



Demand Estimation Technical Forum

5th June 2009

Agenda

- Overview of Demand Estimation & Timetable
- Presentation of Current Completed Analysis
 - Modelling Basis
 - Small NDM – sample details, aggregations, initial models
 - Large NDM – sample details, aggregations, initial models
- Recommendations

Demand Estimation

- Provides a method to differentiate NDM loads and provide profiles of usage
 - Sample Demand : Weather – EUC Definitions
- Provide a reasonable equitable means of apportioning aggregate NDM demand (EUC / Shipper / LDZ) to allow daily balancing regime to work
 - NDM profiles (ALPs & DAFs)
- To provide a means of determining NDM Supply Point capacity
 - NDM EUC Load Factors
- Profiles do not independently forecast NDM EUC demand
- LDZ demand forecasts derived from separate short term demand forecasting processes
- Demand models derived for Demand Estimation:
 - Not suitable for short term demand forecasting – this is not their intended purpose
 - Purpose - deriving profiles and Load Factors

Consultation Process: NDM Demand Models & EUCs (UNC)

- 5 June Technical Forum / DESC meeting (To guide analysis) (H 1.8.1)
- 30 June NDM draft proposals published by now (H 1.8.1)
- 15 July Users make representation by now (H 1.8.3)
Consultation (DESC Meeting 24th July) (H 1.8.4 / 5 / 6)
- 15 Aug Final proposals published by now (H 1.9.1)

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- Transporters' Final proposals published (*date X*)
 - No later than 15 August
 - Transporter or User application for disapproval to Ofgem (*date Y*)
 - by 5 business days of date x
 - Ofgem determination (if required)
 - by 5 business days of *date Y*

Spring 2009 – Ongoing Analysis

- UNC obligation to consult and seek agreement with DESC in June on the current state of analysis
 - Data collected, consider most appropriate data sets via validation and appropriate aggregations to apply to the most recently available sample data - 2008/09
 - Small NDM (up to 2,196 MWh pa)
 - Large NDM (> 2,196 MWh pa)
- } Validation & Analysis
} Considered Separately

Modelling Basis 1

(Previously agreed in consultation with DESC)

- Key aspects of EUC demand modelling basis for Spring 2009 analysis:
 - Model smoothing (over 3 years) retained
 - Standardise models – take average of slopes
 - More robust: minimises year on year volatility (Load Factors, profiles shapes)
 - Variable weekend weather sensitivity model
 - Warm-weather cut-offs not applied to EUC models < 293 MWh pa
 - To help mitigate the identified impact of summer Scaling Factor volatility
 - 13 month analysis for datalogger data sets (2008/09)
 - Data sets cover March to March to ensure they contain Easter period (2007/08 covered April to March)
 - 12 month analysis for datarecorder data sets (2008/09)
 - Data sets always cover mid-March to mid March
- No new CWV definitions since the Spring 2008 analysis

Modelling Basis 2

(Previously agreed in consultation with DESC)

- Aggregate NDM demand models:
 - Historical aggregate NDM demand models based on data from 3 previous gas years will be used to compute DAFs
 - Previous practice has used results from a forecast model for the target gas year
 - UNC does not explicitly state the aggregate NDM demand value should be based on a forecast or historical model
 - Accordingly, for NDM proposals 2009/10 the aggregate NDM models used are models obtained from the average of 3 previous gas years aggregate NDM data modelled against weather (2005/06, 2006/07, 2007/08)
 - The historical model has been applied to the appropriate day of the week and holiday pattern of the target gas year 2009/10 - no forecast element added to the model

Modelling Basis 3

Principles of Holiday Factors, Summer Reductions, CWV Cut-Offs

- All demand modelling is data driven – intention to model based on the sampled data

- If the modelling results indicate then:
 - Holiday & Weekend Factors, Summer Reductions & CWV Cut-Offs will be applied
 - As defined in the methodology agreed with DESC

- 3 year Model smoothing removes the impact of any extreme instances during a single year

- DESC confirmed in November 2007 to continue to apply model smoothing
 - Next assessment of model smoothing due in Autumn 2009

Modelling Basis 4

Principles of Holiday Factors, Summer Reductions, CWV Cut-Offs

- Summer reductions can apply to EUC models over the period 23rd May to 26th September (top 2° of warm weather)
 - Applied by modelling results over 3 years
- Applies along with the more general summer holiday period in July and August
- Warm Weather Cut-offs are not applied to EUCs <293 MWh pa.
 - Cut-offs increase summer Scaling Factor volatility
 - Therefore no cut-off is placed on warm weather demand reduction in EUC models representing nearly 80% of NDM load
 - Any cut-offs are based on modelling results from 3 years
- Modelling methodology described in NDM Report (Appendices 3 & 4)

Comparing Data and Model Accuracy / Appropriateness

- The Technical Forum offers a comparison of data and profiles for analysis
- Analysis:
 - Create profiles of the relationship of demand to weather
 - Identify the best fit profile based on available data samples
 - Identifies and addresses any significant instances of change year-on-year
- Tools used to identify best model ('goodness of fit' of profile):
 - Root Mean Squared Error and R^2 – statistical tool for identifying 'goodness of fit' (100% perfect fit / direct relationship)
 - Variations in Indicative Load Factors.....

Indicative Load Factors (ILF) & Load Factors (LF)

- ILF used to compare variations in models
 - $LF = \text{average daily demand (i.e. } AQ/365) / 1 \text{ in } 20 \text{ peak demand}$
 - $ILF = (AQ/365) / \text{model demand corresponding to } 1 \text{ in } 20 \text{ CWV}$
- 1 in 20 peak Demand is derived from the completed models
 - 1 in 20 not available at this stage
- ILF based on available 1 in 20 CWV against demand to create replicated LF
- ILFs only used to compare prospective demand models as an aid to making decisions on model choice
- ILFs are not the same as proper LFs and their values are not an indicator of the values of proper LFs (ILFs not used for determining NDM capacities).
- There should be distinguishable ILF (LF) values between consumption and WAR bandings

Winter to Annual Ratio (WAR)

- The WAR value of a supply point is defined as the actual consumption in the months December to March divided by the supply point AQ.
- Since the numerator is an actual and the denominator a weather corrected annual consumption, WAR values change from year to year.
- For consumption ranges over which meter points are monthly read, EUCs may be defined on the basis of WAR values as well as consumption band and LDZ.
- In a warmer winter WAR values tend to take on lower values than in a colder winter (2008/09 was average and colder than 2007/08)
- This year the limits defining WAR band EUCs are therefore a little higher than those of last year.
- This is essential because supply points will be assigned these newly defined WAR band EUCs (for 2009/10) based on their (Dec-Mar) consumption behaviour over winter 2008/09.

Small NDM Analysis <2,196,000 kWh

Small NDM Analysis (<2,196 MWh pa)

- Defined Demand Estimation purposes <2,196,000 kWh
- Represents nearly 90% of total NDM load (73% <73,200) and 99.9% of all Supply Points
- EUC consumption ranges not prescribed in Uniform Network Code
 - Process to analyse most appropriate small NDM EUC bands
 - Split consumption range – test profiles (regression analysis, ‘goodness of fit’)
- Purpose:
 - Sample data available / Proposed data sets
 - Results so far / Proposed EUCs / Proposed aggregations
 - Issues raised

Available Sample Data: Small NDM DATA RECORDERS

Active Data Recorders at 17/03/08	4,371
Previous 12 Months:	
<ul style="list-style-type: none"> Net change in sample (commissions / closures) 	-64
Active Data Recorders at 16/03/09	4,307
Data Recorders with data successfully gathered	4,203
Total No. of Validated Data Recorders	<u>3,752</u>
Total No. of Validated Supply Points (3,633 Spring 2008)	<u>3,752</u>
<i>(2,956 classified Domestic & in 0-73.2 MWh pa range. 638 in the 73.2-293 MWh pa range)</i>	

- 451 data recorders failed validation - missing days / consecutive zeros / spikes

Sample Data Available: Small NDM DATALOGGERS

- Data Recorders & Dataloggers used in Small NDM Analysis (<2,196 MWh pa)
- Small NDM Datalogger Counts:

Total Number of Small NDM Validated Dataloggers	6,664
Total Number of Validated Supply Points:	5,562 (5,120)
73.2 to 293 MWh pa Range <i>(Combined with Datarecorders: 1,259)</i>	621 (542)
293 to 2,196 MWh pa Range	4,941 (4,578)

- *2008 highlighted in (x)*

Small NDM: Proposed Data Sets For Analysis

Consumption Range	Sample Data Used	Supply Point Count
0 to 73.2 MWh pa (EUC Band 1)	12 Months Data Recorder Data	2,956 Supply Points <i>(Domestic sub-set)</i> OR 3,003 Supply Points <i>(Incl. Some non-domestic)</i>
73.2 to 293 MWh pa (EUC Band 2)	12 Months Combined Data Recorder & Datalogger Data	1,259 Supply Points
293 to 2,196 MWh pa (EUC Band 3 & 4)	13 Months Datalogger Data	4,941 Supply Points

- Small NDM Analysis undertaken at individual LDZ level
- Band 1 increased (79) Bands 2 to 4 increased (467)
- Sufficient sample data to allow analysis – has not impacted modelling

Small NDM EUC Bands: Investigation of Appropriateness

- Current EUC Bands Small NDM (not defined in UNC):
 - 0 – 73.2 MWh pa
 - 73.2 – 293 MWh pa
 - 293 – 732 MWh pa
 - 732 – 2,196 MWh pa
- Appropriateness of Small NDM EUC bandings investigated
 - Analysis in 2008 - no significant reason for changing the EUC bandings from 'current'
 - 2009 Investigates:
 - 0 to 73.2 MWh pa as single band domestic only / inclusion of non domestics
 - Split Band 2 at 145 MWh pa
 - Split Band 4 at 1,465 MWh pa

Representing 0 - 73.2 MWh pa

Previous analysis

- Spring 2007 NDM analysis, 0-73.2 MWh pa consumption range:
 - Sample sub-divided by LDZ rather than by consumption sub-band (4 bands: 0-10,10-20,20-30,30-73.2 MWh pa)
- Autumn 2007 analysis
 - Investigated splitting 0-73.2 consumption band at 20 MWh pa and 30 MWh pa
 - i.e. 0-20 and 20-73.2 and 0-30 and 30-73.2
- Autumn 2008 analysis
 - Investigated splits of the 0-293 MWh pa range at 30 and 60 MWh pa
 - i.e 0-30 and 30-293 and 0-60 and 60-293
- January 2009 analysis
 - Applying band 01 profiles to domestics in band 02 and applying band 02 profiles to non domestics in band 01
- In all cases there were no compelling statistical grounds to change current arrangements for 0-73.2 band - All results available on Joint Office website
- Spring 2009 analysis does investigate inclusion of non-domestics in 0-73.2 modelling.....

0-73.2 MWh pa: Data Set Identification & Impacts

Domestic & Non-Domestic Inclusion

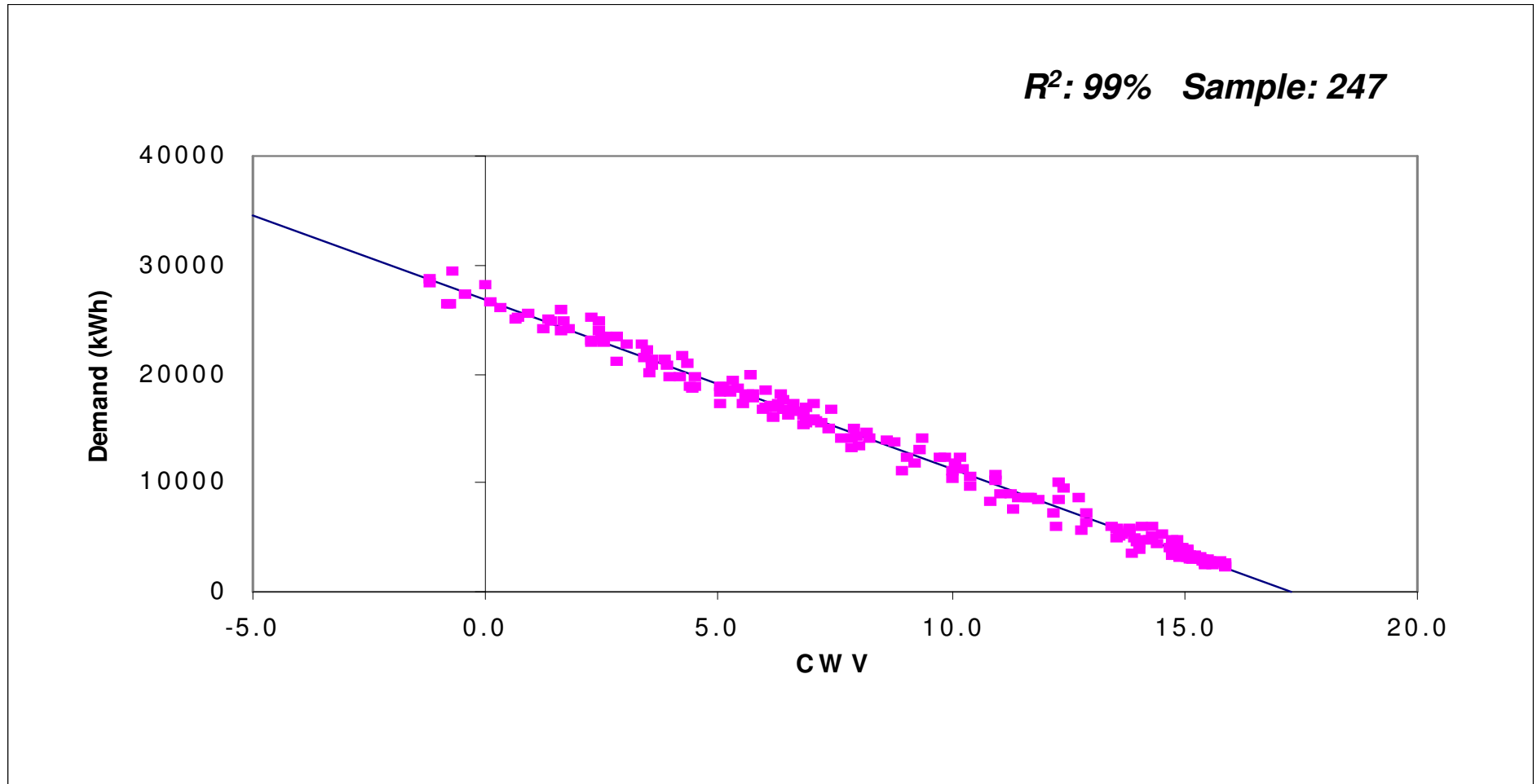
	PROPOSED - Dataset: Domestic Sites Only			Dataset: Including Some Non-Domestic Sites		
SC	41%	98%	249	41%	98%	253
NO	35%	98%	235	35%	98%	239
NW / WN	38%	98%	233	38%	98%	236
NE	37%	98%	258	38%	98%	262
EM	37%	98%	239	37%	98%	243
WM	33%	99%	247	33%	99%	251
WS	35%	98%	257	36%	98%	261
EA	35%	99%	251	35%	99%	255
NT	34%	99%	230	34%	99%	234
SE	33%	98%	245	33%	98%	249
SO	30%	99%	257	30%	99%	261
SW	32%	99%	255	32%	99%	259

- Indicative Load Factor : R^2 Multiple Correlation Coefficient : Sample Size

0-73.2 MWh pa: Smoothed Model Results

	Smoothed Model based on Domestic Only data sets				Smoothed Model based on Domestic Only data sets including some non domestic			
	(Const.)	(Fri)	(Sat)	(Sun)	(Const.)	(Fri)	(Sat)	(Sun)
SC	28090	183	482	452	29748	180	346	245
NO	24609	380	521	550	25814	521	315	224
NW / WN	26555	233	472	395	27299	204	230	39
NE	28970	270	484	473	30163	615	392	199
EM	25452	230	385	424	26686	201	141	130
WM	26795	195	386	559	28148	193	402	489
WS	33056	129	322	482	33973	132	381	569
EA	31383	104	283	388	33055	109	238	322
NT	30273	38	181	244	31564	29	49	-24
SE	30948	59	273	415	32595	15	245	354
SO	33436	86	255	375	35105	27	96	170
SW	29896	110	262	404	31370	164	260	442

Demand against CWV, Monday to Thursday, holidays included, WM LDZ, 0 - 73.2 MWh pa



- Example of 'well behaved' data and excellent fit for Band 1

Representing 0 - 73.2 MWh pa (Band 1): Proposed Approach

- Non-domestic data will have adverse effects on Weekend SF values and therefore reduced model accuracy in allocating demand
- Scaling Factors are multipliers used to correct forecast weather and demand to actual
- Estimated effect:
 - Fri: up to 0.1 % pts.
 - Sat. up to 0.7 % pts.
 - Sun. up to 1.0 %pts.

10 / 12 / 11 LDZs worse in respect of Fri / Sat / Sun
- Therefore proposed approach is: *(same as spring 2008 & previous years)*
 - Domestic Supply Point only smoothed model for 0 – 73.2 MWh band
 - Consistently positive Fri/Sat/Sun weekend factors in smoothed model but have a statistically insignificant impact (would be more apparent with inclusion of non-domestic)
 - Consistent with previous years analysis and approach

Small NDM 73.2 to 293 MWh pa (Band 2) Split At 145 MWh pa Consumption Band Analysis: ILF Comparison

- Analysis undertaken on Band 2 split at 145 MWh pa
- Impact - Aggregated LDZs required to allow sufficient sample analysis

		Consumption Band								
		73.2 TO 293 MWh pa (NO SPLIT)			73.2 TO 145 MWh pa (SPLIT at 145)			145 TO 293 MWh pa (SPLIT at 145)		
Data Aggregation	SC	41%	98%	70	45%	97%	42	39%	97%	28
	NO / NW / WN	33%	95%	237	34%	96%	101	32%	95%	136
	NE / EM/ WM	32%	96%	307	32%	97%	155	31%	95%	152
	EA / NT / SE	33%	97%	365	34%	97%	167	33%	97%	198
	WS / SO / SW	30%	97%	280	32%	98%	150	29%	96%	130

- Indicative Load Factor : R^2 Multiple Correlation Coefficient : Sample Size

Small NDM 73.2 to 293 MWh pa (Band 2) Split At 145 MWh pa Consumption Band Analysis: Historical ILF Comparison

	2008/09		2007/08		2006/07	
	73.2 to 145 MWh pa	145 to 293 MWh pa	73.2 to 145 MWh pa	145 to 293 MWh pa	73.2 to 145 MWh pa	145 to 293 MWh pa
SC	45%	39%	41%	41%	40%	38%
NO / NW / WN	34%	32%	33%	32%	34%	30%
NE / EM / WM	32%	31%	30%	30%	28%	29%
EA / NT / SE	34%	33%	32%	32%	32%	29%
WS / SO / SW	32%	29%	31%	31%	31%	30%

- Differences in ILF values across the sub-bands are inconsistent across LDZ groups both within and between years
- Therefore: EUC Split at 145 MWh pa (Band 2) is not proposed, further supported by ...

Small NDM 73.2 to 293 MWh pa (Band 2) Split At 145 MWh pa Consumption Band Analysis: Statistical RMSE Comparison

	Population AQ Weighted "Root Mean Squared Error" Values Models Based on 2008/09 Data Set			
	NO SPLIT 73.2 to 293	SPLIT 73.2 to 145 145 to 293	Improvement (+) or Degradation (-) Using Two Bands	
			CURRENT: 2008/09	2007/08
SC	438974.1	480832.3	-9.5%	-16.1%
NO / NW / WN	1283497.4	1328822.3	-3.5%	-8.3%
NE / EM / WM	1837243.8	1934498.2	-5.3%	-5.9%
EA / NT / SE	1686615.1	1760822.3	-4.4%	-3.7%
WS / SO / SW	1053927.2	1085408.0	-3.0%	-8.0%
OVERALL	567541.3	591960.2	-4.3%	-6.9%

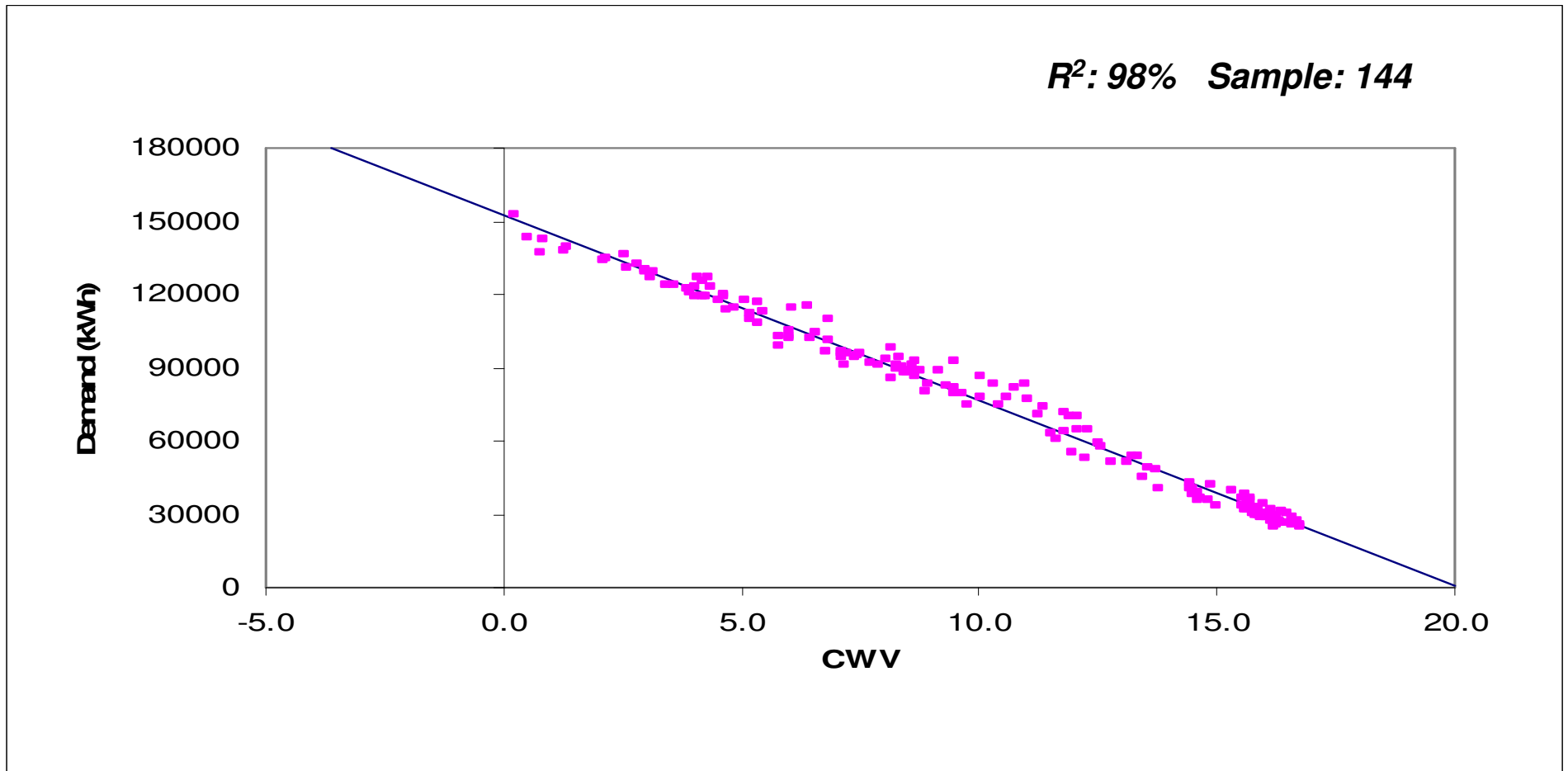
- No split further supported by no overall improvement in RMSE analysis of model accuracy ('goodness of fit')
- RMSE analysis shows a degradation in model/profile accuracy when splitting EUC Band 2

PROPOSED APPROACH: Small NDM Indicative Load Factors

EUC Band 2: 73.2 to 293 MWh pa (No Split)

	Indicative Load Factor	R ² Multiple Correlation Coefficient	Sample Size
SC	41%	98%	70
NO	30%	95%	106
NW / WN	33%	95%	131
NE	30%	94%	97
EM	34%	97%	105
WM	31%	96%	105
WS	29%	96%	69
EA	31%	96%	110
NT	35%	98%	144
SE	33%	97%	111
SO	32%	98%	103
SW	29%	96%	108

Demand against CWV, Monday to Thursday, holidays excluded, NT LDZ, 73.2 – 293 MWh pa



- Band 2 example – good sample size and very good fit

Small NDM 293 to 2,196 MWh pa (Band 3&4) Split At 1465 MWh pa Consumption Band Analysis: ILF Comparison

- No Split Band 3 (293 to 732 MWh pa) – Band 4 analysis undertaken split at 1465 MWh pa

	293 TO 732MWh pa			732 TO 1,465 MWh pa			1,465 TO 2,196 MWh pa			732 TO 2,196 MWh pa		
SC	42%	97%	118	41%	97%	171	41%	98%	147	41%	98%	318
NO	33%	96%	95	31%	96%	127	33%	96%	101	32%	96%	228
NW / WN	32%	94%	156	35%	95%	224	40%	96%	181	38%	96%	405
NE	33%	92%	85	35%	95%	154	37%	96%	94	36%	95%	248
EM	34%	95%	137	33%	95%	208	35%	96%	154	34%	96%	362
WM	27%	92%	96	29%	93%	148	32%	95%	147	31%	94%	295
EA	33%	97%	133	33%	98%	210	35%	98%	116	34%	98%	326
NT	34%	96%	160	36%	97%	212	38%	98%	179	37%	98%	391
SE	33%	97%	149	34%	98%	237	39%	98%	125	36%	98%	362
WS	28%	92%	51	29%	95%	78	33%	94%	55	31%	95%	133
SO	29%	96%	100	30%	97%	167	31%	97%	121	31%	97%	288
SW	31%	97%	98	32%	98%	120	35%	98%	87	34%	98%	207

- Indicative Load Factor : R^2 Multiple Correlation Coefficient : Sample Size

Small NDM 732 to 2,196 MWh pa (Band 4) Split At 1465 MWh pa Consumption Band Analysis: Historical ILF Comparison

	2008/09		2007/08		2006/07	
	732-1465 MWh pa	1465-2196 MWh pa	732-1465 MWh pa	1465-2196 MWh pa	732-1465 MWh pa	1465-2196 MWh pa
SC	41%	41%	40%	40%	40%	38%
NO	31%	33%	31%	31%	31%	29%
NW / WN	35%	40%	33%	37%	33%	36%
NE	35%	37%	34%	34%	32%	37%
EM	33%	35%	31%	37%	31%	33%
WM	29%	32%	29%	33%	26%	30%
EA	33%	35%	33%	34%	30%	32%
NT	36%	38%	36%	37%	33%	35%
SE	34%	39%	32%	35%	32%	33%
WS	29%	33%	28%	33%	26%	31%
SO	30%	31%	30%	33%	28%	32%
SW	32%	35%	33%	36%	32%	34%

- Majority of ILF differences small & inconsistent across LDZs within & between years
- 5 LDZs indicate $\geq 2\%$ points ILF difference across all 3 years

Small NDM 732 to 2,196 MWh pa (Band 4) Split At 1,465 MWh pa Consumption Band Analysis: Statistical RMSE Comparison

	Population AQ Weighted RMSE			
	Values Models Based on 2008/09 Data Set			
	NO SPLIT 732 to 2196	SPLIT 732 to 1465 1465 to 2196	Improvement (+) or Degradation (-) Using Two Bands	
			CURRENT: 08/09	07/08
SC	432642.6	476765.8	-10.2%	-3.5%
NO	290942.1	310788.3	-6.8%	-3.4%
NW / WN	688500.7	728897.7	-5.9%	-5.3%
NE	399684.5	413002.6	-3.3%	-3.3%
EM	498568.3	522354.0	-4.8%	-7.1%
WM	596824.8	639595.9	-7.2%	-8.2%
EA	175248.4	188398.0	-7.5%	-9.1%
NT	387221.8	405175.1	-4.6%	-3.3%
SE	529740.0	561290.8	-6.0%	-5.0%
WS	390688.2	420603.2	-7.7%	-6.8%
SO	403016.4	410425.7	-1.8%	-5.8%
SW	222004.5	236353.1	-6.5%	-4.2%
Overall	445993.0	474195.0	-6.3%	-6.0%

- No overall improvement in RMSE ('goodness of fit') when splitting Band 4
- Retain current approach
- EUC split at 1,465 is not proposed

Small NDM <2,196,000 kWh WAR Band Analysis

Winter Annual Ratio: WAR Band Analysis

- WAR Band – Winter Annual Ratio profiles
 - Profile split by consumption in winter as a ratio of total consumption
- Applied to Supply Points where Consumption >293 MWh pa
 - Band 3 and above
 - 2 Small NDM EUC Bands have WAR Bands
 - 293 to 732 MWh pa and 732 to 2,196 MWh pa
 - BUT - Grouped to allow individual LDZ analysis
 - 4 bands defined as 20:30:30:20 percentage split of sample population
 - WAR Band definitions change by Consumption Band and by year
 - Analysis – War Band limits have moved towards one as a result of the ‘colder’ winter in 08/09 compared with 07/08

Small NDM EUC Band 3&4: 293 to 2,196 MWh pa WAR Band Analyses

Count of Validated Sample Numbers per WAR Band

	WAR Banding				Total
	0.00 – 0.45	0.45 – 0.52	0.52 – 0.60	0.60 – 1.00	
SC	176	138	89	33	436
NO	82	104	103	34	323
NW / WN	161	147	166	87	561
NE	89	102	81	61	333
EM	105	131	138	125	499
WM	85	102	98	106	391
EA	70	112	134	143	459
NT	108	142	160	141	551
SE	69	172	134	136	511
WS	31	38	51	64	184
SO	61	92	105	130	388
SW	52	73	94	86	305
Total	1089	1353	1353	1146	4941

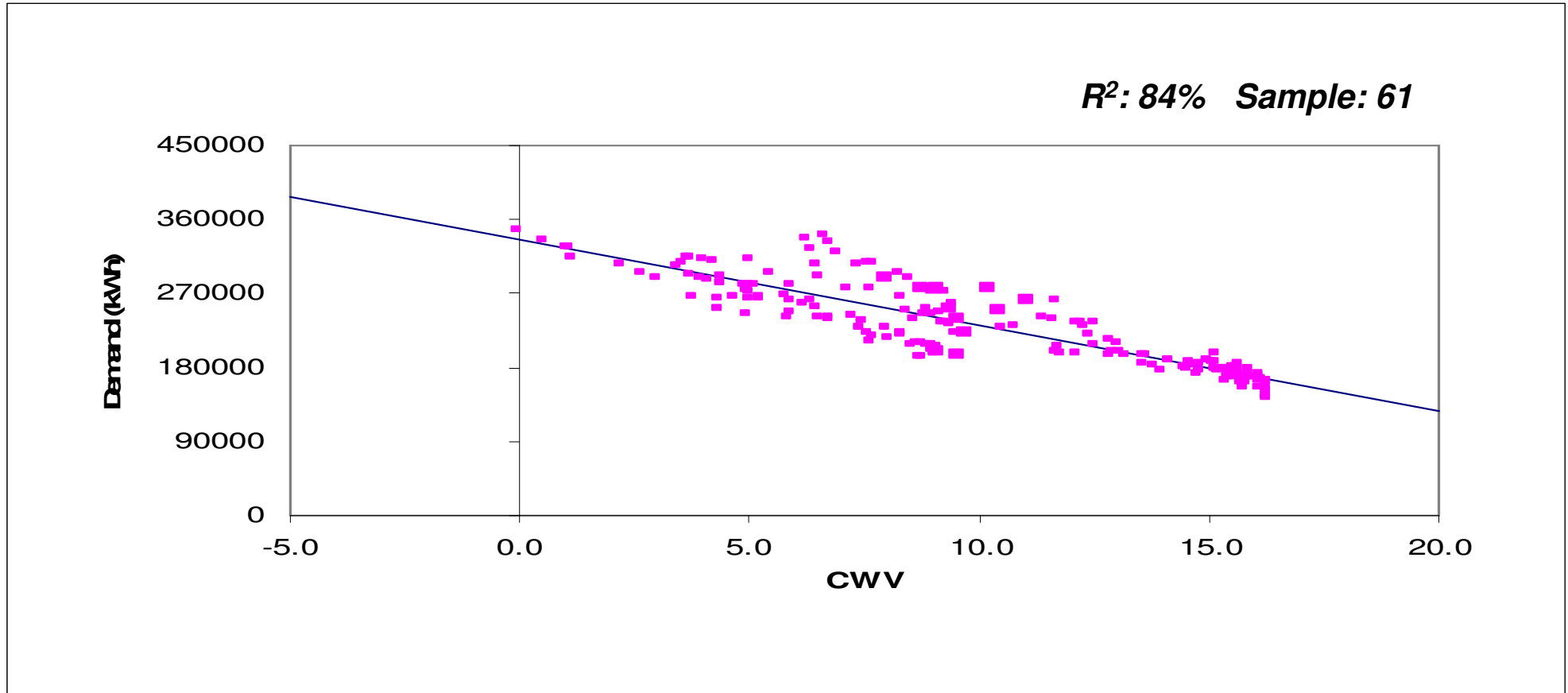
- Model whole consumption band as one - No LDZ aggregation required (more appropriate)

Small NDM EUC Band 3&4: 293 to 2,196 MWh pa WAR Band Analyses Indicative Load Factors

	WAR Banding											
	0.00 – 0.45			0.45 – 0.52			0.52 – 0.60			0.60 – 1.00		
SC	57%	93%	176	40%	97%	138	31%	97%	89	27%	96%	33
NO	50%	85%	82	35%	95%	104	26%	95%	103	22%	96%	34
NW / WN	55%	90%	161	42%	96%	147	29%	95%	166	24%	95%	87
NE	54%	89%	89	40%	95%	102	31%	95%	81	23%	93%	61
EM	55%	87%	105	43%	97%	131	30%	96%	138	24%	95%	125
WM	51%	90%	85	37%	94%	102	26%	93%	98	21%	95%	106
EA	59%	91%	70	45%	96%	112	33%	97%	134	24%	96%	143
NT	61%	85%	108	44%	97%	142	34%	98%	160	25%	97%	141
SE	57%	88%	69	46%	98%	172	33%	97%	134	24%	96%	136
WS	55%	88%	31	42%	97%	38	29%	94%	51	22%	93%	64
SO	48%	84%	61	41%	95%	92	30%	97%	105	22%	96%	130
SW	57%	86%	52	43%	99%	73	30%	97%	94	23%	96%	86

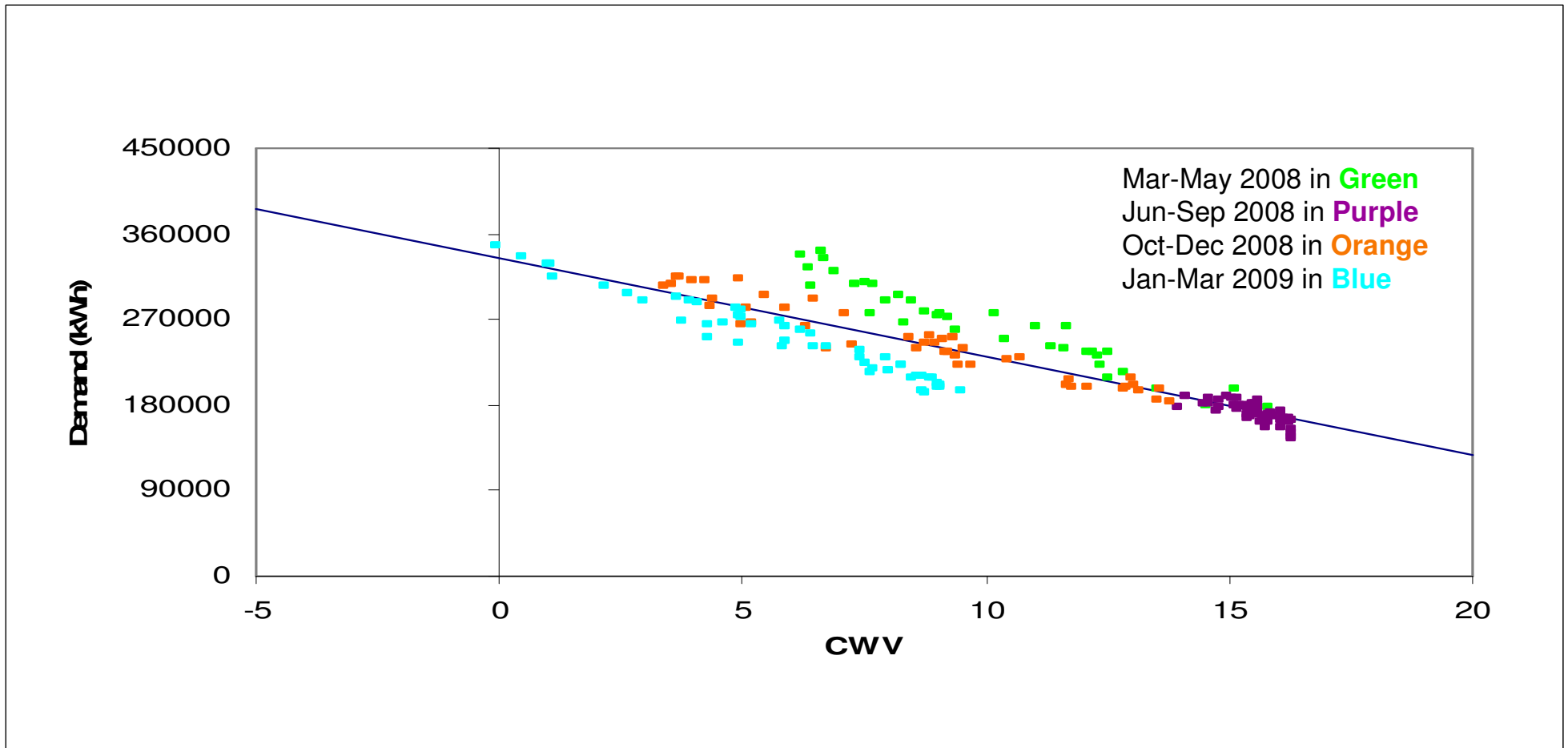
- Indicative Load Factor : R^2 Multiple Correlation Coefficient : Sample Size

Demand against CWV, Monday to Thursday, holidays excluded, SO LDZ, 293 – 2,196 MWh pa, WAR band 1



- Low R-squared value due to less weather dependent demand
- Economic downturn believed to have resulted in greater data scatter than previous years – impacts of unfolding recession over time span of data set seen on next slide...

Demand against CWV, Monday to Thursday, holidays excluded, SO LDZ, 293 – 2,196 MWh pa, WAR band 1



- Chart shows how demand has changed over time as non weather effects have impacted energy consumption in this set of supply points

Small NDM - WAR Band Analysis 293 – 2,196 MWh pa

- Modelling 293 - 2196 MWh pa consumption range for WAR band analysis allows individual LDZ analyses (NW/WN combined).
- Sample sizes are reasonable for all 48 data sets.
- Same basis was used in 2008 & 2007 (and previous years).
- Many WAR band 1 data sets show greater scatter due to non-weather related demand effects occurring over the time span of the data set
- WAR band 1 models have R^2 values between 84% and 93%
- Model fits (R^2 values) for all WAR band 2,3 and 4 data sets are 93% or better
- In 2008 one WAR band 1 data set had a R^2 value less than 90% and in 2007 two WAR band 1 models had R^2 values less than 90%
- Proposal is to retain this approach. WAR band models derived for 293 - 2196 MWh pa range on an individual LDZ basis.

Small NDM Analysis
<2,196,000 kWh
Summary

Small NDM: EUC Smoothed Models - Provisional Results

- Review of provisional model results

Number 'Straight' (no cut-offs, no summer reductions)	56	(52)
Number with Warm Weather Cut-Off	41	(35)
Number with Summer Reduction	37	(45)
Number with no Slope (weather insensitive)	0	(0)
Number with Cut-Offs and Reductions	22	(24)
Last years figures in (x)		

- No cut-offs are applied to EUCs in consumption bands 0-73.2 and 73.2 to 293 MWh pa (which represents nearly 80% of the overall NDM load)
- Cut-offs have been primarily applied for the peakier WAR bands (3 & 4) across consumption range 293 to 2,196 MWh pa (67%)
- Modelling is undertaken as reflected by the sample data

Small NDM EUC Smoothed Models for 2009/10 Changes to Cut-offs

- For small NDM there are 156 EUCs in total
- 63 EUCs with cut-offs in smoothed models for 2009/10 (59 in 2008/09)
- 4 of 63 EUCs have cut-offs in 2009/10 but did not have cut-offs in 2008/09
 - Those EUCs make up 0.39% of NDM load
- There are 0 EUCs that do not have cut-offs in 2009/10, but had cut-offs in 2008/09
- The 'flipping' of cut-offs unlikely to have a material impact on NDM demand attribution
 - Effect of cut-offs on the shape of the NDM profiles is restricted to some warm weather days during the summer months

Small NDM – Proposals for Analysis

- Therefore:
 - 0 to 73.2 MWh pa
 - Consumption Band Analysis by LDZ
 - Use Domestic sites only – do not use I&C
 - 73.2 to 293 MWh pa
 - Analysis by LDZ
 - No additional split at 145 MWh pa
 - 293 to 732 and 732 to 2,196 MWh pa
 - Consumption & WAR Band analysis by LDZ
 - Consumption Band analysis for 293 – 732 and 732 – 2,196
 - WAR Band analysis across whole band 293 – 2,196
 - No additional split at 1,465 MWh pa
- No change from previous year as analysis has not highlighted any requirements for change

Large NDM
>2,196,000 kWh

Large NDM Analysis (>2,196 MWh pa)

- Defined Demand Estimation purposes > 2,196,000 kWh
 - Prescribed EUCs for Large NDM (in respect of consumption range) defined (UNC) as:
 - 2,196 to 5,860 MWh
 - 5,860 to 14,650 MWh
 - 14,650 to 29,300 MWh
 - 29,300 to 58,600 MWh
 - >58,600 MWh
- 1 Consumption Band
x4 Winter Annual Ratio
(WAR) Bands
- Identify sample data available pre and post validation and proposed aggregations

Available Sample Data: Large NDM Dataloggers

	TOTAL		
Number of Active Dataloggers As At 01/03/2008	16,836		
Number of Validated Dataloggers	12,303	6,664	5,639
Number of Supply Points After Validation	2009 Analysis	2008 Analysis	
Large NDM	4,001	3,923	
Small NDM	5,562	5,120	
Total	9,563	9,043	

- Both Large & Small validated sample has increased since 2008
- Overall increase of 520 validated supply points
- Different spread of sample across various bands
- Still a good representation of the population
- Following slides highlight aggregations as a result – no change & no modelling impact

Large NDM: Sample Data Aggregations

- Aggregation of sample data to allow sufficient sample analysis
- Comparable with 2008 - values shown (x)

	Consumption Band Analysis	WAR Band Analysis
Band 05 2,196 to 5,860 MWh pa	Individual LDZ <i>(Individual LDZ)</i>	By 5 LDZ Groups <i>(By 5 LDZ Groups)</i>
Band 06 5,860 to 14,650 MWh pa	Individual LDZ <i>(Individual LDZ)</i>	By 3 LDZ Groups <i>(By 3 LDZ Groups)</i>
Band 07 14,650 to 29,300 MWh pa	By 5 LDZ Groups <i>(By 5 LDZ Groups)</i>	National <i>(National)</i>
Band 08 29,300 to 58,600 MWh pa	By 3 LDZ Groups <i>(By 3 LDZ Groups)</i>	National <i>(National)</i>
Band 09 >58,600 MWh pa	National <i>(National)</i>	N/A - No WAR Bands

Available Sample Data: Large NDM Dataloggers *Count Per Consumption Band (+ Aggregations)*

	2,196 - 5,860	5,860 – 14,650	14,650 – 29,300	29,300 – 58,600	>58,600
SC	275	67	22	4	2
NO	167	60	12	6	10
NW & WN	364	120	43	22	8
NE	150	74	30	11	4
EM	225	107	45	23	8
WM	298	105	41	26	13
EA	186	78	22	13	5
NT	291	98	21	12	4
SE	190	49	10	6	2
WS	80	32	15	7	6
SO	202	64	22	7	1
SW	145	60	16	11	4
TOTAL	2,573	914	299	148	67

- Aggregations highlighted

Large NDM: Count of Sample Supply Points to Total Market Supply Points Comparison

Consumption Range	Validated Sample	Firm Supply Point Population (1)
2,196 to 5,860 MWh pa	2,573 (42%)	6,100
5,860 to 14,650 MWh pa	914 (52%)	1,770
14,650 to 29,300 MWh pa	299 (56%)	530
29,300 to 58,600 MWh pa	148 (62%)	240
>58,600 MWh pa	67 ⁽²⁾ (45%)	150 ⁽³⁾

Notes:

1. Approx. for all Firm supply points at April 2009 : >2,196 MWh represents 10.3% of NDM load (0.04% of Supply Points)
2. Sample data includes all firm supply points passing data validation because there are too few NDM supply points with AQ>58,600 MWh pa. Supply points >58,600 MWh pa should be DM.
3. Number of NDM supply points with AQ>58,600 MWh pa as at April 2009 was 10 (~0.17% of aggregate NDM AQ).

Total NDM Population Counts: Supply Point & AQ

Consumption Range	% of Total NDM	
	Total AQ	Total Count
0 – 73.2 MWh pa	73.5%	98.47%
0 – 2,196 MWh pa	89.7%	99.96%
>2,196 MWh pa	10.3%	0.04%

- On an AQ Basis:
 - Small NDM is by far the main component of the overall NDM sector
 - The range 0 – 73.2 MWh pa constitutes nearly 3/4 of overall NDM
 - Large NDM is a minority component of overall NDM
 - BUT – requires NDM modelling, sample counts have allowed this

Large NDM Supply Points (>2,196 MWh pa) Consumption Band Analyses – Indicative Load Factors

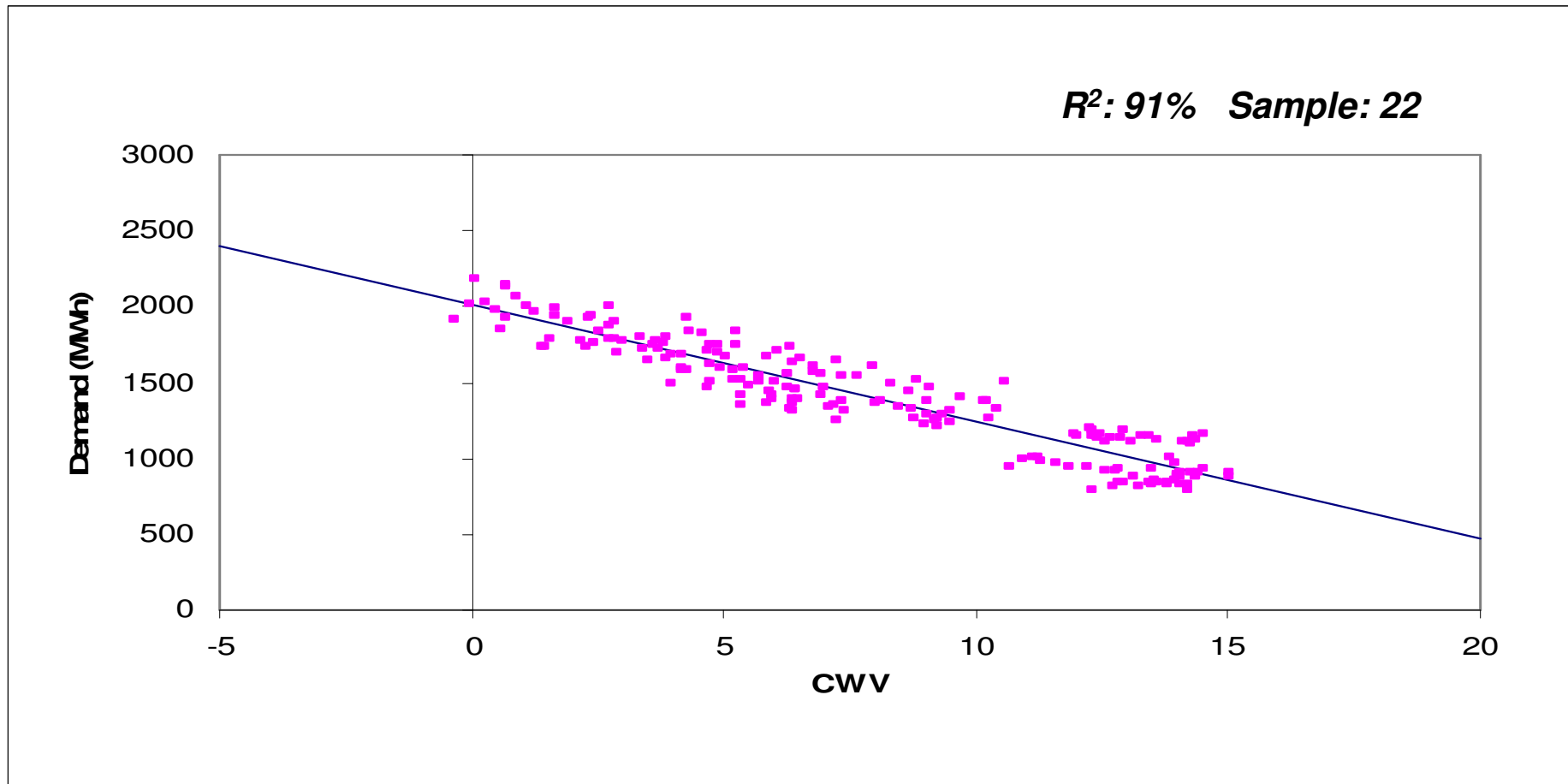
	Large NDM Consumption Band (MWh pa)																	
	2,196 TO 5,860			5,860 TO 14,650			14,650 TO 29,300			29,300 TO 58,600			>58,600					
SC	44%	98%	275	47%	97%	67	48%	91%	22	65%	81%	67						
NO	37%	96%	167	42%	96%	60	50%	96%	55							61%	93%	32
NW / WN	41%	97%	364	46%	97%	120												
NE	37%	96%	150	48%	96%	74	56%	93%	116							66%	90%	60
EM	40%	97%	225	48%	96%	107												
WM	38%	96%	298	45%	93%	105												
EA	39%	97%	186	42%	97%	78	43%	96%	53							47%	95%	56
NT	39%	99%	291	41%	98%	98												
SE	38%	98%	190	42%	96%	49												
WS	38%	97%	80	45%	96%	32												
SO	35%	98%	202	39%	98%	64	45%	97%	53									
SW	39%	97%	145	44%	96%	60												

- Indicative Load Factor : R2 Multiple Correlation Coefficient : Sample Size

Model for SC LDZ: 14,650-29,300 MWh pa Consumption Band

- Sample size is small (22) but overall population for the band in SC LDZ is also small (43, in early April 2009 and of these only 25 were assigned to this consumption band EUC).
- The model is well behaved despite the small sample size (91% R² value).
- Same sample size with good model fit was accepted in 2008
- The graph that follows shows the model for SC LDZ on its own is good.

Demand Against CWV, Monday to Thursday, Non-Holiday SC LDZ (5 LDZ Group Analysis) 14,650-29,300 MWh pa, Consumption Band, SC CWV



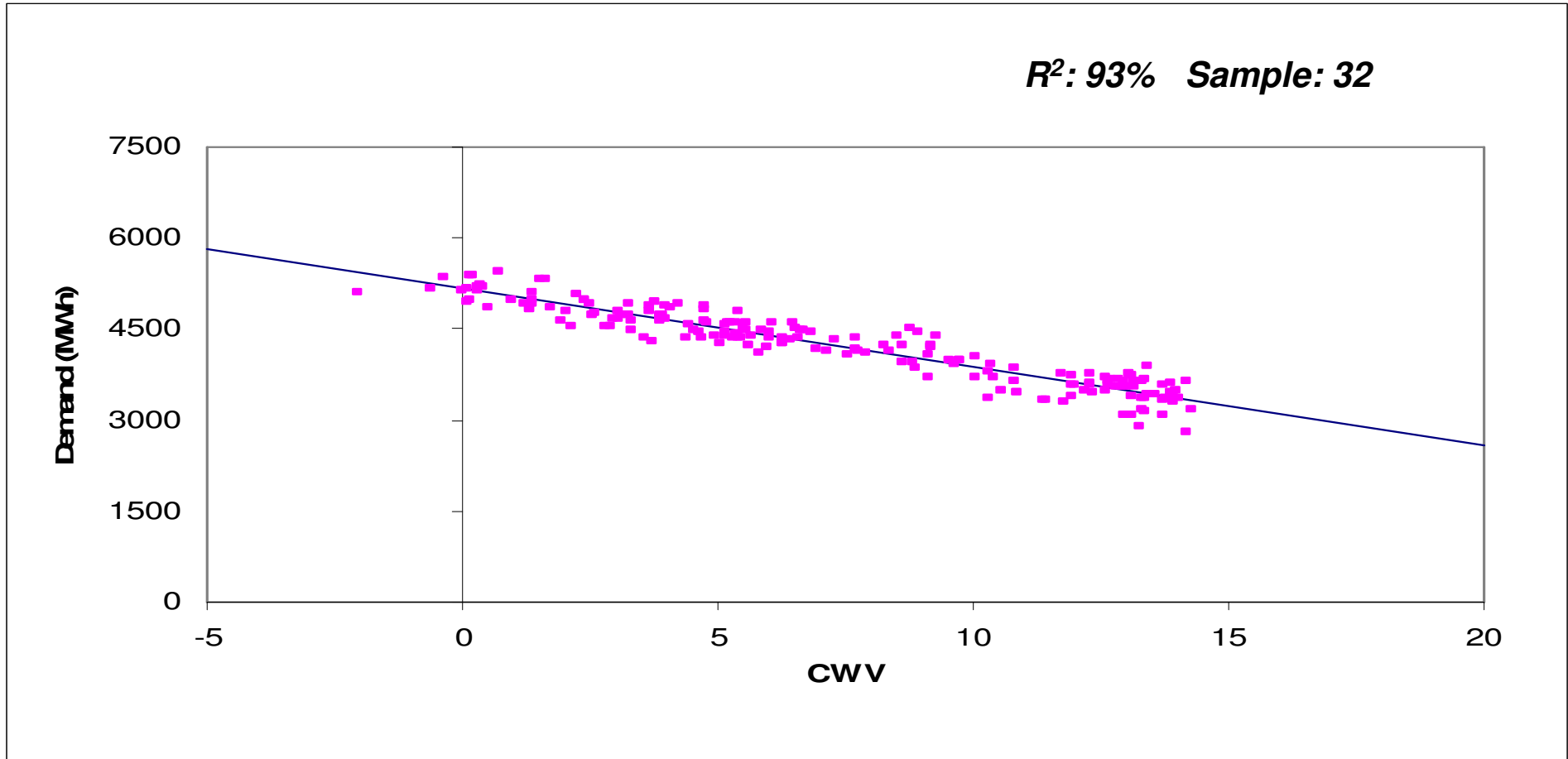
- Lower sample count.
- Some scatter however model seems acceptable.

Model for SC/NO/NW/WN Group: 29,300-58,600 MWh pa Consumption Band

- Sample size is fairly small at 32, but still acceptable
- Overall NDM population for this consumption range in these 4 LDZs is only 34 (at early April 2009). Of these 34 just 20 supply points were assigned to this consumption band EUC
- The model is well behaved despite the small sample size (93% R² value)
- The graph that follows shows the model for NO LDZ in this grouped aggregation (SC/NO/NW/WN)

Demand Against CWV, Monday to Thursday, Non-Holiday

3 LDZ Group Aggregation 29,300-58,600 MWh pa, Consumption Band, NO CWV



- Small sample size but model seems acceptable.

Large NDM >2,196,000 kWh WAR Band Analysis

Winter Annual Ratio: WAR Band Analysis

- WAR Band – Winter Annual Ratio profiles
 - Profile split by consumption in winter (December to March) as a ratio of total consumption
- Applied to all Large supply point bands
 - Bands 5 and above
 - 4 bands defined as 20:30:30:20 percentage split of sample population
 - WAR Band definitions change by Consumption Band and by year
 - Analysis – War Band limits have moved towards one as a result of the ‘colder’ winter in 08/09 compared with 07/08

Observations on WAR Band 1 EUC Demand Models

- Within the period encompassed by this most recent data set, unprecedented events have been taking place in economy at large, with a recession taking hold and deepening
- These external recessionary effects have manifested themselves most notably in the data sets applicable to WAR band 1 in each consumption range
- Generally, demand models for WAR band 1 are not very weather sensitive, hence the ensuing model R^2 values are lower than 90%
- The most recent models for WAR bands 2, 3 and 4 (in each consumption range) are intrinsically more weather sensitive
- These do not appear to have been as significantly affected by recession related demand behaviour

Large NDM Supply Points (2,196 to 5,860 MWh pa) Count of Validated Sample Numbers per WAR Band + Aggregations

- Consumption Band 5: 2,196 to 5,860 MWh pa : Aggregations applied

	WAR Banding			
	0.00 – 0.41	0.41 – 0.48	0.48 – 0.56	0.56 – 1.00
SC	61	101	88	25
NO / NW / WN	137	154	149	91
NE / EM / WM	173	183	171	146
EA / NT / SE	78	159	239	191
WS / SO / SW	86	93	119	129
TOTAL	535	690	766	582

- Numbers in each WAR Band aggregation
- In SC LDZ, WAR Band 4 remains small but ensuing model fit remains good....

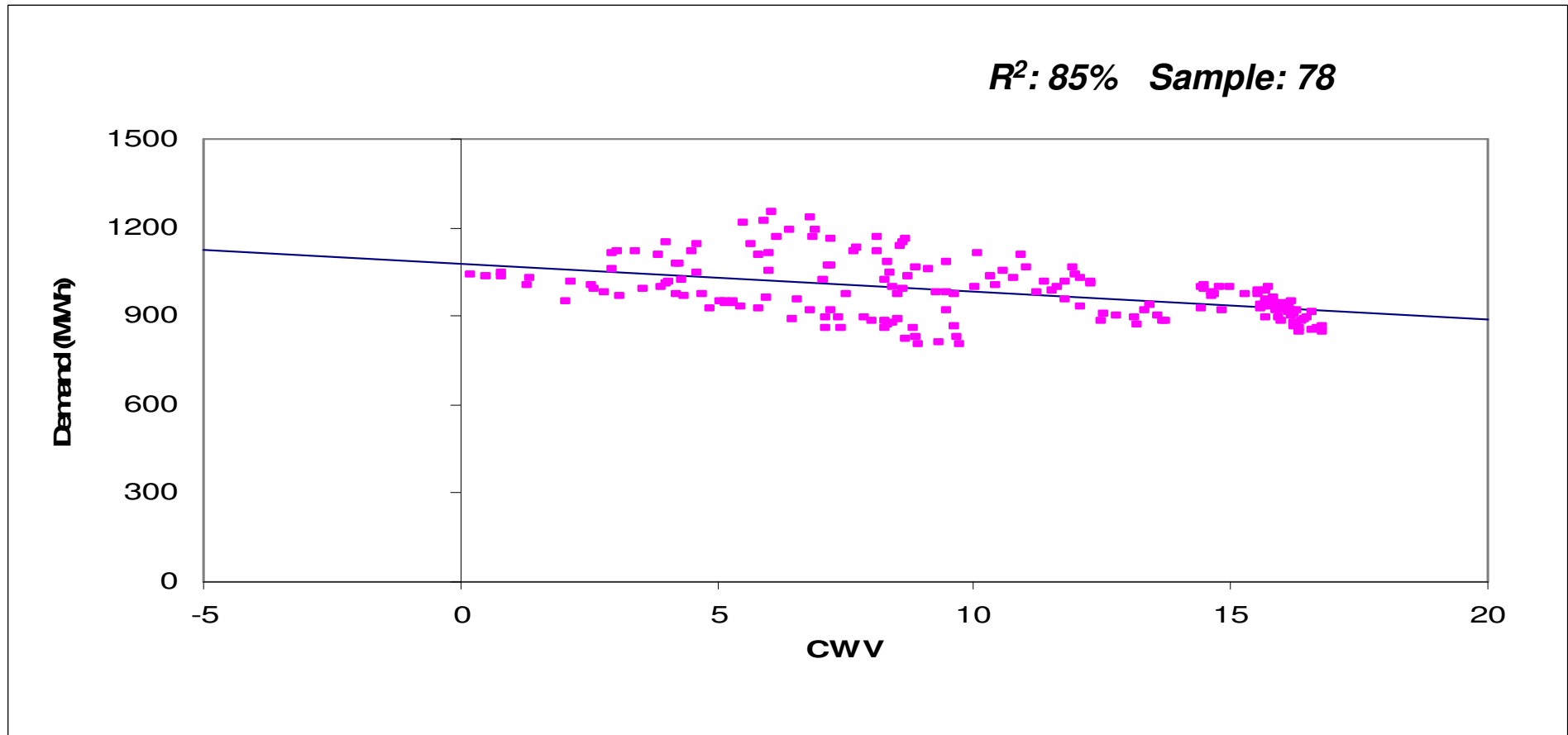
Large NDM Supply Points (2,196 to 5,860 MWh pa) 5 LDZ Group : Aggregated WAR Band : Indicative Load Factors

- Consumption Band 5: 2,196 to 5,860 MWh pa : 5 LDZ Aggregations Applied : ILF

	WAR Banding											
	0.00 – 0.41			0.41 – 0.48			0.48 – 0.56			0.56 – 1.00		
SC	64%	88%	61	48%	97%	101	36%	97%	88	28%	95%	25
NO / NW / WN	60%	91%	137	48%	96%	154	34%	96%	149	25%	96%	91
NE / EM / WM	60%	93%	173	45%	96%	183	35%	97%	171	25%	96%	146
EA / NT / SE	67%	85%	78	50%	99%	159	40%	98%	239	27%	96%	191
WS / SO / SW	65%	92%	86	47%	96%	93	36%	98%	119	25%	97%	129

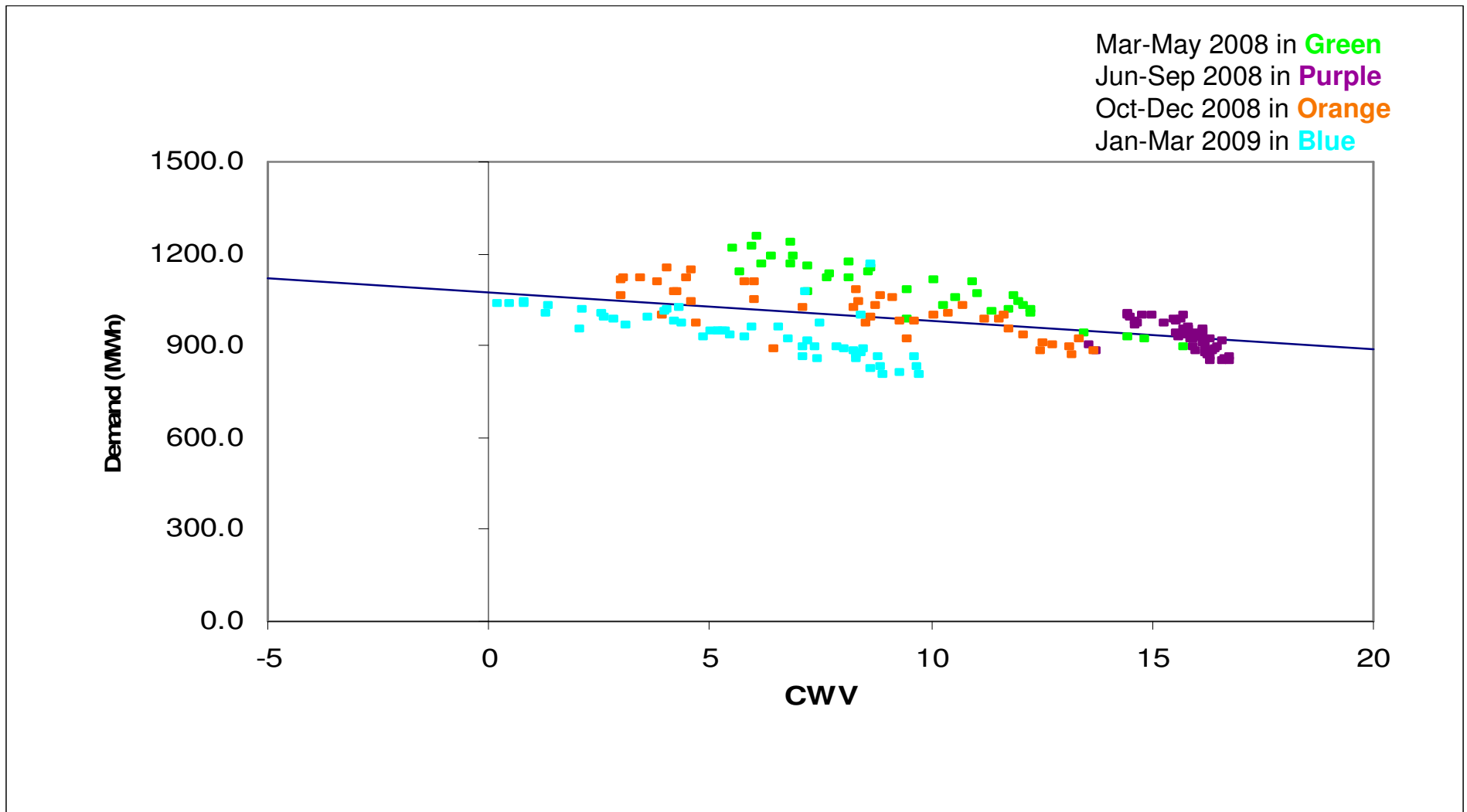
- Indicative Load Factor : R2 Multiple Correlation Coefficient : Sample Size

Demand Against CWV, Monday to Thursday, Non-Holiday EA/NT/SE LDZ Group Analysis, 2196-5860 MWh pa, WAR Band 1, NT CWV



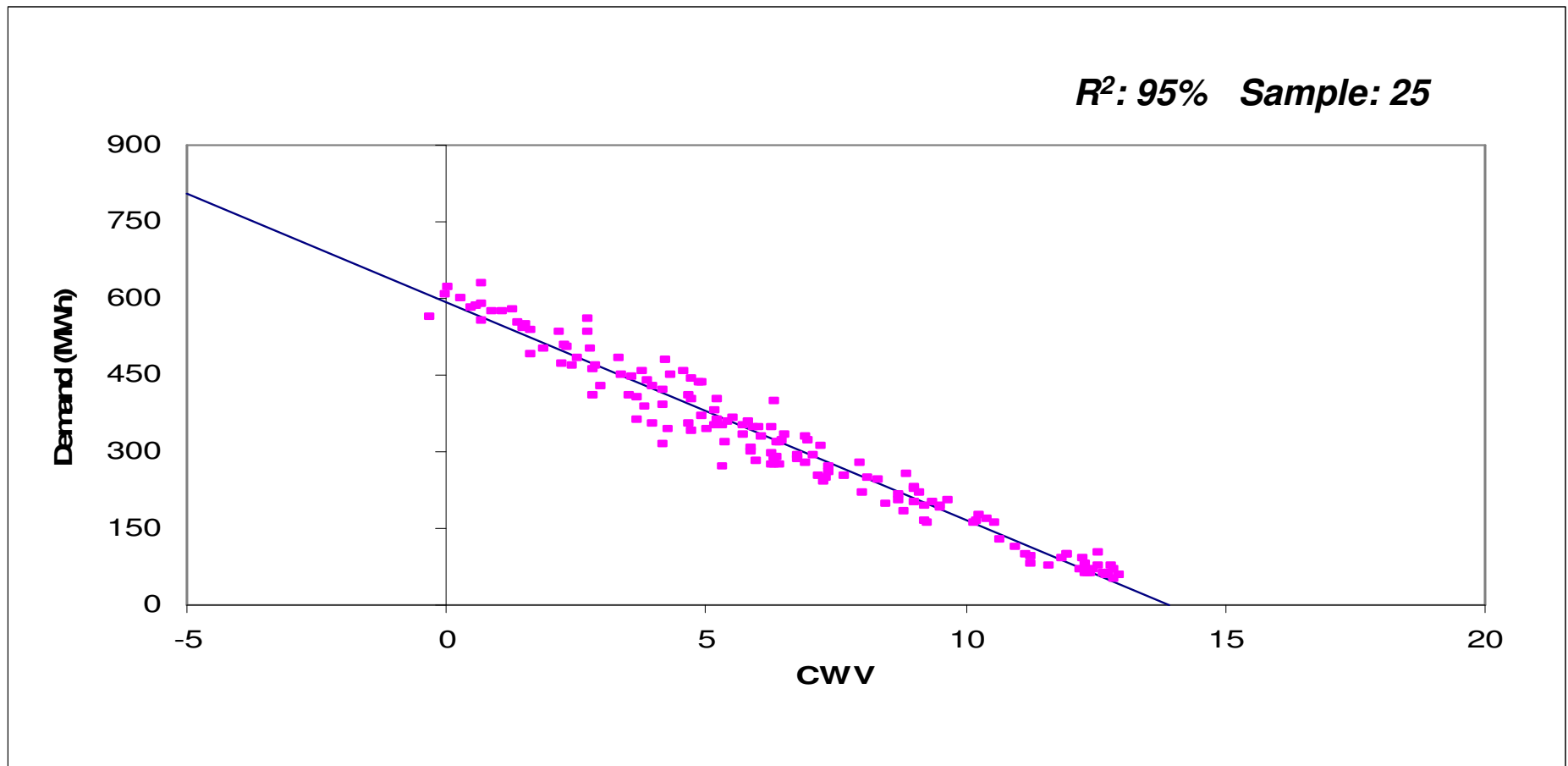
- Greater data scatter than in previous years believed to be due to demand being affected by economic downturn

Demand Against CWV, Monday to Thursday, Non-Holiday EA/NT/SE LDZ Group Analysis, 2196-5860 MWh pa, WAR Band 1, NT CWV



Demand Against CWV, Monday to Thursday, Non-Holiday

SC LDZ (5 LDZ Group Analysis) 2,196-5,860 MWh pa, WAR Band 4, SC CWV



- Typical weather sensitive WAR band 4 model

Large NDM Supply Points (>2,196 MWh pa)

WAR Band Analysis 2,196 – 5,860 MWh pa

- WAR band 1 models in SC LDZ and in the EA/NT/SE LDZ group show R^2 values lower than 90% due to greater data scatter
- WAR band 1 EUC models (in all consumption ranges generally) are affected by non-weather related demand behaviour in this most recent data set
- 5 LDZ group basis appropriate despite small sample size in WAR band 4 in SC LDZ modelled on its own in the 5 group set.
- Model fit (R^2 value) for this case is very good: 95%
- 5 LDZ group basis of data aggregation also applied in 2008 and in 2007

Large NDM Supply Points : Remaining Bands 5,860 to >58,600 MWh pa Count of Validated Sample Numbers per WAR Band + Aggregations

- Consumption Band 6: 5,860 to 14,650 MWh pa : 3 LDZ Aggregations Applied

	WAR Banding			
	0.00 – 0.34	0.34 – 0.45	0.45 – 0.54	0.54 – 1.00
SC/NO/NW/WN	52	86	73	36
NE/EM/WM	82	95	63	46
EA/NT/SE/WS/SO/SW	36	108	135	102
TOTAL	170	289	271	184

- Consumption Band 7: 14,650 to 29,300 MWh pa : National Aggregations Applied

	0.00 – 0.34	0.34 – 0.41	0.41 – 0.53	0.53 – 1.00
ALL LDZs	64	88	86	61

- Consumption Band 8: 29,300 to 58,600 MWh pa : National Aggregations Applied

	0.00 – 0.33	0.33 – 0.37	0.37 – 0.48	0.48 – 1.00
ALL LDZs	29	43	44	32

Large NDM Supply Points : Remaining Bands 5,860 to >58,600 MWh pa Aggregated WAR bands : Indicative Load Factors

- Consumption Band 6: 5,860 to 14,650 MWh pa : 3 LDZ Aggregations Applied

	WAR Banding											
	0.00 – 0.34			0.34 – 0.45			0.45 – 0.54			0.54 – 1.00		
SC/NO/NW/WN	74%	87%	52	54%	96%	86	40%	98%	73	26%	94%	36
NE/EM/WM	73%	86%	82	56%	97%	95	39%	98%	63	27%	96%	46
EA/NT/SE/WS/SO/SW	72%	84%	36	58%	97%	108	41%	98%	135	28%	96%	102

- Consumption Band 7: 14,650 to 29,300 MWh pa : National Aggregations Applied

	WAR Banding											
	0.00 – 0.34			0.34 – 0.41			0.41 – 0.53			0.53 – 1.00		
ALL LDZs	77%	81%	64	62%	96%	88	45%	97%	86	30%	95%	61

- Consumption Band 8: 29,300 to 58,600 MWh pa : National Aggregations Applied

	WAR Banding											
	0.00 – 0.33			0.33 – 0.37			0.37 – 0.48			0.48 – 1.00		
ALL LDZs	91%	59%	29	71%	92%	43	57%	93%	44	33%	94%	32

- Indicative Load Factor : R2 Multiple Correlation Coefficient : Sample Size

Large NDM Supply Points (>2,196 MWh pa) WAR Band Analysis 5,860 – 14,650 MWh pa

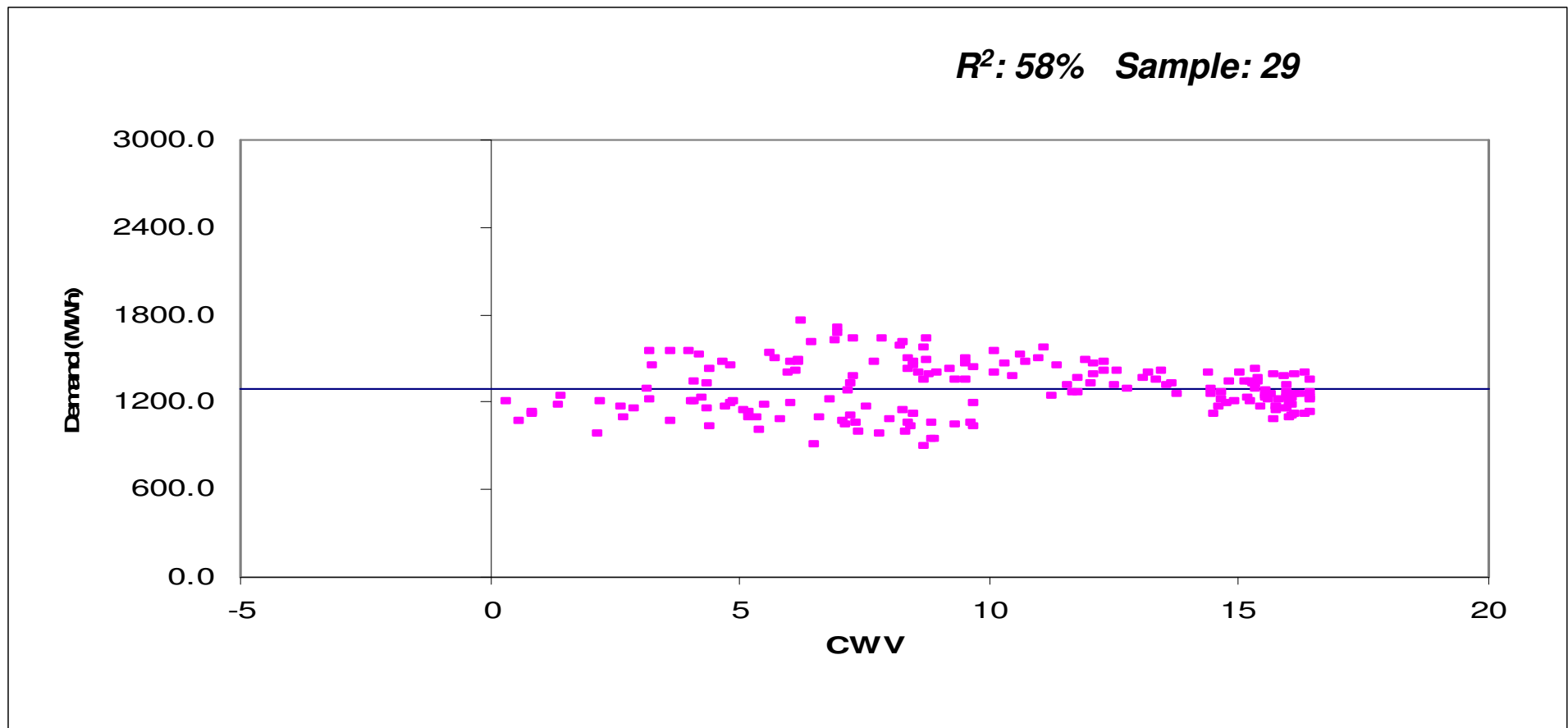
- 3 LDZ group basis gives adequate sample sizes for all data sets
- Apart from WAR band 1, for which data sets demand is not weather related, all model fits (R^2 values) are good with 3 groups
- Model fits (R^2 values) for WAR bands 2,3 and 4 are 94% or greater
- Same level of aggregation as applied in 2008, 2007 and 2006
- Retaining the 3 LDZ group aggregation is better because they provide a more statistically robust set of models.

Large NDM Supply Points (>2,196 MWh pa) WAR Band Analysis 14,650 – 29,300 MWh pa

- National aggregation - sample sizes sufficient in all four WAR bands.
- Same level of aggregation as applied in 2008, 2007 and 2006.
- Sample sizes are insufficient for any lower level of aggregation.
- Apart from WAR band 1, for which data sets demand is not weather related, all model fits (R^2 values) are good
- Model fits for WAR bands 2, 3 and 4 are 95% or greater
- Models for WAR band 1 have zero slope (same in 2008 and 2007)

Demand Against CWV, Monday to Thursday, Non-Holiday

National Aggregation, 29300-58600 MWh pa, WAR Band 1, EM CWV



- Band 8 WAR Band 1 in EM LDZ – Weather insensitive but worse R² value this year

Large NDM Supply Points (>2,196 MWh pa)

WAR Band Analysis 29,300 – 58,600 MWh pa

- National aggregation - sample sizes sufficient in all four WAR bands.
- Same level of aggregation as applied in 2008, 2007 and 2006.
- Sample sizes are insufficient for any lower level of aggregation.
- Model fits (R^2 values) for WAR bands 2, 3 and 4 are 92% or greater.
- Model for WAR band 1 has a zero slope and significant data scatter - hence high ILF of 91% and lower R^2 value of 58%.
- The smoothed models for this WAR band 1 EUC have had zero slope since gas year 2005/06 (gas year 2009/10 will be the same).

Large NDM Analysis
> 2,196,000 kWh
Summary

LARGE NDM: EUC Smoothed Models - Provisional Results

- Review of provisional model results

Number 'Straight' (no cut-offs, no summer reductions)	157	(170)
Number with Warm Weather Cut-Off	57	(53)
Number with Summer Reduction	33	(37)
Number with no Slope (weather insensitive)	26	(13)
Number with Cut-Offs and Reductions	0	(0)
Last years figures in (x)		

- No significant change from previous years
- Cut-offs have been primarily applied for the peakier WAR bands (3 & 4) across consumption bands

Large NDM EUC Smoothed Models for 2009/10 Changes to Cut-offs

- For large NDM there are 273 EUCs in total
- 57 EUCs with cut-offs in smoothed models for 2009/10 (53 in 2008/09)
- 9 will have cut-offs in 2009/10 but did not have cut-offs in 2008/09
 - Those EUCs make up 0.24% of NDM load
- 5 will not have cut-offs in 2009/10, but had cut-offs in 2008/09
 - Those EUCs make up 0.09% of total NDM load
- The 'flipping' of cut-offs is unlikely to have a material impact on NDM demand attribution
 - Effect of cut-offs on the shape of the NDM profiles is restricted to some warm weather days during the summer months.

Recommendations

Summary

- Analysis presented is an overview of the ongoing analysis
- Small and Large NDM Analysis
- Consumption and WAR Bandings
 - Derive EUCs
 - Model consumption profiles
- Draft proposals due to be published by June 30th will include:
 - In depth analysis of what has been presented here
 - Calculated profiling and capacity estimation parameters to be applied in new Gas Year
 - Available on the xoserve UK Link Docs Extranet, access via:
(www.xoserveextranet.com/uklinkdocs/default.asp)
- Recommendations at this stage.....

Recommendations

- Retain Small NDM EUC Breakdowns at same points as previous years
 - Splits degrade model / profiling accuracy & provide no significant benefit to Indicative Load Factors
- Model EUC Band 1 (0 to 73.2 MWh pa) using Domestic only dataset
 - Inclusion of non-domestic would under estimate demand for weekend periods, adverse effect on Scaling Factors, degrade model / profiling
- Model Large NDM EUC bands using similar levels of aggregation to previous years (same as 2008/09)
- Ongoing Analysis: No significant differences to previous years analysis
- Publication of initial proposals: by 30th June
- Consultation: Representations invited by 15th July
- Publication of final proposals: by 15th August