Reconciliation Variance (RV) Analysis

NDM Sample Consumption Analysis

Document: Evaluation of Algorithm Performance 2005/06 Gas Year

Reconciliation Variance: Actual to Allocated Analysis

- Assess validity of NDM profiles comparing actual to allocated

- Use Reconciliation Meter Point data (actual) for band 'B' EUCs
  - Not Band 1 (no reconciliation)

- Identify variance between total allocated (from NDM models) and actual energy (Reconciliation) per EUC

- Rejection criteria applied to remove inappropriate or erroneous reconciliation data
  - Negative and zero consumptions, actual to allocated ratio

- Profile comparisons are then categorised as:
  - 'Peaky' - 'Flat' - 'Ok'

- Reconciliation profile should be similar to EUC profile

Assessment of Standard & Suppressed Reconciliation
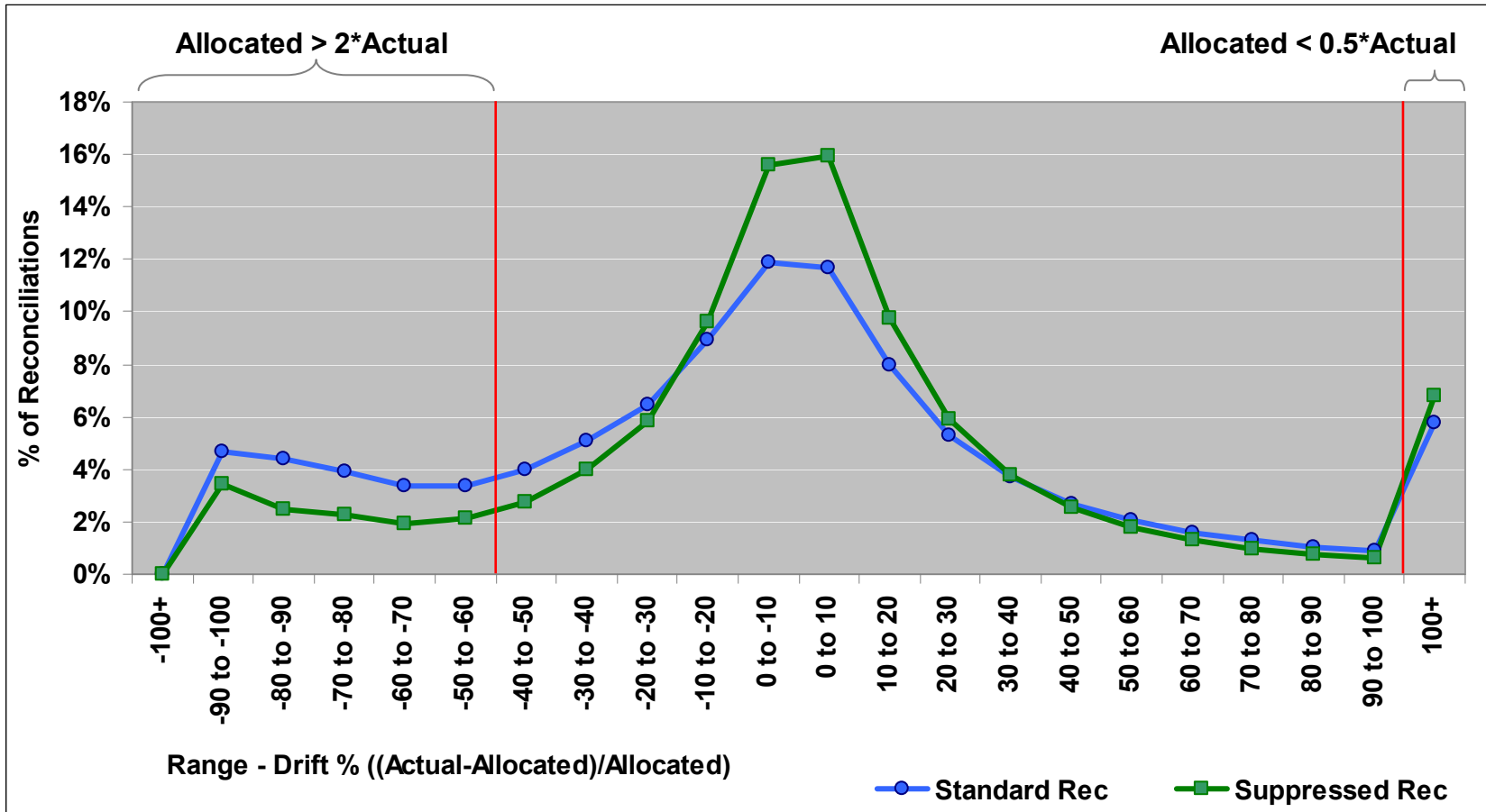
- Drift: Between Actual & Allocated energy (Drift) for Standard & Suppressed (issue) reconciliation's
- Removed erroneous reconciliation's

RV Rejection Reasons

Rejection Category	Day Where (%):	
	Minimum Rejection (Dec05: 19.2%)	Maximum Rejection (Sep05: 49.0%)
AQ <= 3 kWh pa	1.1%	1.0%
Actual < 0	1.9%	2.8%
Actual = 0	2.6%	7.9%
Actual > 0 Allocated >2*Actual	9.6%	23.9%
Actual >0 Allocated <0.5*Actual	4.1%	13.4%

- Main RV exclusions for the highest and lowest instance days (asset and AQ errors)
- Primary: Allocated to Actual ratios - Higher in the summer due to smaller consumptions resulting in percentage difference being more apparent
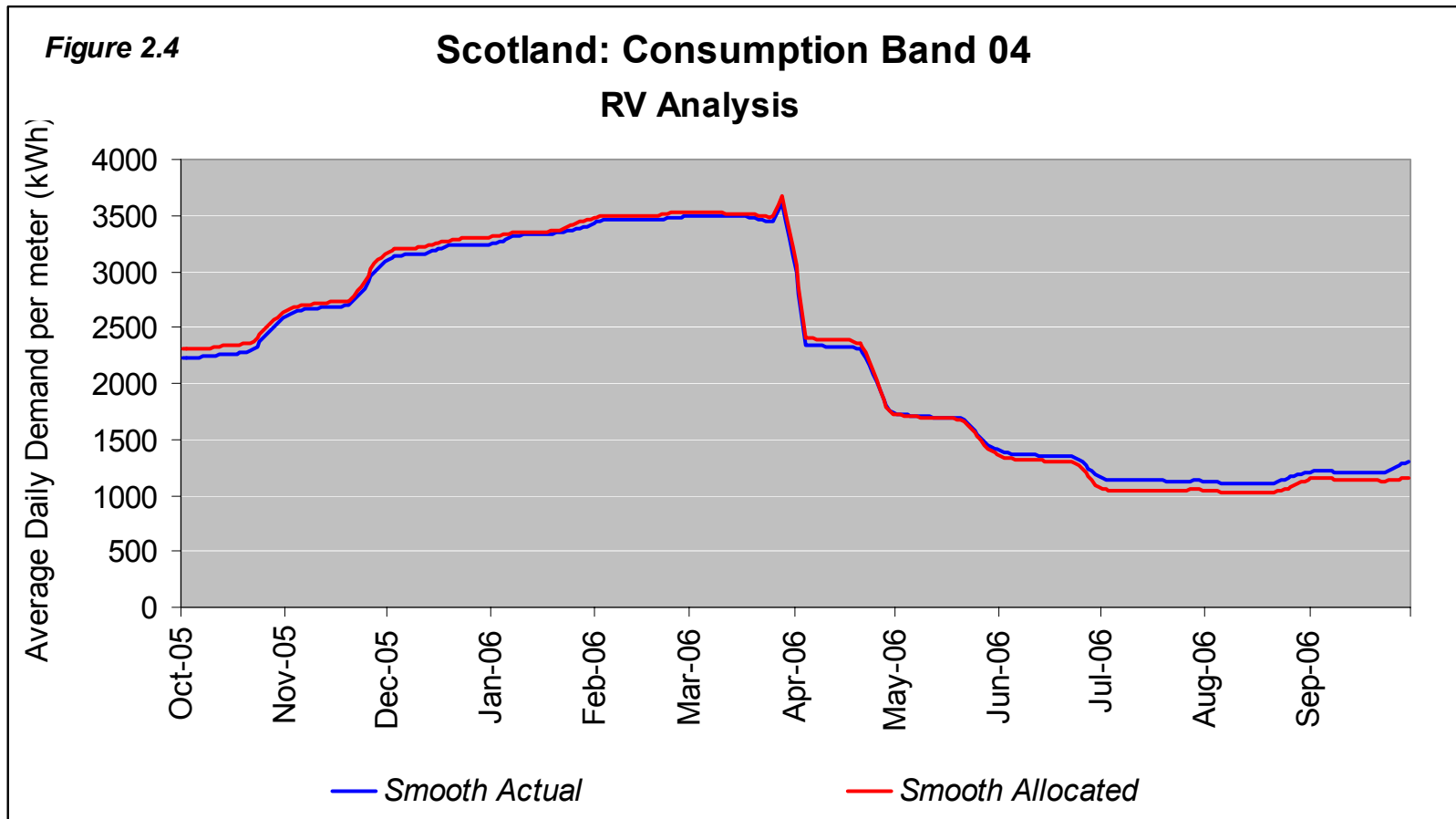
SC : Consumption Band 04
RV Analysis – Allocated to Actual

Figure 2.3

Scotland: Consumption Band 04
RV Analysis
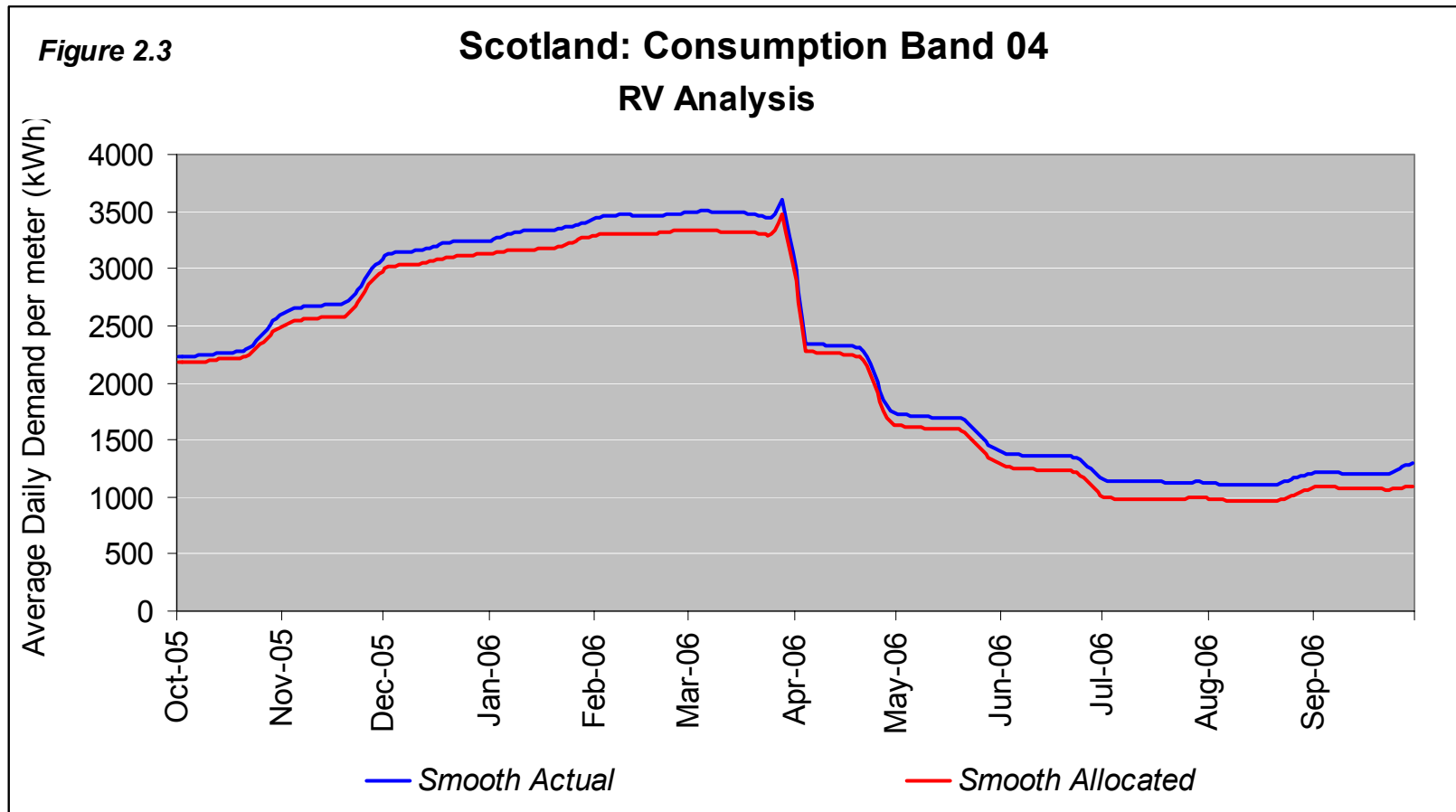
- Examples available for all EUC Bands (B) and a cross section of LDZs
- Issue of actual AQ to calculated AQ – requires normalising / scaling
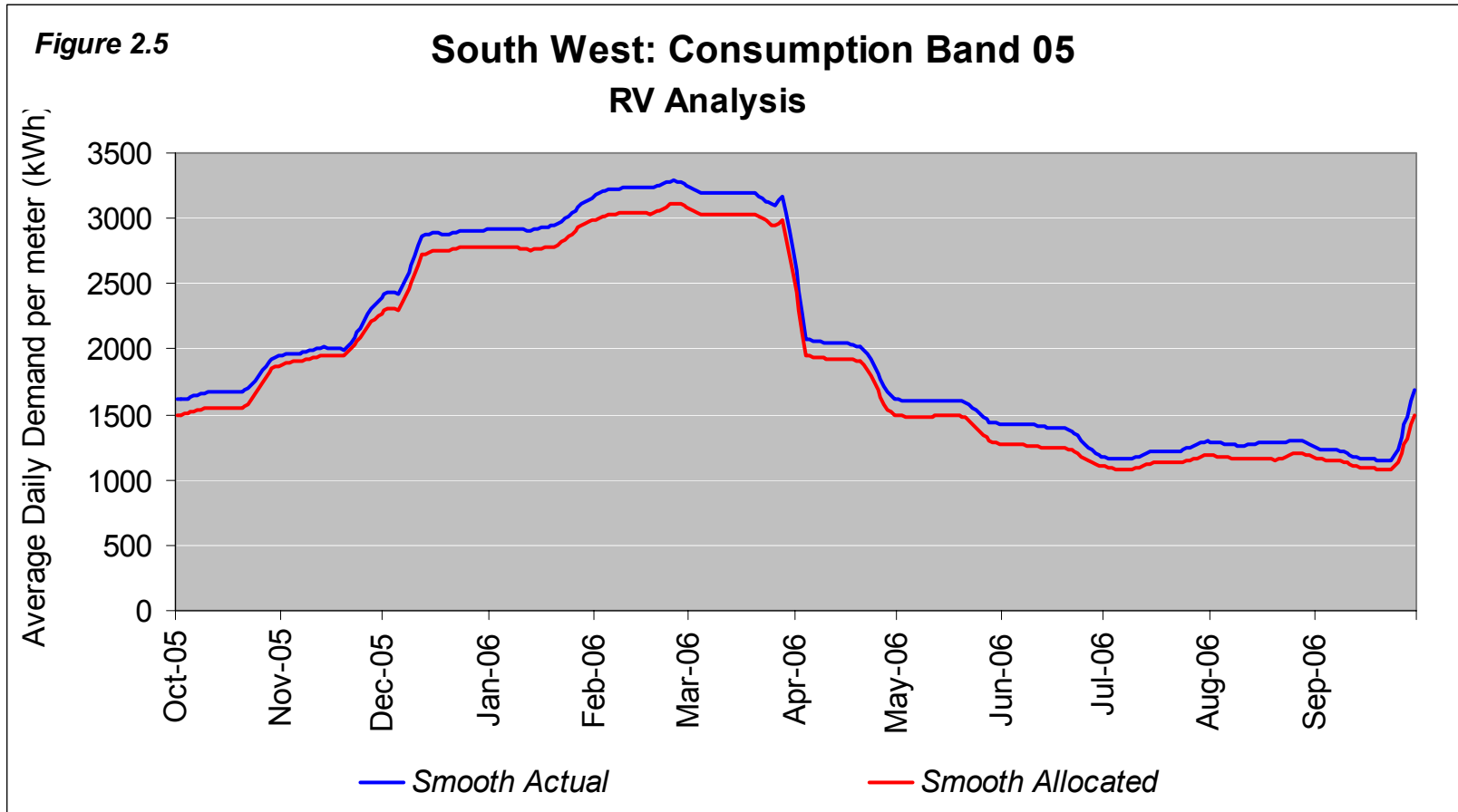
SC : Consumption Band 04
RV Analysis (After Scaling) – Allocated to Actual

Figure 2.4

Scotland: Consumption Band 04
RV Analysis

- Normalised ('scaled') to remove impact of AQ differences
- 5% tolerance drift: 'close' relationship – Trend: 'peaky' - Winter Over, Summer Under

SW : Consumption Band 05
RV Analysis – Allocated to Actual
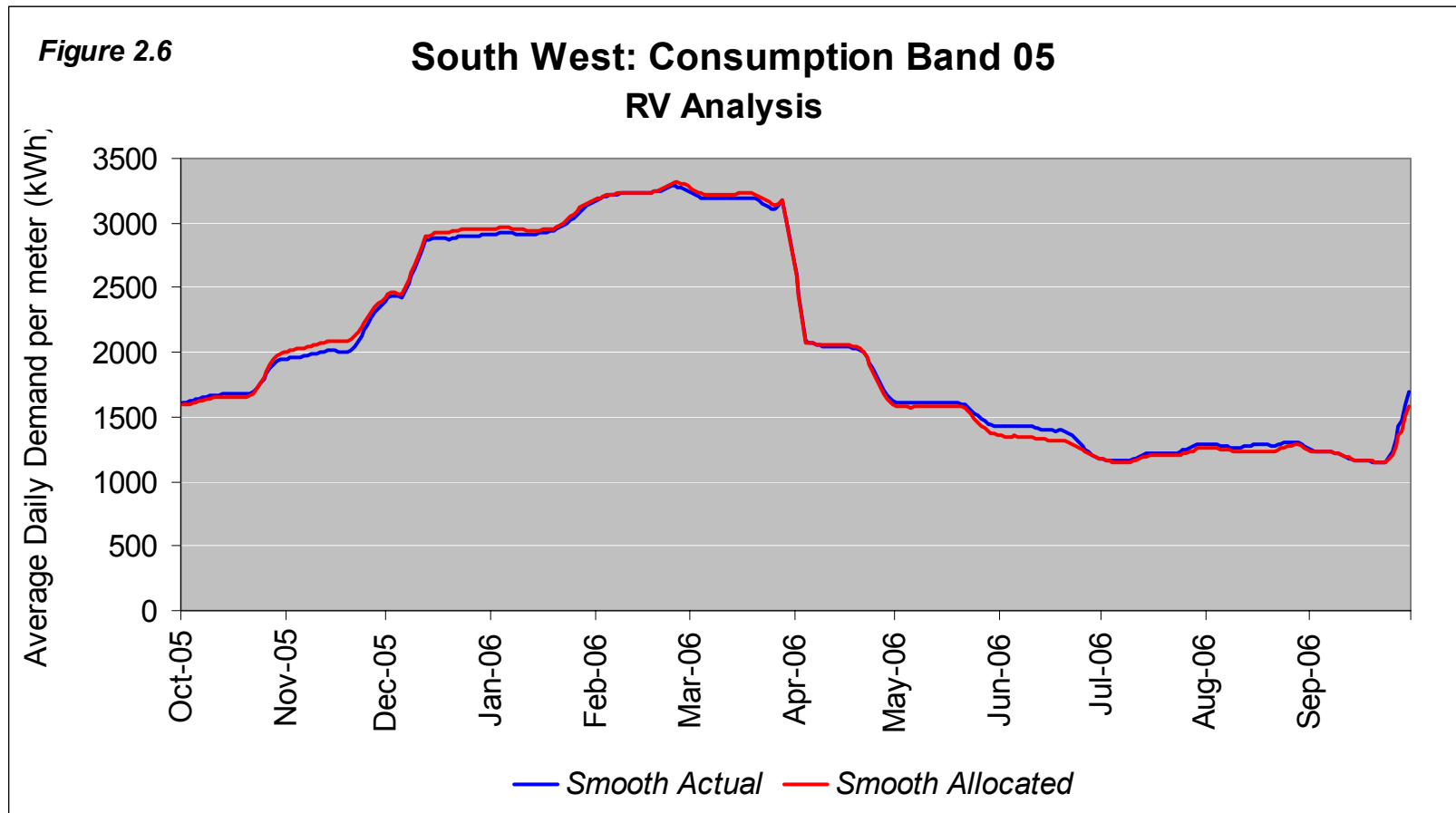

Figure 2.5

South West: Consumption Band 05
RV Analysis

Y-axis: Average Daily Demand per meter (kWh)

Legend: — Smooth Actual   — Smooth Allocated

- Issue of actual AQ to calculated AQ – requires normalising / scaling

SW : Consumption Band 05
RV Analysis (After Scaling) – Allocated to Actual

Figure 2.6

South West: Consumption Band 05
RV Analysis

- Acceptable within 5% level
- Trend again highlights 'peaky' Winter Over Allocation, Summer Under Allocation

RV Categorisation : Further Details
Gas Year 2005/06

- Table 2.2 / 2.3 in the document highlights the % error between allocated and actual for all LDZs and EUC

  - Drift may be higher (10%) in some instances but purpose is to identify profile trend and performance not demand differences

- Primarily, in smaller bandings, indicating the same trend and primarily within the 5% tolerance

  - Winter over Allocation
  - Summer under Allocation
  - Some 'flat' profiles in higher bandings

- This is then reflected in the 'peakiness' or 'flatness' of the profiles

RV Categorisation : LDZ / EUC Profile
Gas Year 2005/06

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
↓	Too Flat

10 % Level

⇑	Too Peaky
⇓	Too Flat

- 'Peaky' – Winter Over Summer Under stating : 'Flat' – Winter Under Summer Over
- Higher bandings in the 10% error level due to smaller sample numbers
- Smaller bandings in the 5% error level and primarily profile is good ('-') or too peaky
- No detail – 2 or less meters for analysis

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RV Analysis - Average Number of Meters
During the Full Period of Gas Year 2005/06

EUC	Band	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
02	B	15901	8188	22327	12360	16010	14930	1837	4960	13369	23788	21033	12873	10558
03	B	1086	703	1495	929	1499	1007	128	363	1321	2395	2268	1280	989
04	B	510	349	859	397	715	556	77	206	786	1386	1303	889	608
05	B	256	278	354	233	425	313	25	111	387	624	736	592	371
06	B	121	82	147	162	155	133	34	49	133	276	231	262	183
07	B	43	28	13	29	74	26	15	16	63	54	68	61	43
08	B		28	13	3	5	13			3	2	4	4	11
09	B	3	3							4			4	

5 % Level: ↑ Too Peaky — ↓ Too Flat

10 % Level: ⇑ Too Peaky — ⇓ Too Flat

- Average number of meters contributing to the analysis
- Good counts in smaller bands
- Smaller, more restrictive counts of reconciled meters in larger bands (>=06B)
- Pattern – peaky or flat in smaller counts

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EUC	Band	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
02	B	1.02	1.02	1.01	1.01	1.01	1.03	0.97	1.01	1.02	1.03	1.01	1.01	1.02
03	B	1.04	1.05	1.04	1.02	1.05	1.06	1.02	1.05	1.04	1.04	1.04	1.03	1.03
04	B	1.06	1.05	1.05	1.03	1.04	1.08	1.02	1.06	1.06	1.05	1.05	1.02	1.06
05	B	1.01	1.05	1.06	1.03	1.06	1.05	1.03	1.01	1.07	1.03	1.03	1.01	1.06
06	B	1.03	0.96	1.06	1.12	1.03	1.09	1.03	0.97	1.08	1.04	1.04	0.99	1.06
07	B	1.09	1.02	1.12	1.03	1.05	1.04	0.84	1.15	0.99	1.05	0.93	1.04	1.00
08	B		0.99	1.11	0.95	0.89	1.01			0.96	0.79	1.10	1.03	1.00
09	B	1.09	1.20							1.08			1.04	

- Scaling values used to normalise calculated AQ to actual consumptions
  - (Pink) Indicates uplift of allocated to actual consumptions: AQs too low 05/06
  - Not reflective of previous analysis (SF) & actual observations
  However RV Analysis:
  - Not reflective of population (excludes Band 01B)
  - Proportion of data discarded to allow profile analysis
  - All reconciliation data for gas year not yet available
- Therefore - Reflective for profile comparison rather than AQ trends

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RV Analysis & NDM Sample Analysis

- RV analysis highlighting a trend of:
  - Over Allocation – Winter
  - Under Allocation – Summer

- Analysis of actual NDM Sample consumption

  - Using the NDM Sample actual consumption for gas year 05/06

  - Compare the % error of actual consumption against:

    - Allocated actual using 05/06 ALPs & DAFs and used WCF and SF
    - Allocated using 05/06 EWCF and 05/06 ALPs & DAFs
    - Allocated using 06/07 EWCF and 06/07 ALPs & DAFs

  - This is completed by EUC for all LDZs and also by month by LDZ

  - Examples shown – detailed examples available in document including actual values

Allocated Error As % of Actual Demand
Weighted average across LDZs. 'As Used'
Actual WCF and SF – Actual ALPs and DAFs – NDM Sample Actual AQs <u>(not system AQs)</u>
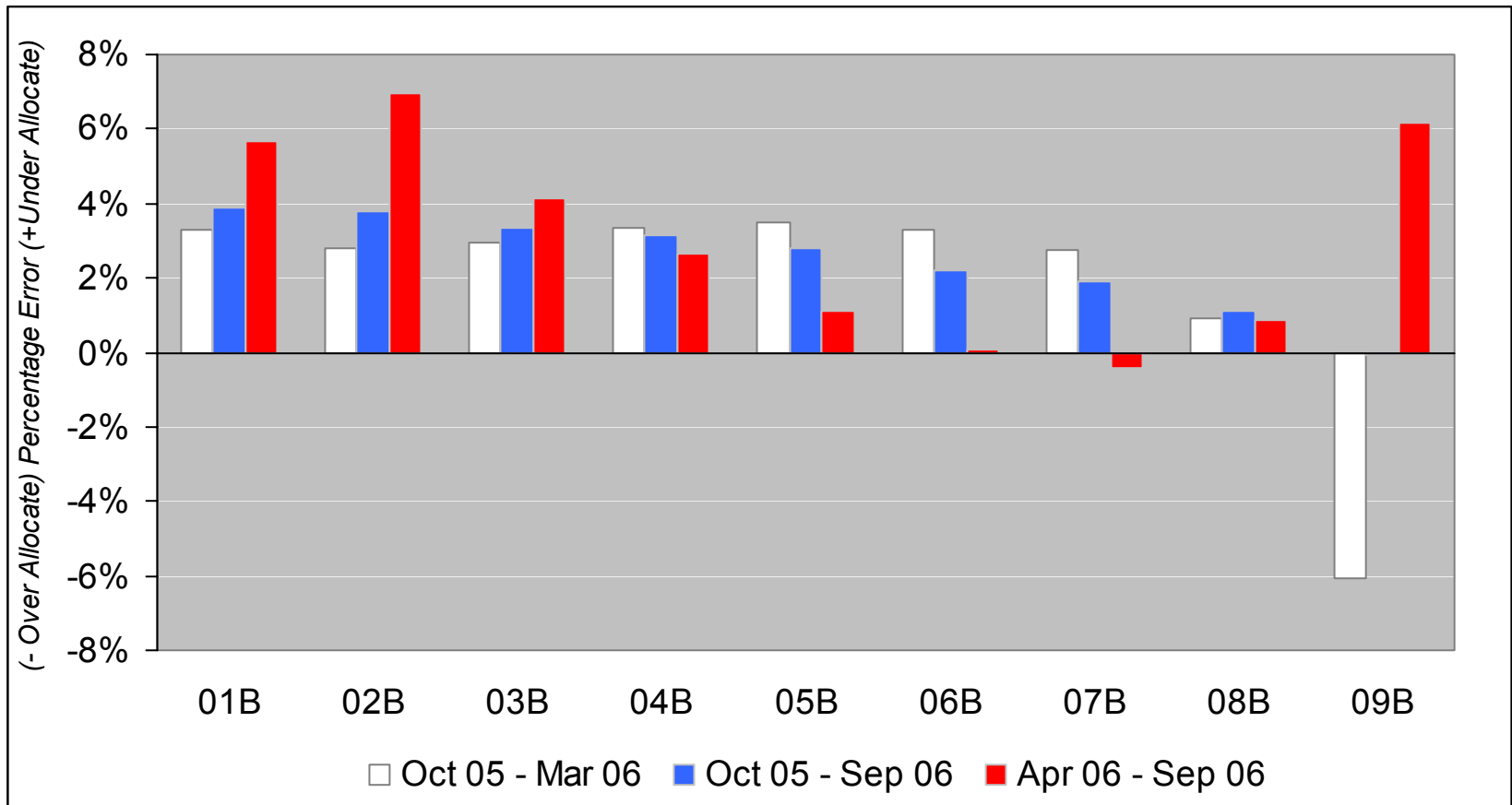

- Positive error - 'allocation' here uses real SFs and ACTUAL AQs resulting in an under allocation as used SFs will already have accounted for the reduction
- Profile error as result of too high AQs supported by WCF and SF analysis & reduction 06/07 AQs

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Allocated Error As % of Actual Demand
Weighted average across LDZs. 'Best Estimate 05'
EWCF and SF =1 – ALPs and DAFs 05/06 Algorithms - NDM Sample derived AQs (not system AQs)
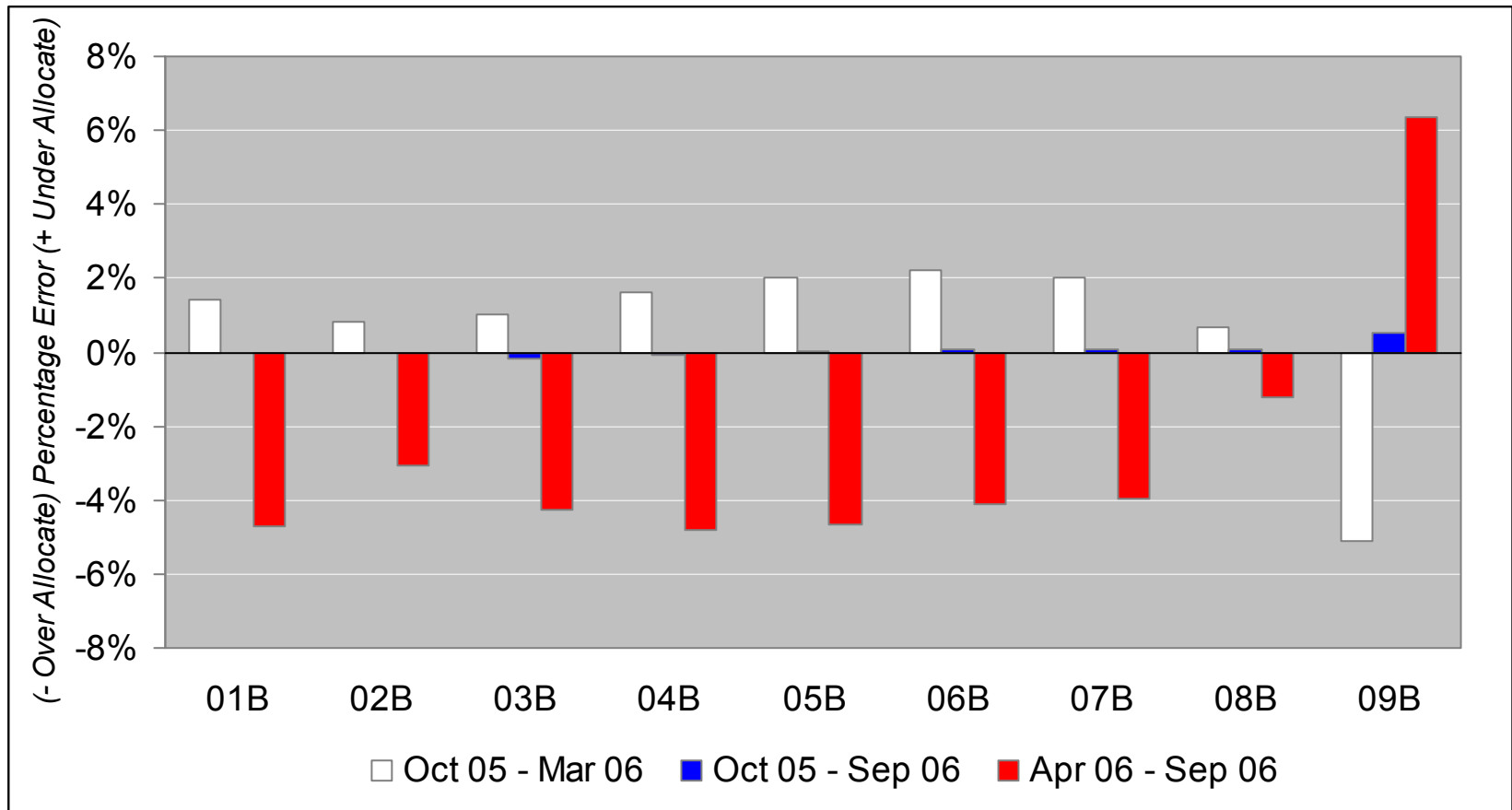

- Impact of SF removed and EWCF calculated from NDM model – avoids WCF bias caused by SND (which was too high) and removes AQ error allowing a better view of algorithm performance
- Little overall error in algorithms – under allocation in winter, over allocation in summer

Allocated Error As % of Actual Demand
Weighted average across LDZs. 'Best Estimate 06'
EWCF and SF =1 – ALPs and DAFs 06/07 Algorithms - NDM Sample derived AQs (not system AQs)
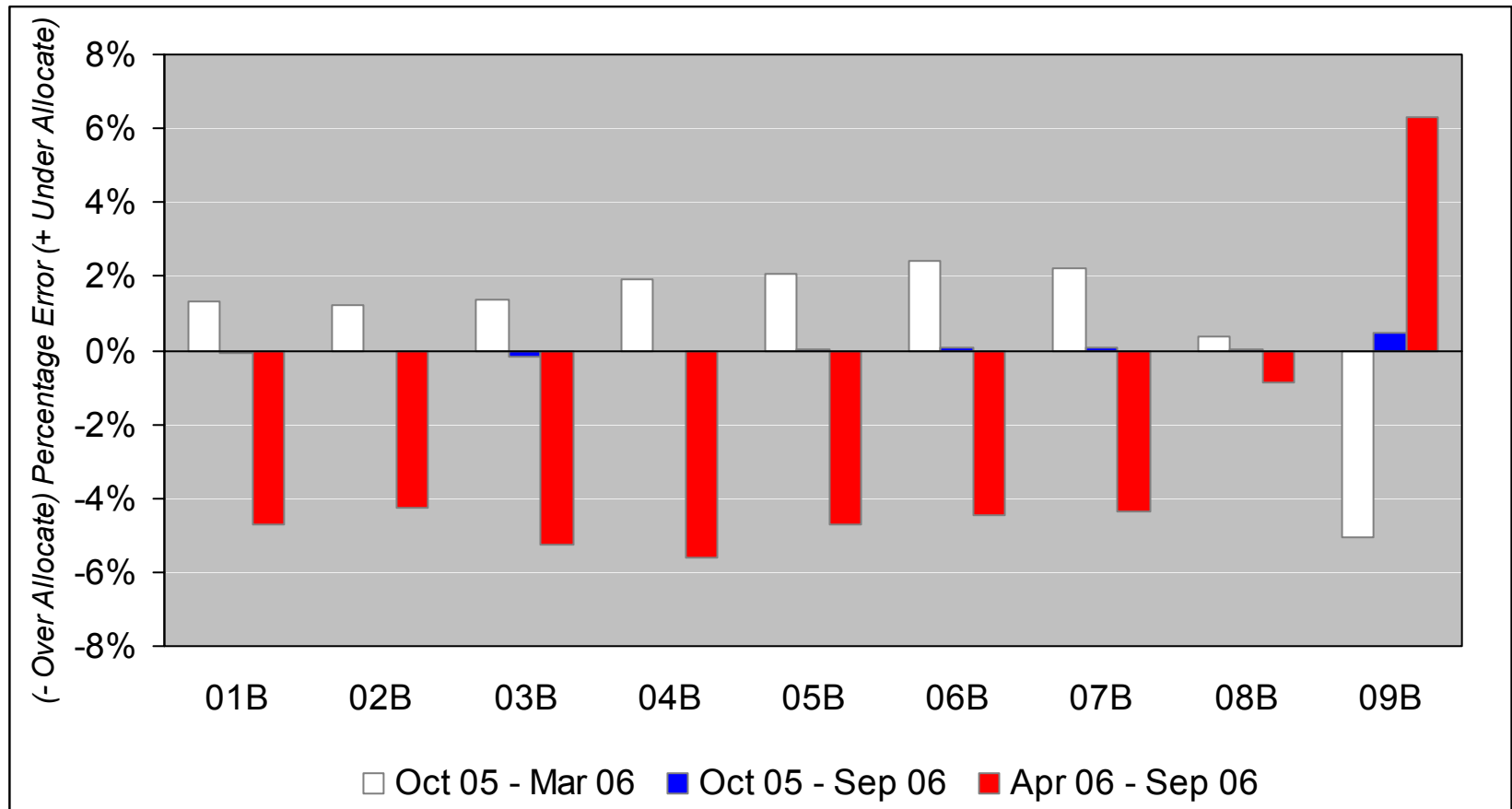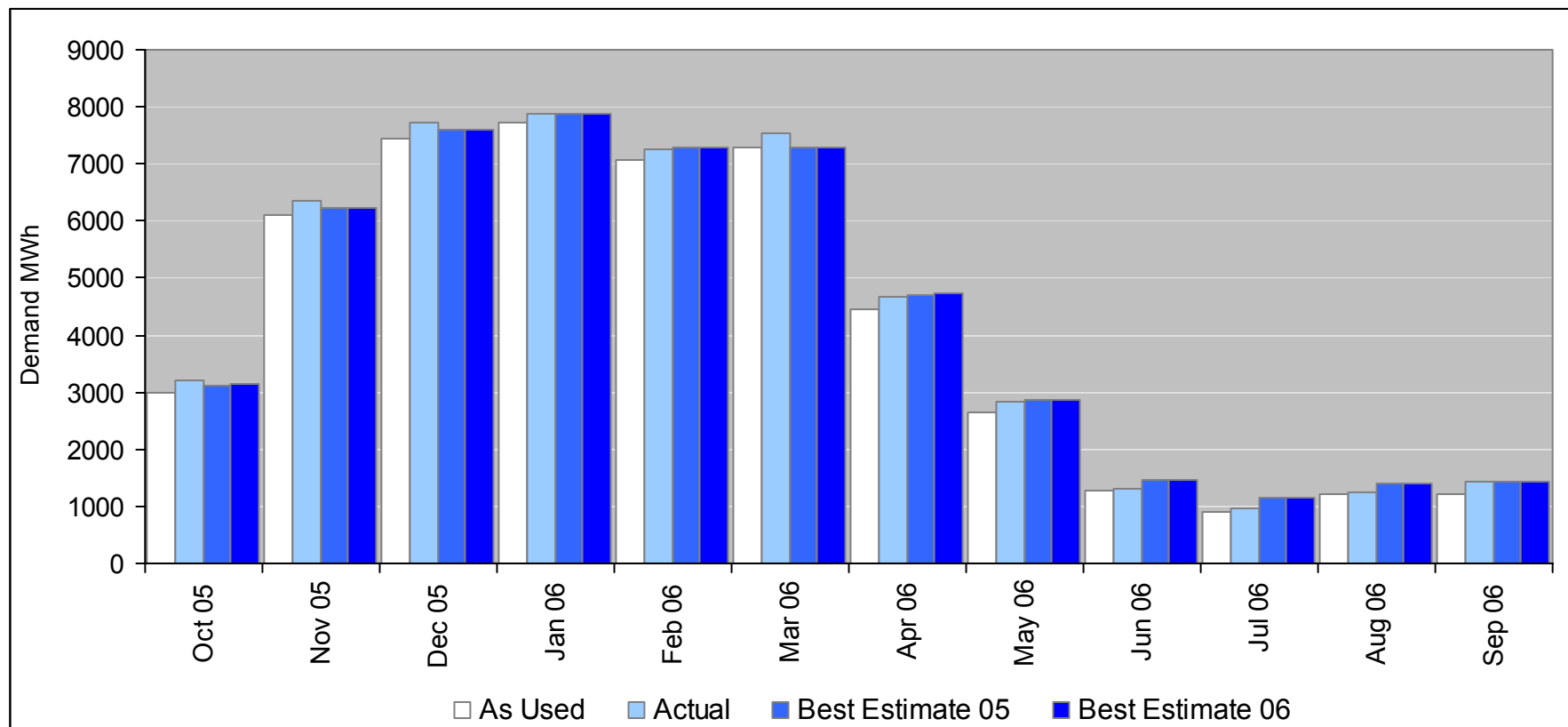

- Using the 06/07 parameters derived from this actual gas years sample consumptions
- Little overall error or difference in algorithms – winter under allocation, summer over allocation
- 05/06 onwards models perform better than 04/05: better underlying models (revision of CWVs)

Monthly Actual & Deemed Demand
01B (All LDZs)
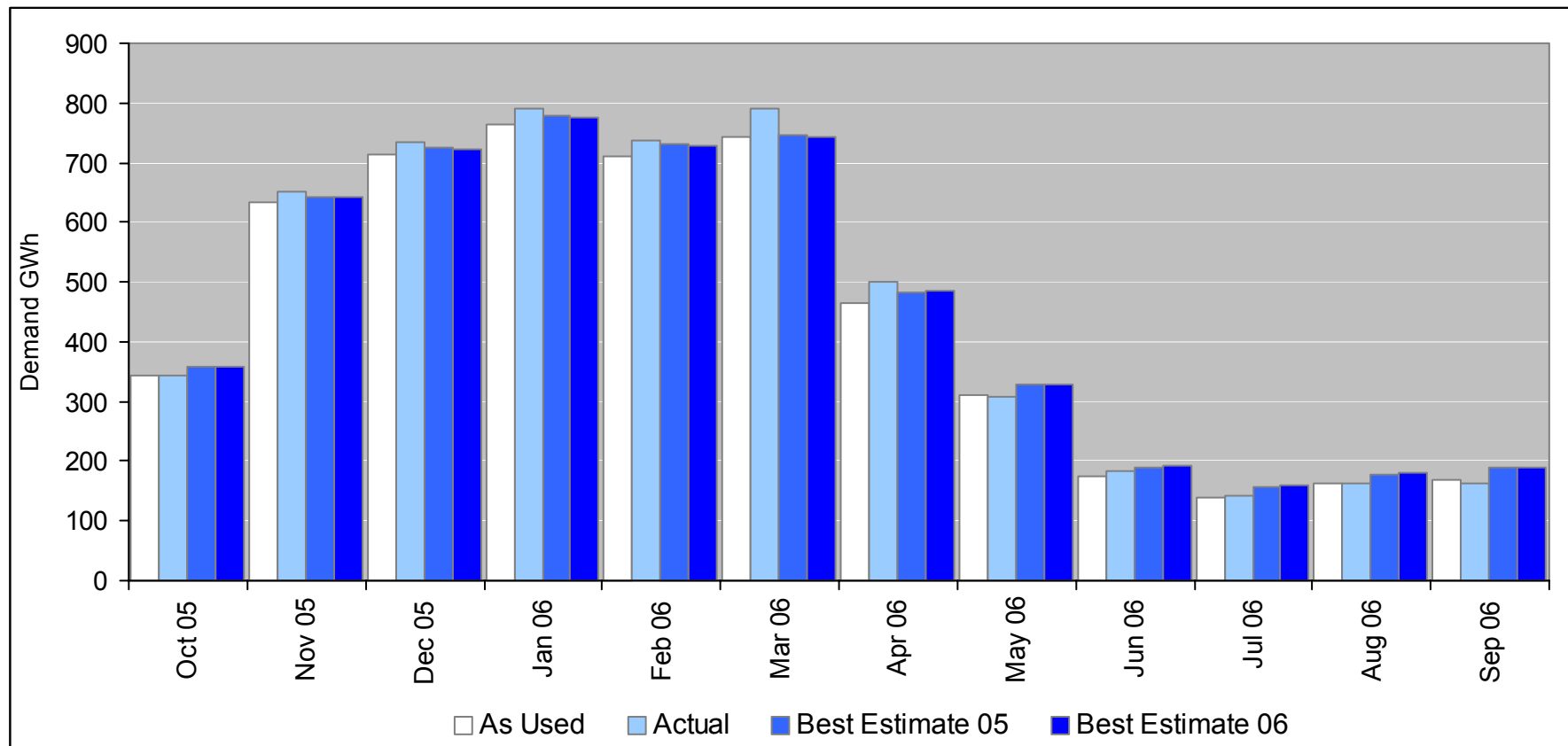### As previous but by EUC Band and By Month

- 3 examples of previous analysis but by EUC Band and Month: Trends
- General trend winter under, summer over allocation
- March: Marked under allocation – profile not react to unusual cold weather (unlike previous years)
- July: Some over allocation identified, but not comparably different to other summer months

Monthly Actual & Deemed Demand
04B (All LDZs)
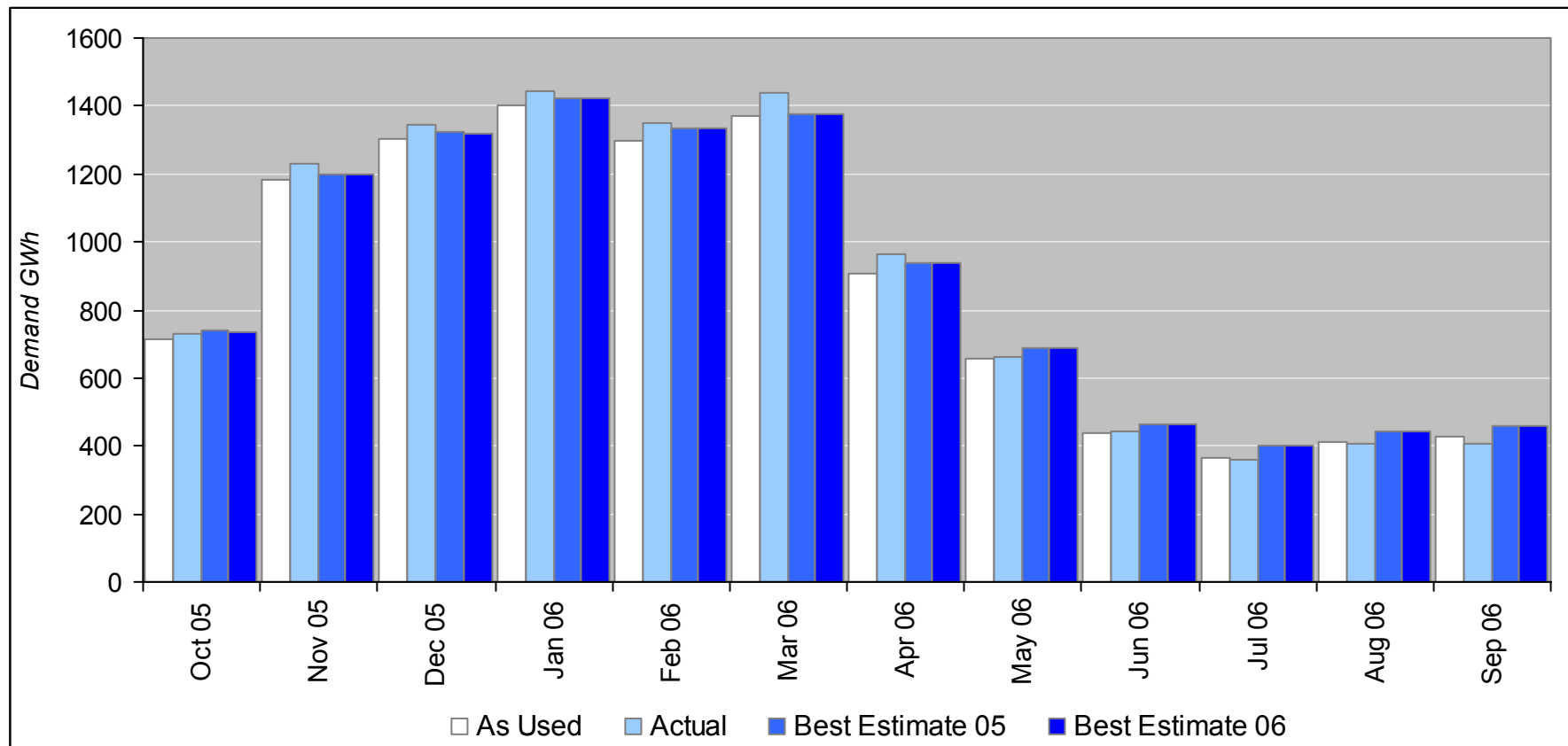### As previous but by EUC Band and By Month

- Band 04B – March06 under allocation more apparent (unusually cold)
- Same trend apparent – Winter under, Summer over allocation

Monthly Actual & Deemed Demand
05B (All LDZs)
As previous but by EUC Band and By Month

- Band 05B – March06 under allocation more apparent (unusually cold)
- Same trend apparent – Winter under, Summer over allocation

RV Analysis & NDM Sample Analysis
Conclusions

	NDM Sample Analysis	RV Analysis
WINTER	UNDER Allocation	OVER Allocation
SUMMER	OVER Allocation	UNDER Allocation

- Conflicting outcomes when assessing algorithm performance
- BUT: Usefull Analysis with Limitations - different, restricted data sets
  - Neither of are necessarily representative of the population as a WHOLE
  - RV analysis excludes band 01B & based on a sub-set of rec data
  - NDM sample analysis is based on validated NDM SAMPLE data
  - Both analyses suffer from small numbers of contributing meter/supply points at the higher consumption bands
- Both analysis provide answers on either side of 'ideal' algorithm
- Important - But both suggest only small inaccuracies (as did SF analysis)
- Possibility that actual algorithm performance is between the two
- Comparable, if not better than previous years (as was SF analysis)

Removal of X09 File Requirement

X09 / R09 File - Requirements

- Determine if X09 / R09 File is used by Shippers
- A <u>sample</u> of Reconciliation Variance data used to replicate the RV analysis
- Created and loaded to INV95 by xoserve – Output R09 File
- xoserve RV analysis now uses all RV data (not the sample) from a different source
- Therefore no longer require the file as has no other purpose

- Do Shippers require the file – no evidence to support Shippers ever using / requiring this file?
- Agreement from DESC to remove X09 requirement
- Progress through UK Link Committee

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Action: Formal Agreement of CWV Proposals

Formal Agreement: Revised CWV Definitions

- Presented at November DESC Meeting
- Revised CWV definitions for NT, EA and SE
- Result of weather station change from Heathrow to London Weather Centre
- Summary
  - To be used Spring07 NDM analysis and implemented 1st October 07
  - Produce a very good fit to aggregate NDM demand, almost as good as the current CWVs in all 3 LDZs.
  - NT and SE LDZs did not significantly alter the estimated 1 in 20 peak aggregate NDM demand.
  - Little seasonal bias & a good seasonal fit to demand in all 3 LDZs
- Seek formal agreement of revised CWV definitions implementation from DESC

Approach to Spring 2007 Modelling

Document: 'Spring 2007 NDM Analysis – Proposed Approach'

Spring 2007 Modelling Proposed Approach

- Discussion & agreement approach to Spring07 Modelling
- For proposals to be applied to gas year 2007/08
- Full details provided in
  - 'Spring 2007 NDM Analysis – Proposed Approach' document

- Very little change from 2005/2006 modelling approach
- General modelling approach same as 2006

  - Determining Summer Reductions and Cut-Offs
  - Weekend and holiday effects included as 2006
  - Appropriateness of EUC bandings investigated

New CWV Definitions & Model Smoothing

- New CWV Definitions - presented and agreed at Nov DESC
- Heathrow to London Weather Centre : EA, NT, SE
- Definitions will be applied in the 2007 analysis

- Model Smoothing - approach agreed at November DESC
  - No evidence of widespread or consistent trends – model smoothing agreed to be sound
  - Retain previous years approach
  - NDM models (averaged) for 3 years will be used for smoothing
  - Model re-runs for previous years will take place to account for new CWV definitions (consistency and future analysis)

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2007 Modelling – Clarifications & Additional Reporting

- Additional Reporting:
  - In addition to the parameters and previous provided data reports (ALP, DAF, CWV, SNET etc) xoserve will also provide information (i.e. values of factors and flags where these apply to each model) pertaining to: summer cut-off, summer reduction, non-holiday weekend effects, and holiday effects (replication)

- Fallback Position (Ofgem Disapproved):
  - Section H UNC: EUC definitions & derived factors will be applied to gas year 07/08 based on EUC demand models from the spring 06 NDM analysis AND the forecast aggregate NDM demand model for 07/08 made in spring 2006 (not made in spring 07).

- Publication: xoserve extranet (UK Link Documentation)
- Very little change from 2006 Approach – DESC Agreement?

2007 / 2008 Work Plan

- June 2007 (4th)
  - Technical Forum - Consultation on proposed revision of EUC definitions and demand models

- July 2007 *(if required)*
  - Response to representations on EUC definitions and demand models and finalisation of proposed revisions

- November 2007 (8th PM)
  - Re-evaluation of model smoothing
  - Re-evaluation of NDM Sampling and sizes
  - Re-evaluation of EUC definitions and demand model performance Strand 1 – Scaling Factor and WCF analysis

- January 2008 (15th)
  - Re-evaluation of EUC definitions and demand model performance Strand 2 – RV and NDM sample strands
  - Approach for Spring analysis