

# Demand Estimation Technical Forum

Monday 4<sup>th</sup> June 2007

# 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
- Issues for DESC Consideration

# Demand Estimation - Overview

# 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 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)

- 4 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 23<sup>rd</sup> 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*

# Current Position Spring 2006 – 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 - 2006/07
  - 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)*

- Modelling basis broadly unchanged from spring 2006
  - 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
  - 12 month analysis for most recent data sets (2006/07)
    - Data sets cover mid-march to mid march or April – March (depending on data set)
- New CWV applied for LDZs: EA, NT, SE
  - Revision necessary because of weather station change
  - London Heathrow replaces London Weather Centre

## Modelling Basis 2

### *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 anomalous instances during a single year



## Modelling Basis 3

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

- Summer reductions can apply to EUC models over the period 25<sup>th</sup> May to 28<sup>th</sup> September (top 2<sup>o</sup> 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) and DESC Jan07 'Approach to Spring 2007 Modelling'

# 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

# Small NDM Analysis <2,196,000 kWh

## Small NDM Analysis (<2,196 MWh pa)

- Defined Demand Estimation purposes <2,196,000 kWh
- Represents nearly 89% 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 17/03/06	4,184
Previous 12 Months:	
▪ Sample Site Terminations	480
▪ Sample Site Replacements	525
▪ New Installations	75
Active Data Recorders at 16/03/07	4,304
Data Recorders Active At 17/03/06 and with data	3,712
Total No. of Validated Data Recorders	<u>3,379</u>
Total No. of Validated Supply Points (3,493 Spring 2006)	<u>3,371</u>
<i>(2,521 classified Domestic &amp; in 0-73.2 MWh pa range. 669 in the 73.2-293 MWh pa range)</i>	

- Overall Reduction of 122 Data Recorders since Spring 2006 – Does not impact modelling

# Available Sample Data: Small NDM Data Recorders

## Domestic Supply Points – Band 0 to 73.2 MWh pa

	No. Active at 16/03/06	Of These: No. Data Collected	Of These: No. Active 17/03/05	Of These: No. Pass Validation	% Passing Validation
SC	268	243	242	228	94%
NO	274	227	224	208	93%
NW / WN	264	222	222	196	88%
NE	299	228	225	208	92%
EM	260	219	219	200	91%
WM	269	206	206	187	91%
WS	274	237	237	217	92%
EA	277	239	238	223	94%
NT	261	248	248	228	92%
SE	260	214	213	202	95%
SO	269	235	235	220	94%
SW	265	217	217	204	94%
TOTAL	3,240	2,735	2,726	2,521	92%

- Instances below 200 count identified

# Sample Data Available: Small NDM DATALOGGERS

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

Active Dataloggers at Start of Analysis Period (at 01/04/06)	11,382
Total Number of Small NDM Validated Dataloggers	9,664
Total Number of Validated Supply Points:	5,708 (5,900)
73.2 to 293 MWh pa Range (Combined with Datarecorders: 1,219)	550 (505)
293 to 2,196 MWh pa Range	5,158 (5,395)

- 2006 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	2,521 Supply Points <i>(Domestic sub-set)</i> OR 2,569 Supply Points <i>(Incl. Some non-domestic)</i>
73.2 to 293 MWh pa (EUC Band 2)	12 Months Combined Data Recorder & Datalogger Data	1,219 Supply Points
293 to 2,196 MWh pa (EUC Band 3 & 4)	12 Months Datalogger Data	5,158 Supply Points

- Small NDM Analysis undertaken at individual LDZ level
- Reduction of 313 from 2006
- 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 2006 - no significant reason for changing the EUC bandings from 'current'
  - 2007 Investigates:
    - Configuration of 0 to 73.2 MWh pa (Sub Bands split & Inclusion non-domestics)
    - Split Band 2 at 145 MWh pa
    - Split Band 4 at 1,465 MWh pa

## 0-73.2 MWh pa: Data Set Identification & Impacts

### Impacts of Sub Bands Split

- Previously undertaken in 2005, completed again this year

	ILF	Population %	AQ %
0-73.2	35%	100%	100%
0 - 10	34%	17.3%	5.4%
10 - 20	34%	42.2%	33.2%
20 - 30	36%	27.4%	34.3%
30 - 73.2	37%	13.1%	27.1%

- Comparison of ILF for 0 -73.2 and ILF for Sub Bandings within 0 -73.2
- Sub bands: ILF spread per LDZ is small (3% pts)
- Whole band: ILF spread per LDZ is larger (11% pts) – More distinguishable
- Sub banding analysis would also require aggregation of LDZs due to sample size numbers
- Better deployed modelling individual LDZs rather than sub-bands

## 0-73.2 MWh pa: Data Set Identification & Impacts

### Domestic & Non-Domestic Inclusion

- Data Recorder data collection (site visits) allows identification of site usage (Domestic or I&C)
- 'Domestic' or 'I&C' classified based on site visit at time of collection
- Historic analysis has used Domestic Supply Points only
- But - 0-73.2 MWh pa contains 'domestic' and 'I&C'
- Following slides illustrate:
  - Issues for identification in determining 0-73.2 MWh datasets
  - Impacts of inclusion of non-domestic data
  - Modelling impacts

## 0-73.2 MWh pa: Data Set Identification & Impacts Domestic & Non-Domestic Inclusion

- Pre-competition figures (~1992) indicate around 2% non-domestic
- Market Sector Flag (MSF) instituted some years ago
  - No MSF information available for ~8.9 million Meter Points (04/07)
  - ~11.8 million Meter Points classified to date: ~1.8% are non-domestic
  - Separate treatment of domestic/non-domestic is not currently feasible due to of accuracy and verification persisting with MSF
- Analysis - Inclusion of a proportion of non-domestic sample points: ILF and  $R^2$  values are not significantly different. Leads to lower positive or negative weekend factors in the 01B model
  - Weekend (Fri/Sat/Sun) Scaling Factor (SF) patterns continue to indicate under estimations of demand (as with previous years) with inclusion of non-domestics
- From a modelling perspective this leads to lower accuracy

# 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%	228	41%	98%	232
NO	34%	98%	208	35%	98%	212
NW / WN	38%	98%	196	38%	98%	200
NE	38%	97%	208	39%	97%	212
EM	37%	98%	200	37%	98%	204
WM	34%	99%	187	34%	98%	191
WS	34%	98%	217	34%	98%	221
EA	33%	98%	223	33%	98%	227
NT	32%	99%	228	32%	99%	232
SE	32%	98%	202	32%	98%	206
SO	30%	98%	220	30%	98%	224
SW	33%	98%	204	33%	98%	208

- *Indicative Load Factor* : *R<sup>2</sup> Multiple Correlation Coefficient* : *Sample Size*

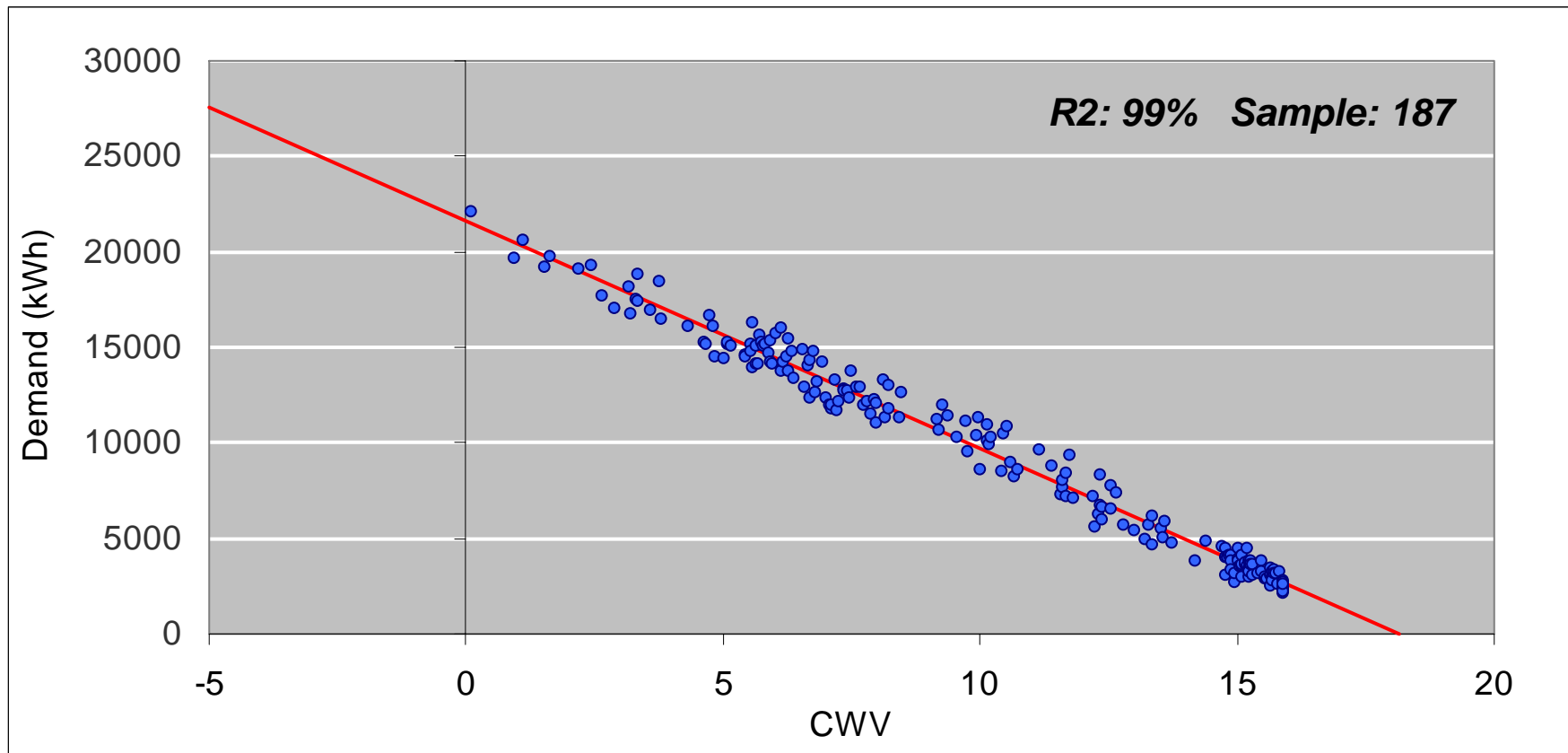
# Representing 0 - 73.2 MWh pa (Band 1): Proposed Approach

- 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: small effect up to 0.4% pts.
  - Sat. up to 1.3% pts.
  - Sun. up to 1.7%pts.

*9 / 13 / 13 LDZs worse in respect of Fri / Sat / Sun*
- Therefore proposed approach is: *(same as spring 2006 & 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

# Demand Against CWV (Mon-Thu : Holidays Included)

Example: WM LDZ : 0 - 73.2 MWh pa

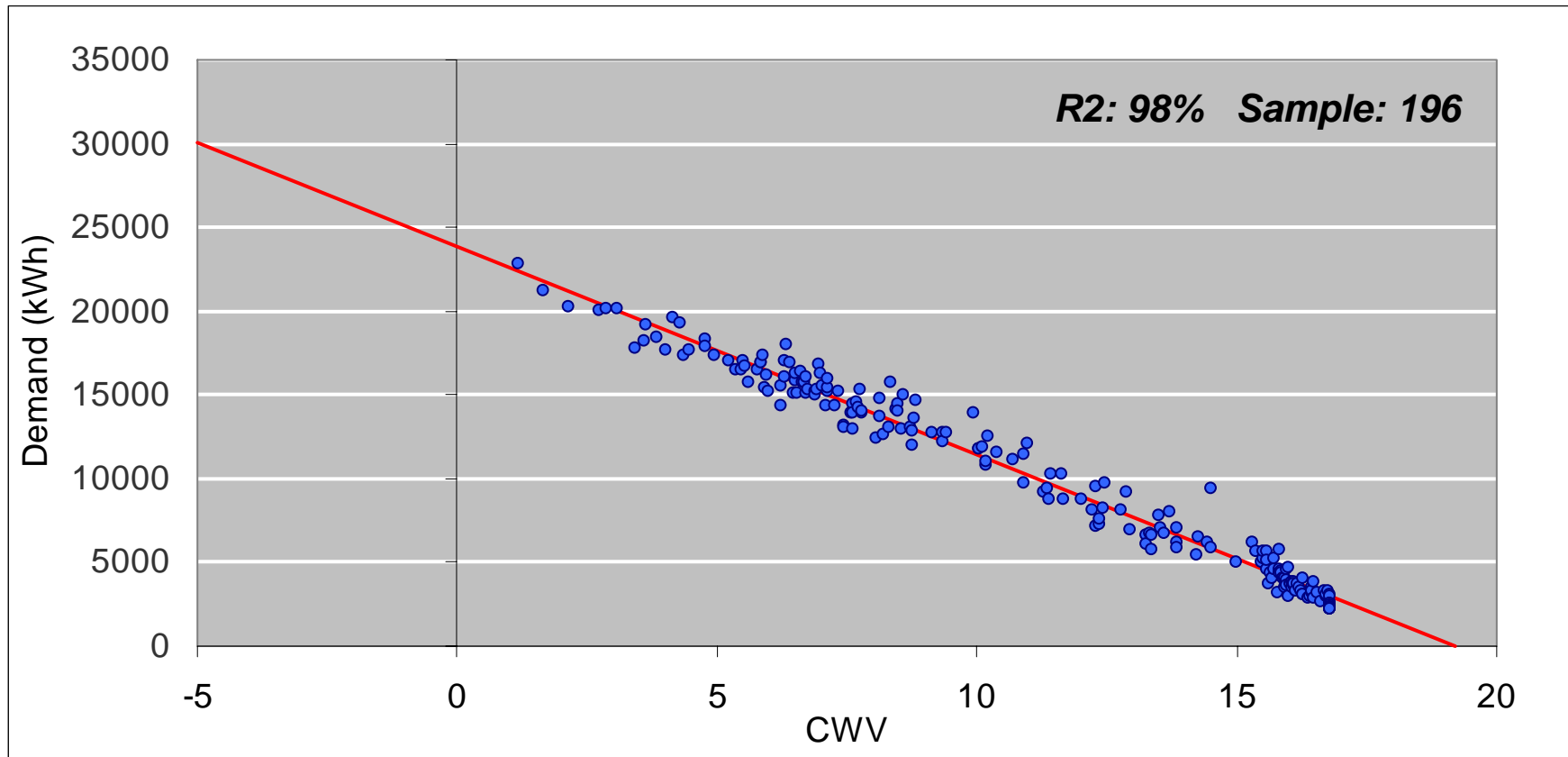


- Representative of 0 – 73.2 MWh pa Model (highlighted: lower sample count)
- Low CWV: More ‘severe’ weather: Higher demand
- Regression analysis – ‘goodness of fit’ to data – derive model variables



# Demand Against CWV (Mon-Thu : Holidays Included)

Example: NW LDZ : 0 - 73.2 MWh pa



- Low CWV: More 'severe' weather: Higher demand
- Regression analysis – 'goodness of fit' to data – derive model variables

# 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	38%	98%	88	40%	98%	41	38%	96%	47
	NO / NW / WN	31%	95%	218	34%	96%	84	30%	95%	134
	NE / EM/ WM	29%	96%	296	28%	96%	149	29%	95%	147
	EA / NT / SE	30%	96%	353	32%	97%	128	29%	96%	225
	WS / SO / SW	30%	97%	264	31%	96%	138	30%	96%	126

- 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

	2006/07		2005/06		2004/05	
	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	40%	38%	38%	37%	-	-
SC / NO / NW / WN	-	-	-	-	33%	32%
NO / NW / WN	34%	30%	33%	31%	-	-
NE / EM / WM	28%	29%	31%	31%	29%	30%
EA / NT / SE	32%	29%	34%	33%	32%	33%
WS / SO / SW	31%	30%	31%	29%	30%	30%

- Differences in ILF values across the sub-bands are generally small and 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 2006/07 Data Set			
	NO SPLIT 73.2 to 293	SPLIT 73.2 to 145 145 to 293	Improvement (+) or Degradation (-) Using Two Bands	
			CURRENT: 2006/07	2005/06
SC	454359.3	512280.1	-12.7%	-13.2%
NO / NW / WN	1817843.2	1727259.8	5.0%	-10.0%
NE / EM / WM	2639060.3	2734173.0	-3.6%	-6.7%
EA / NT / SE	2808524.3	2734114.6	2.6%	-1.2%
WS / SO / SW	1400596.5	1454329.3	-3.8%	-2.1%
OVERALL	840831.2	865721.9	-3.0%	-5.3%

- 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
- 'Fit' is better in 2006/07 than 2005/06 but still insufficient evidence & aggregation issue

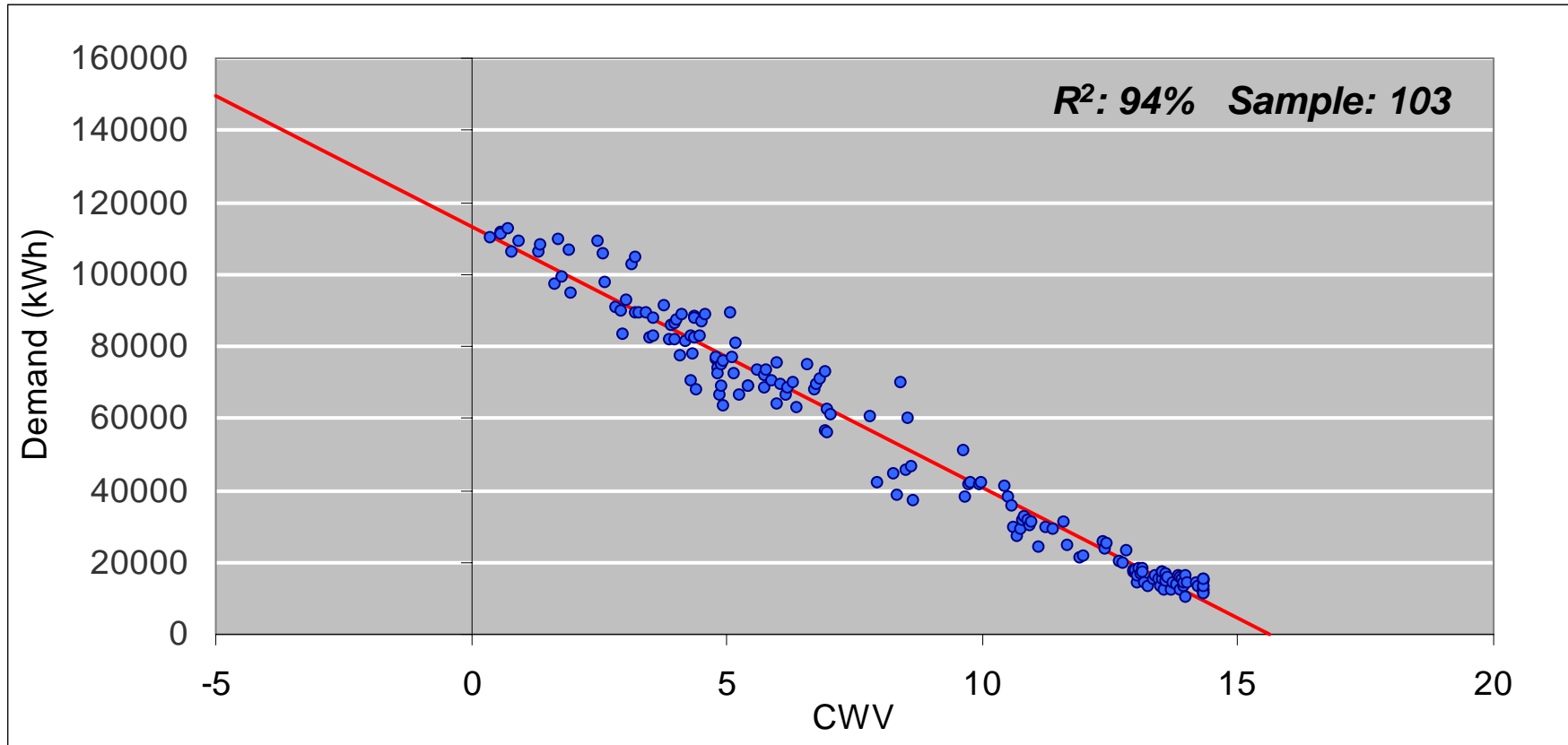
# PROPOSED APPROACH: Small NDM Indicative Load Factors

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

	Indicative Load Factor	R <sup>2</sup> Multiple Correlation Coefficient	Sample Size
SC	38%	98%	88
NO	28%	94%	103
NW / WN	33%	96%	115
NE	29%	94%	94
EM	30%	96%	103
WM	28%	96%	99
WS	29%	95%	73
EA	29%	95%	100
NT	31%	97%	127
SE	29%	95%	126
SO	31%	97%	91
SW	29%	96%	100

# Demand against CWV, (Mon-Thu : Holidays Excluded)

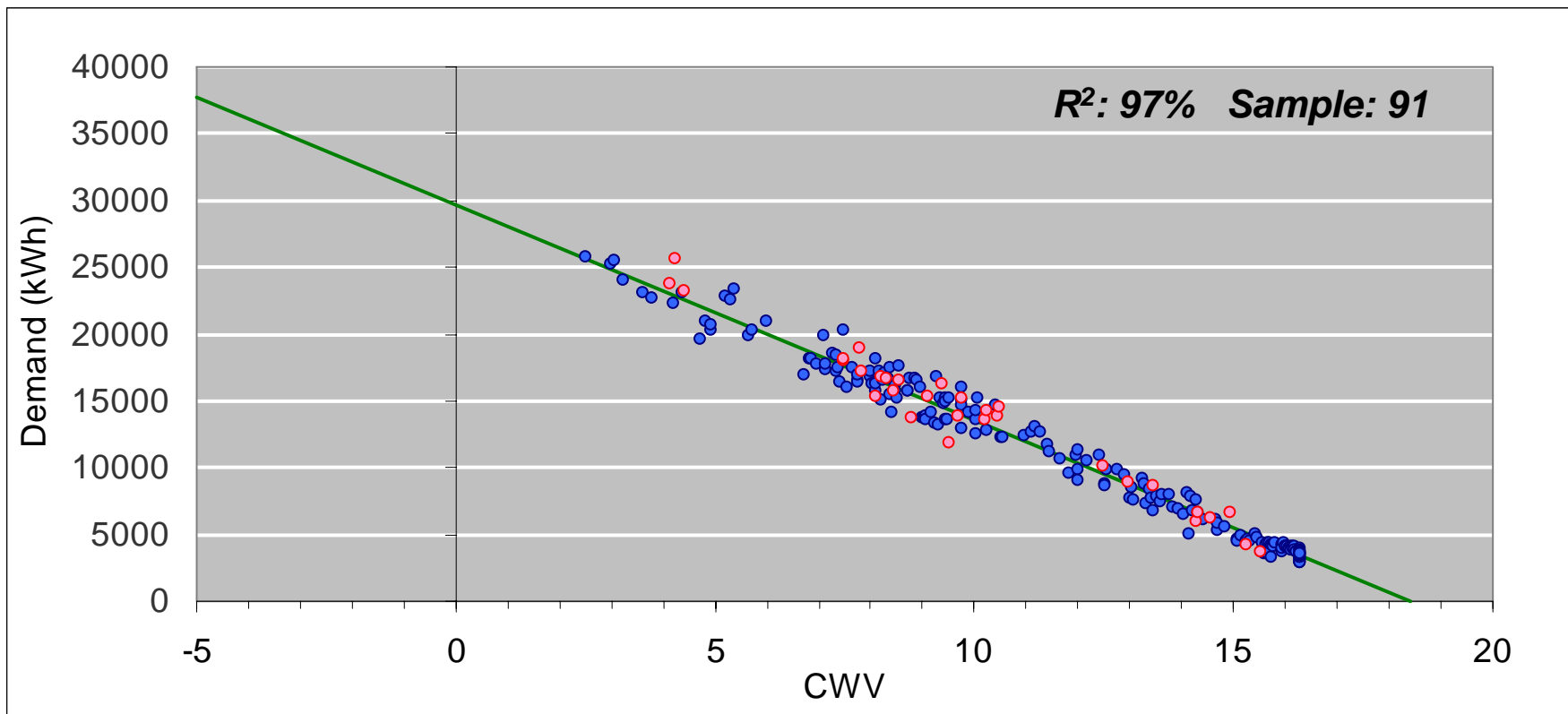
Example: *NO LDZ : EUC Band 2 : 73.2 – 293 MWh pa*



- Representative of 73.2 – 293 MWh pa
- Smaller  $R^2$  value – still good fit

# Demand against CWV, (Mon-Thu : Holidays Excluded)

Example: *SO LDZ : EUC Band 2 : 73.2 – 293 MWh pa*



- Red markers indicate Fridays sample data
- As last year – Indicates a small (0.16%) positive Weekend Factor for Friday
- Fridays not noticeably different from weekdays

# 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 2,196 MWh pa			732 TO 1,465 MWh pa			1,465 TO 2,196 MWh pa		
SC	37%	97%	114	40%	98%	191	38%	97%	167	39%	98%	358
NO	31%	95%	76	31%	95%	134	29%	95%	124	30%	95%	258
NW / WN	32%	94%	147	33%	96%	226	36%	97%	199	35%	97%	425
NE	31%	94%	86	32%	93%	149	37%	97%	113	34%	94%	262
EM	31%	96%	120	31%	95%	198	33%	96%	147	32%	96%	345
WM	23%	92%	75	26%	96%	151	30%	96%	151	29%	96%	302
EA	31%	95%	113	30%	97%	225	32%	97%	133	31%	97%	358
NT	32%	95%	143	33%	97%	211	35%	98%	196	34%	98%	407
SE	31%	96%	165	32%	97%	280	33%	97%	180	32%	97%	460
WS	30%	95%	78	26%	94%	85	31%	97%	63	29%	95%	148
SO	26%	96%	102	28%	97%	174	32%	98%	115	30%	98%	289
SW	29%	96%	84	32%	97%	153	36%	98%	90	34%	97%	243

- 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

	2005/06		2004/05		2003/04	
	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	40%	38%	41%	40%	40%	40%
NO	31%	29%	31%	33%	31%	32%
NW / WN	33%	36%	35%	37%	35%	37%
NE	32%	37%	35%	35%	34%	35%
EM	31%	33%	34%	37%	34%	35%
WM	26%	30%	31%	32%	30%	31%
EA	30%	32%	34%	35%	34%	36%
NT	33%	35%	34%	36%	35%	37%
SE	32%	33%	34%	35%	34%	37%
WS	26%	31%	30%	33%	31%	34%
SO	28%	32%	31%	34%	31%	32%
SW	32%	34%	33%	34%	33%	36%

- ILF sub-band difference's: small & inconsistent across LDZs within & between years
- Only 3 LDZs indicate a minor (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 2006/07 Data Set			
	NO SPLIT 732 to 2196	SPLIT 732 to 1465 1465 to 2196	Improvement (+) or Degradation (-) Using Two Bands	
			CURRENT: 06/07	05/06
SC	762843.9	788702.7	-3.4%	-3.2%
NO	540386.5	554302.1	-2.6%	-5.3%
NW / WN	1294926.7	1326507.0	-2.4%	-6.4%
NE	779021.1	809415.3	-3.9%	-9.1%
EM	1130228.7	1153585.2	-2.1%	-7.7%
WM	1098746.9	1146965.6	-4.4%	-4.1%
EA	351864.6	367177.2	-4.4%	-7.2%
NT	855868.8	869720.3	-1.6%	-5.2%
SE	1168381.6	1204963.6	-3.1%	-3.3%
WS	1021202.9	1029347.2	-0.8%	-10.0%
SO	689766.7	714889.3	-3.6%	-6.1%
SW	543045.4	557547.0	-2.7%	-3.2%
Overall	911400.6	944114.8	-3.6%	-6.4%

- No Improvement in RMSE ('goodness of fit') when splitting Band 4
- RMSE analysis shows a degradation in model / profile accuracy when split
- Combined with minimal impact on R<sup>2</sup> and ILF values
- Retain current approach
- EUC split at 1,465 is not proposed

# 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 zero as a result of the 2006/07 'warm' winter

# 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 – 0.41	0.41 – 0.49	0.49 – 0.57	0.57 – 1.00	
SC	132	168	123	49	472
NO	57	110	116	51	334
NW / WN	156	156	175	85	572
NE	87	96	104	61	348
EM	88	128	135	114	465
WM	83	85	100	109	377
EA	72	158	132	109	471
NT	117	184	149	100	550
SE	110	215	177	123	625
WS	45	57	76	48	226
SO	93	119	109	70	391
SW	76	90	85	76	327
Total	1,116	1,566	1,481	995	5,158

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

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

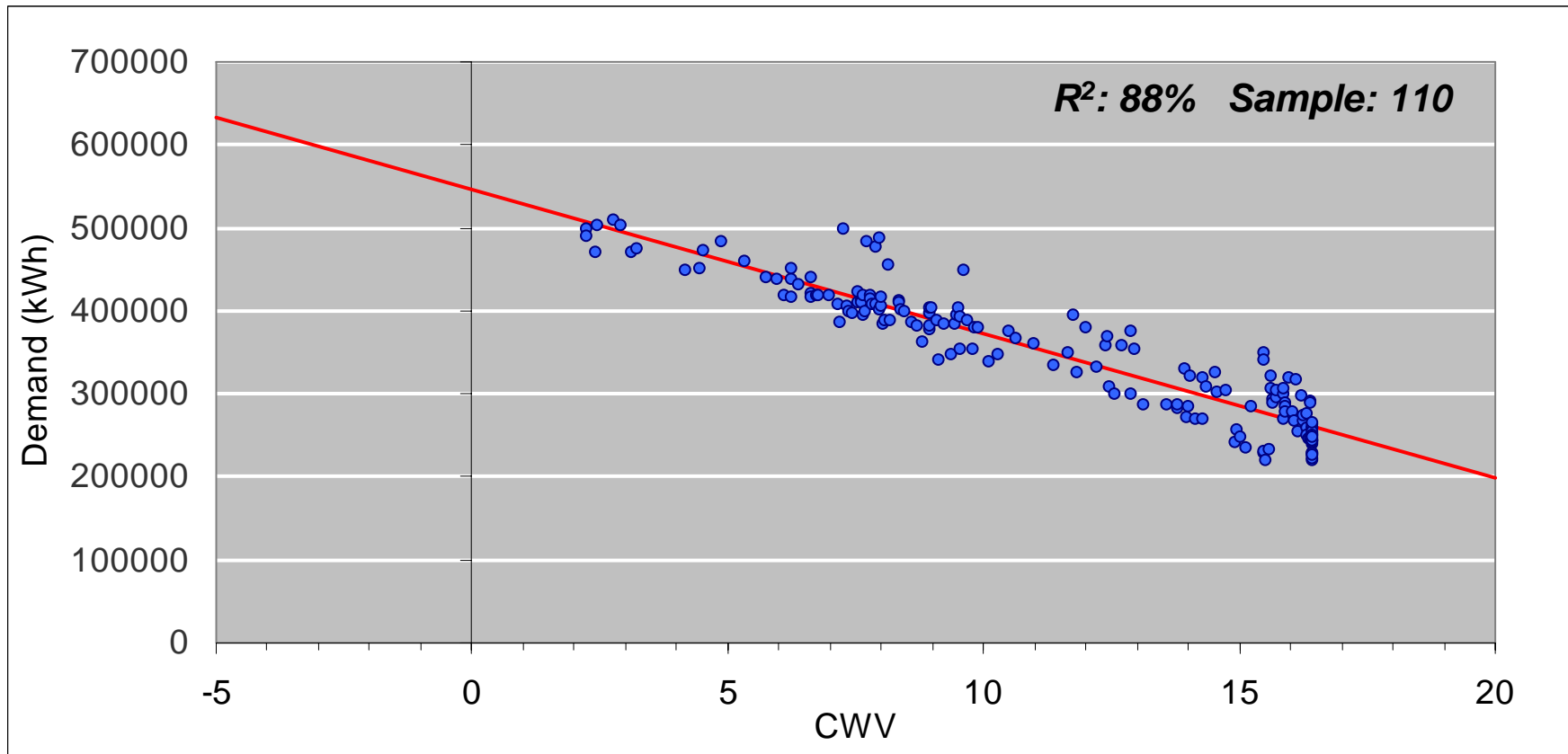
## Indicative Load Factors

	WAR Banding											
	0.00 – 0.41			0.41 – 0.49			0.49 – 0.57			0.57 – 1.00		
SC	60%	94%	132	42%	98%	168	30%	96%	123	24%	95%	49
NO	54%	94%	57	36%	96%	110	25%	94%	116	20%	96%	51
NW / WN	59%	94%	156	40%	97%	156	27%	95%	175	22%	96%	85
NE	57%	96%	87	40%	97%	96	27%	93%	104	21%	94%	61
EM	59%	95%	88	40%	98%	128	29%	96%	135	22%	95%	114
WM	56%	95%	83	35%	97%	85	25%	95%	100	18%	95%	109
EA	58%	94%	72	41%	98%	158	27%	96%	132	21%	95%	109
NT	61%	93%	117	40%	98%	184	28%	97%	149	22%	95%	100
SE	56%	88%	110	41%	97%	215	27%	96%	177	21%	94%	123
WS	58%	87%	45	39%	98%	57	25%	94%	76	20%	94%	48
SO	55%	92%	93	35%	98%	119	23%	96%	109	18%	95%	70
SW	62%	91%	76	41%	98%	90	27%	96%	85	21%	95%	76

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

# Demand against CWV (Mon-Thu : Holidays Excluded)

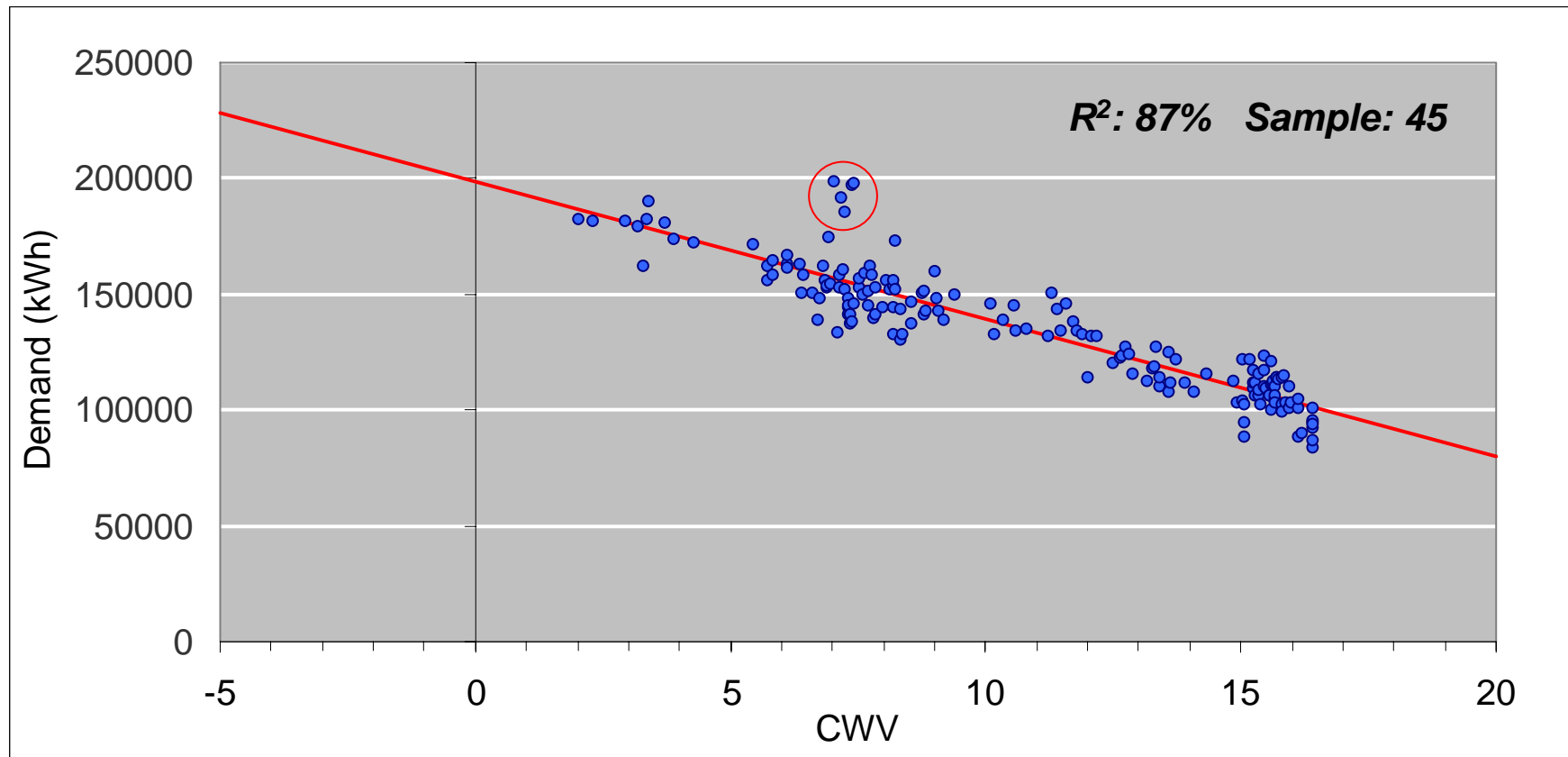
Example: SE LDZ : EUC Band 3&4 : 293 - 2196 MWh pa : WAR Band 1



- Low  $R^2$  value: Some data scatter – No significant or explanatory events identified
- Still identifies the CWV demand relationship - valid data

# Demand against CWV (Mon-Thu : Holidays Excluded)

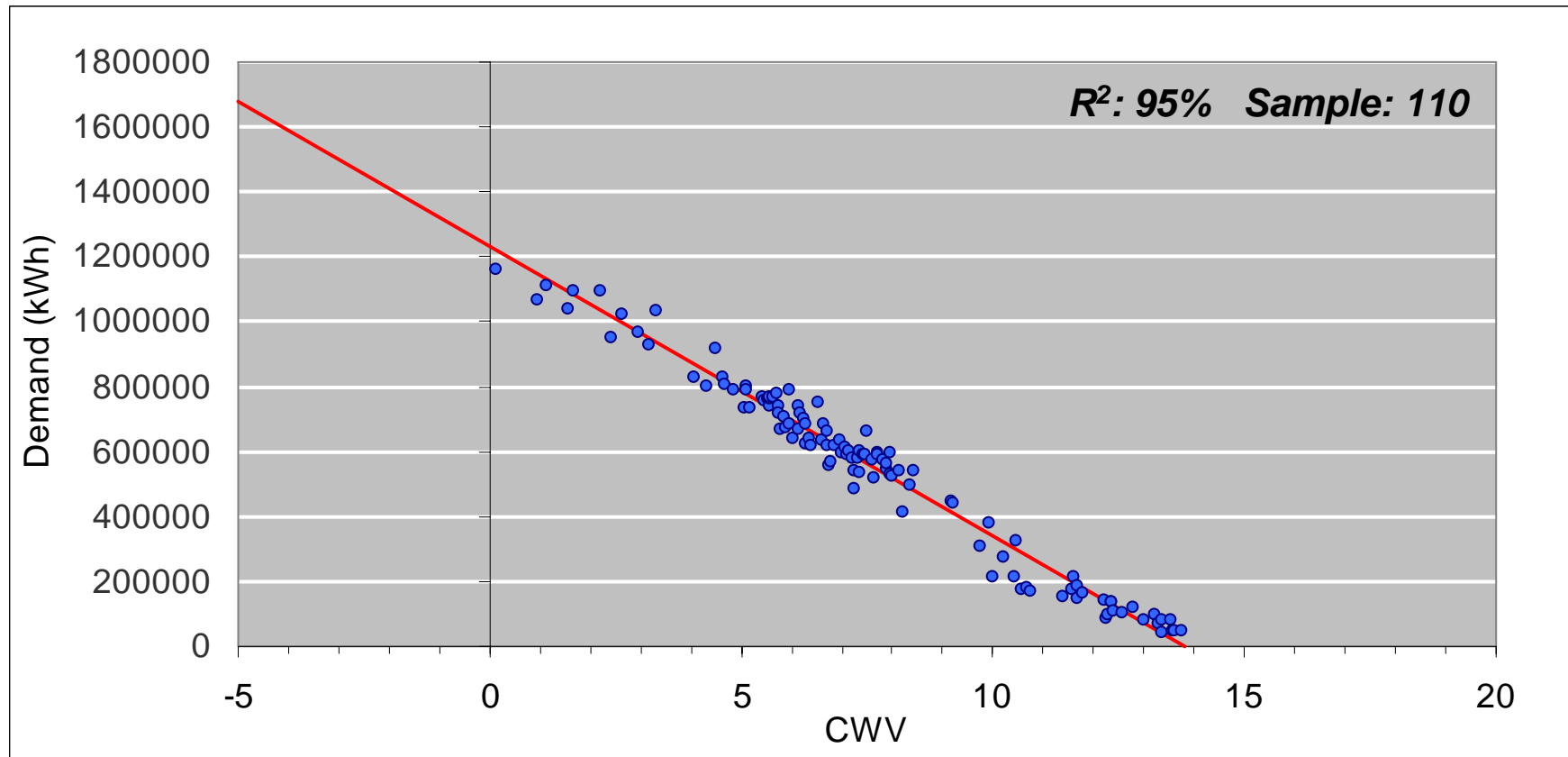
Example: WS LDZ : EUC Band 3&4 : 293 - 2196 MWh pa : WAR Band 1



- Low R<sup>2</sup> value: Some data scatter – No significant or explanatory events identified: April 2006 (post 'cold snap' impacts)
- Still identifies the CWV demand relationship - valid data

# Demand against CWV (Mon-Thu : Holidays Excluded)

Example: WM LDZ : EUC Band 3&4 : 293 - 2196 MWh pa : WAR Band 4



- Lower ILF (18%): Lower CWV intercept, steeper slope = peakier model
- Good  $R^2$  value, good fit – SO indicates a similar profile and fit



# SMALL NDM: EUC Smoothed Models - Provisional Results

- Review of provisional model results

Number 'Straight' (no cut-offs, no summer reductions)	41	(37)
Number with Warm Weather Cut-Off	54	(32)
Number with Summer Reduction	89	(108)
Number with no Slope (weather insensitive)	0	(0)
Number with Cut-Offs and Reductions	28	(21)
		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 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 (75%)
- Modelling is undertaken as reflected by the sample data

# Small NDM – Proposals for Analysis

- Therefore:
  - 0 to 73.2 MWh pa
    - Consumption Band Analysis by LDZ
    - Use Domestic sites only – do not use IAC
  - 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 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	Small NDM	Large NDM
Number of Active Dataloggers As At 01/04/2006	16,631	11,382	5,249
Number of Validated Dataloggers	14,520	9,664	4,856
Number of Supply Points After Validation	2007 Analysis	2006 Analysis	
Large NDM	4,751	5,240	
Small NDM	5,708	5,900	
Total	10,459	11,140	

- Small NDM Dataloggers used in Small NDM analysis (previously reviewed)
- Large NDM Dataloggers has reduced by 489 since 2006
- Result of site terminations and the increased impact of missing read periods
- 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 2006 - values shown (x)
- Possible future issue with WAR Band analysis for consumption Band 8

	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	321	102	33	13	13
NO	177	75	22	15	17
NW & WN	365	161	32	33	23
NE	204	83	41	16	8
EM	240	116	49	33	24
WM	306	115	51	34	26
EA	197	83	26	8	4
NT	364	119	14	7	5
SE	238	81	12	13	4
WS	101	51	18	10	9
SO	223	73	32	11	7
SW	175	75	26	11	6
<b>TOTAL</b>	<b>2,911</b>	<b>1,134</b>	<b>356</b>	<b>204</b>	<b>146</b>

- Aggregations highlighted

# Available Sample Data: Large NDM Dataloggers

## *Changes in Disposition Sample Available for Analysis (2006 to 2007)*

	2,196 - 5,860	5,860 – 14,650	14,650 – 29,300	29,300 – 58,600	>58,600
SC	-56	-1	1	3	2
NO	-21	0	-1	3	-2
NW & WN	-47	-19	-15	2	-2
NE	-15	-11	3	-6	3
EM	-39	-5	-10	1	4
WM	-45	-29	-10	-5	3
EA	-9	-10	-2	-4	-1
NT	-32	-5	-4	-2	1
SE	-47	-6	-4	1	-1
WS	-15	4	-5	-1	1
SO	-8	-7	-3	2	1
SW	-12	-6	-4	2	1
TOTAL	-346	-95	-54	-4	10

- Has not impacted aggregation requirements - Compare to actual population



# 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	2,911 (43%)	6,750
5,860 to 14,650 MWh pa	1,134 (56%)	2,020
14,650 to 29,300 MWh pa	356 (59%)	600
29,300 to 58,600 MWh pa	204 (75%)	270
>58,600 MWh pa	146 (86%) (2)	170 (3)

## Notes:

1. Approx. for all Firm supply points at April 2007 : >2,196 MWh represents 10.8% 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 2007 was 14 (~0.21% 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	72%	98%
0 – 2,196 MWh pa	89%	99.96%
>2,196 MWh pa	11%	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 more than 2/3 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 (>2196 MWh pa)

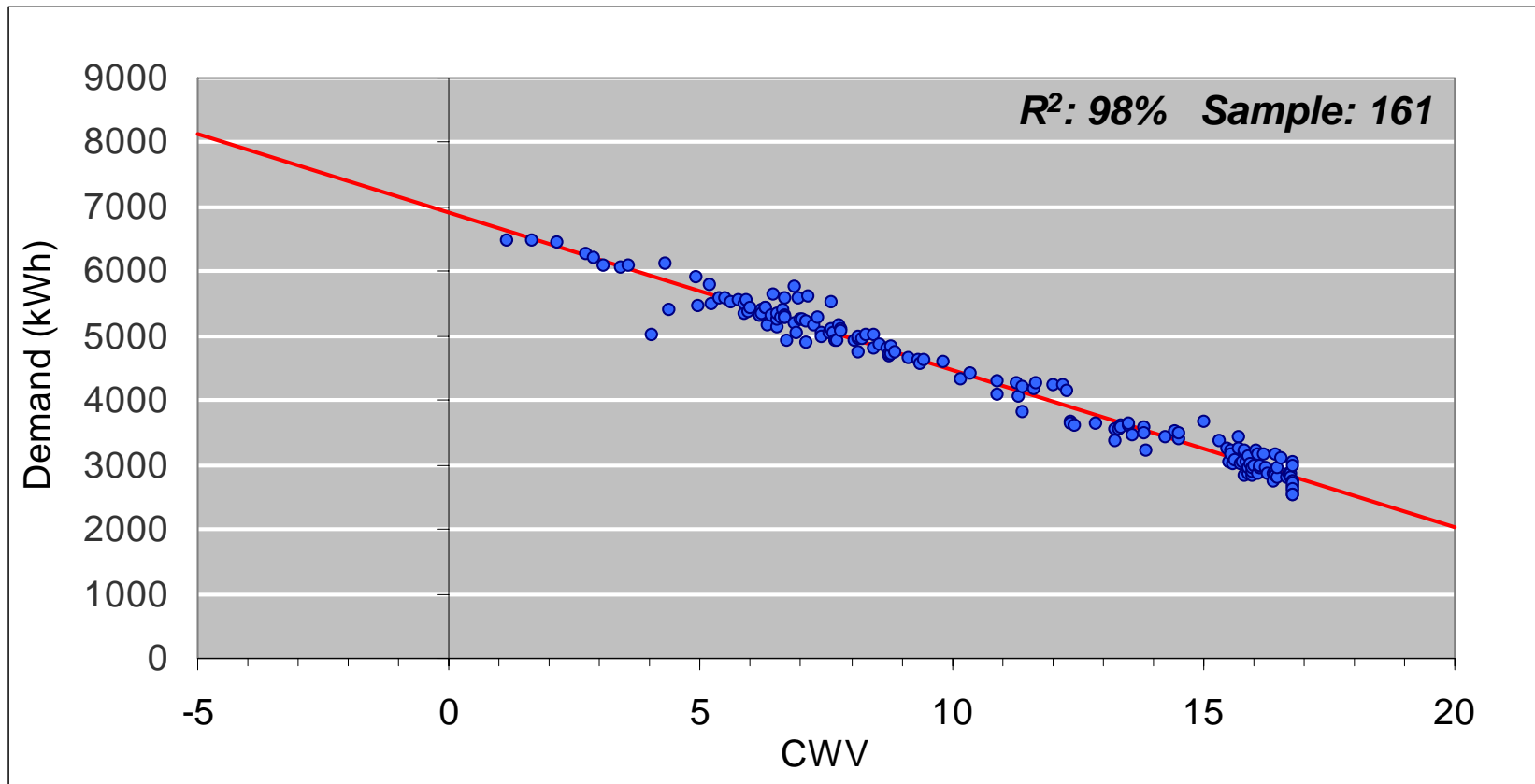
## Consumption Band Analyses – Indicative Load Factors

	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	42%	98%	321	46%	98%	102	58%	95%	33	70%	93%	61	71%	93%	146
NO	36%	98%	177	42%	97%	75	51%	98%	54						
NW / WN	40%	97%	365	50%	98%	161				53%	98%	141			
NE	38%	97%	204	46%	97%	83	50%	98%	52						
EM	41%	98%	240	46%	98%	116				46%	97%	76			
WM	35%	98%	306	43%	97%	115	38%	98%	238						
EA	36%	98%	197	43%	98%	83				34%	98%	223			
NT	40%	98%	364	46%	98%	119	38%	98%	175						
SE	38%	98%	238	46%	98%	81				45%	97%	75			
WS	38%	98%	101	43%	98%	51									
SO	34%	98%	223	37%	98%	73									
SW	38%	98%	175	45%	97%	75									

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

# Demand Against CWV (Mon-Thu : Holidays Excluded)

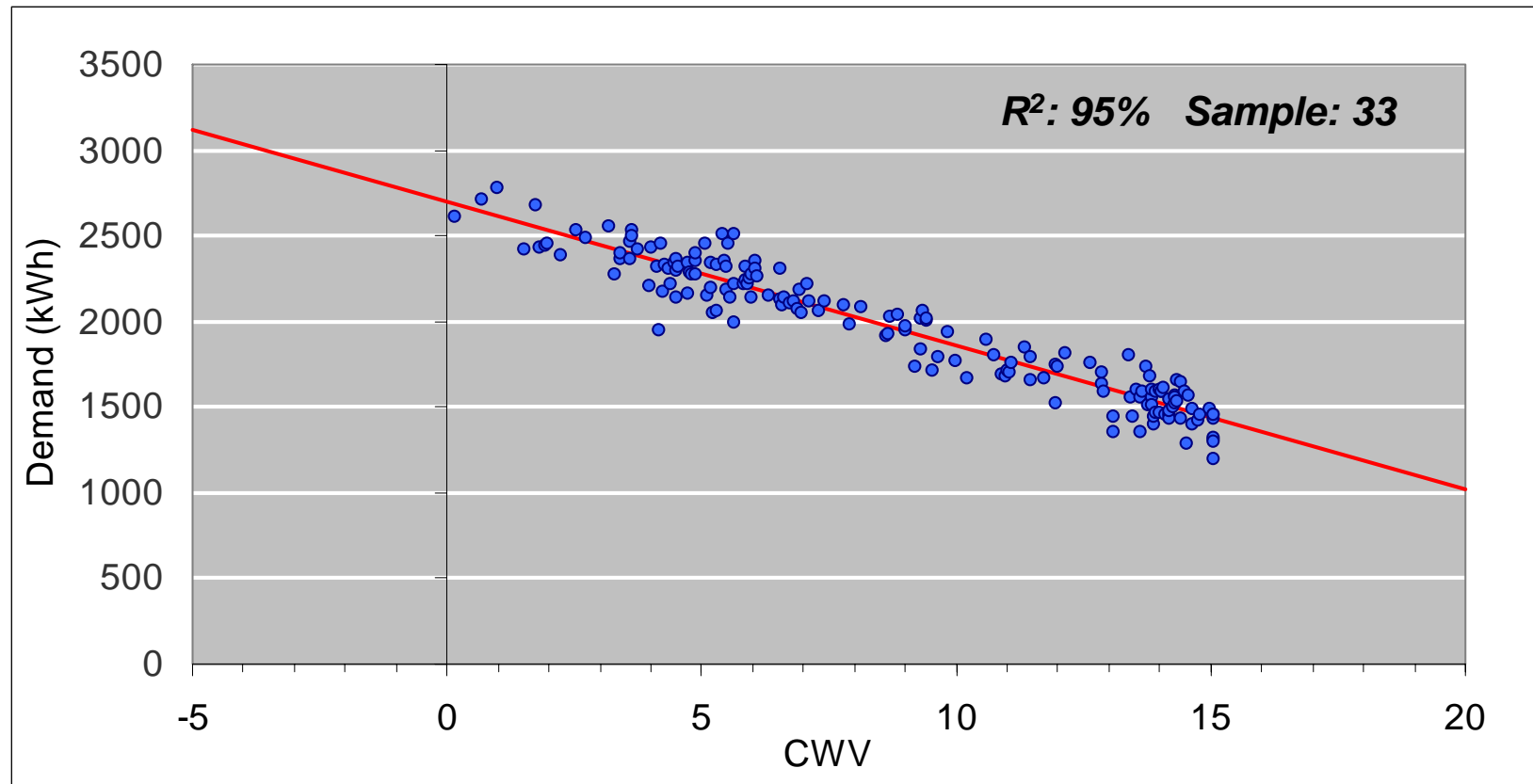
*NW/WN LDZ (5 LDZ Group Analysis) : EUC Band 6 : 5860-14650 MWh pa (NW CWV)*



- Higher ILF than other LDZs in Band 6
- Representative of sample data, model appears sound

# Demand Against CWV (Mon-Thu : Holidays Excluded)

## SC LDZ : 14650 - 29300 MWh pa, EUC Band 7 (SC CWV)



- Lower sample count. Model appears sound (sample count was 32 last year – only 47 Supply Points in Band 7 in SC in total)

# Large NDM Supply Points (2,196 to 5,860 MWh pa)

## Count of Validated Sample Numbers per WAR Band

- Consumption Band 5: Aggregations Required at WAR due to further data splits

	WAR Banding				TOTAL
	0.00 – 0.37	0.37 – 0.44	0.44 – 0.52	0.52 – 1.00	
SC	49	99	119	54	321
NO	30	58	51	38	177
NW / WN	96	116	78	75	365
NE	48	58	52	46	204
EM	62	76	54	48	240
WM	63	91	83	69	306
WS	28	23	28	22	101
EA	33	47	61	56	197
NT	51	125	129	59	364
SE	30	77	76	55	238
SO	39	61	73	50	223
SW	45	44	46	40	175
TOTAL	574	875	850	612	2,911

# 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 – 0.37	0.37 – 0.44	0.44 – 0.52	0.52 – 1.00
SC	49	99	119	54
NO / NW / WN	126	174	129	113
NE / EM / WM	173	225	189	163
EA / NT / SE	114	249	266	170
WS / SO / SW	112	128	147	112
<b>TOTAL</b>	<b>574</b>	<b>875</b>	<b>850</b>	<b>612</b>

- Sample sizes healthier
- Emphasis on stability – robust sample sizes rather than individual LDZ results (and risk of anomalous results)
- Comparable with 2006

# 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 - 0.37			0.37 – 0.44			0.44 – 0.52			0.52 – 1.00		
SC	72%	93%	49	51%	98%	99	37%	97%	119	28%	96%	54
NO / NW / WN	64%	97%	126	49%	97%	174	33%	97%	129	24%	96%	113
NE / EM / WM	67%	98%	173	46%	98%	225	34%	98%	189	23%	96%	163
EA / NT / SE	70%	95%	114	49%	98%	249	37%	98%	266	24%	96%	170
WS / SO / SW	67%	97%	112	45%	98%	128	34%	98%	147	22%	96%	112

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



# Large NDM Supply Points : Remaining Bands 5,860 to >58,650 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 – 0.37	0.37 – 0.46	0.46 – 0.55	0.55 – 1.00
SC/NO/NW/WN	66	108	97	67
NE/EM/WM	71	102	63	78
EA/NT/SE/WS/SO/SW	77	127	178	100
<b>TOTAL</b>	<b>214</b>	<b>337</b>	<b>338</b>	<b>245</b>

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

	0.00 – 0.35	0.35 – 0.41	0.41 – 0.51	0.51 – 1.00
ALL LDZs	65	115	110	66

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

	0.00 – 0.33	0.33 – 0.37	0.37 – 0.45	0.45 – 1.00
ALL LDZs	40	70	52	42

# Large NDM Supply Points : Remaining Bands 5,860 to >58,650 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 – 0.32			0.32 – 0.40			0.40 – 0.48			0.48 – 1.00		
SC/NO/NW/WN	79%	95%	66	59%	97%	108	43%	97%	97	27%	96%	67
NE/EM/WM	81%	94%	71	57%	97%	102	40%	98%	63	26%	96%	78
EA/NT/SE/WS/SO/SW	81%	97%	77	58%	97%	127	41%	98%	178	28%	98%	100

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

	0.00 – 0.31			0.31 – 0.36			0.36 – 0.45			0.45 – 1.00		
ALL LDZs	90%	94%	65	67%	98%	115	46%	97%	110	30%	96%	66

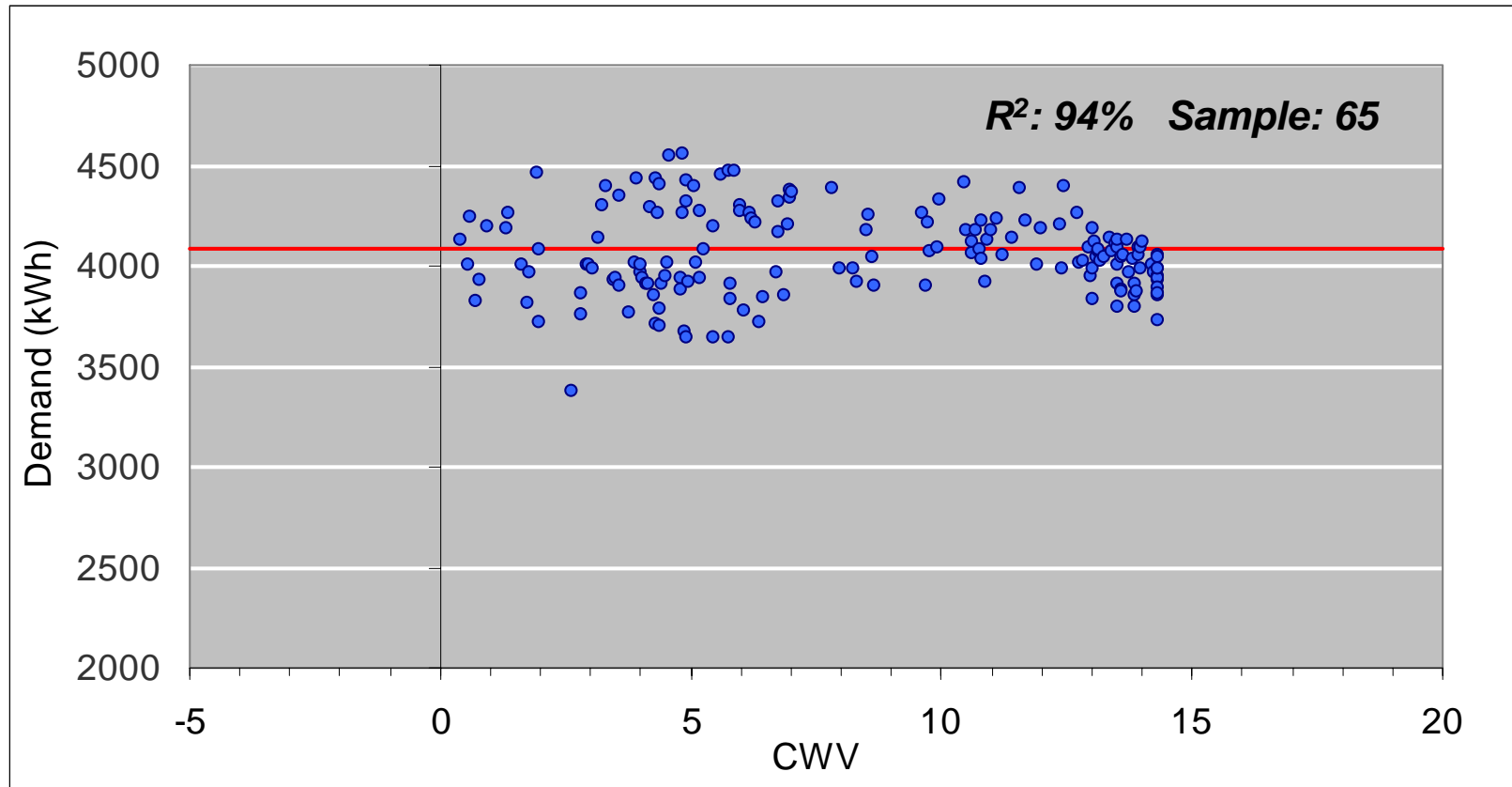
- Consumption Band 8: 29,300 to 58,600 MWh pa : National Aggregations Applied

	0.00 – 0.30			0.30 – 0.33			0.33 – 0.41			0.41 – 1.00		
ALL LDZs	93%	70%	40	82%	95%	70	61%	95%	52	35%	96%	42

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

# Demand Against CWV (Mon-Thu : Holidays Excluded)

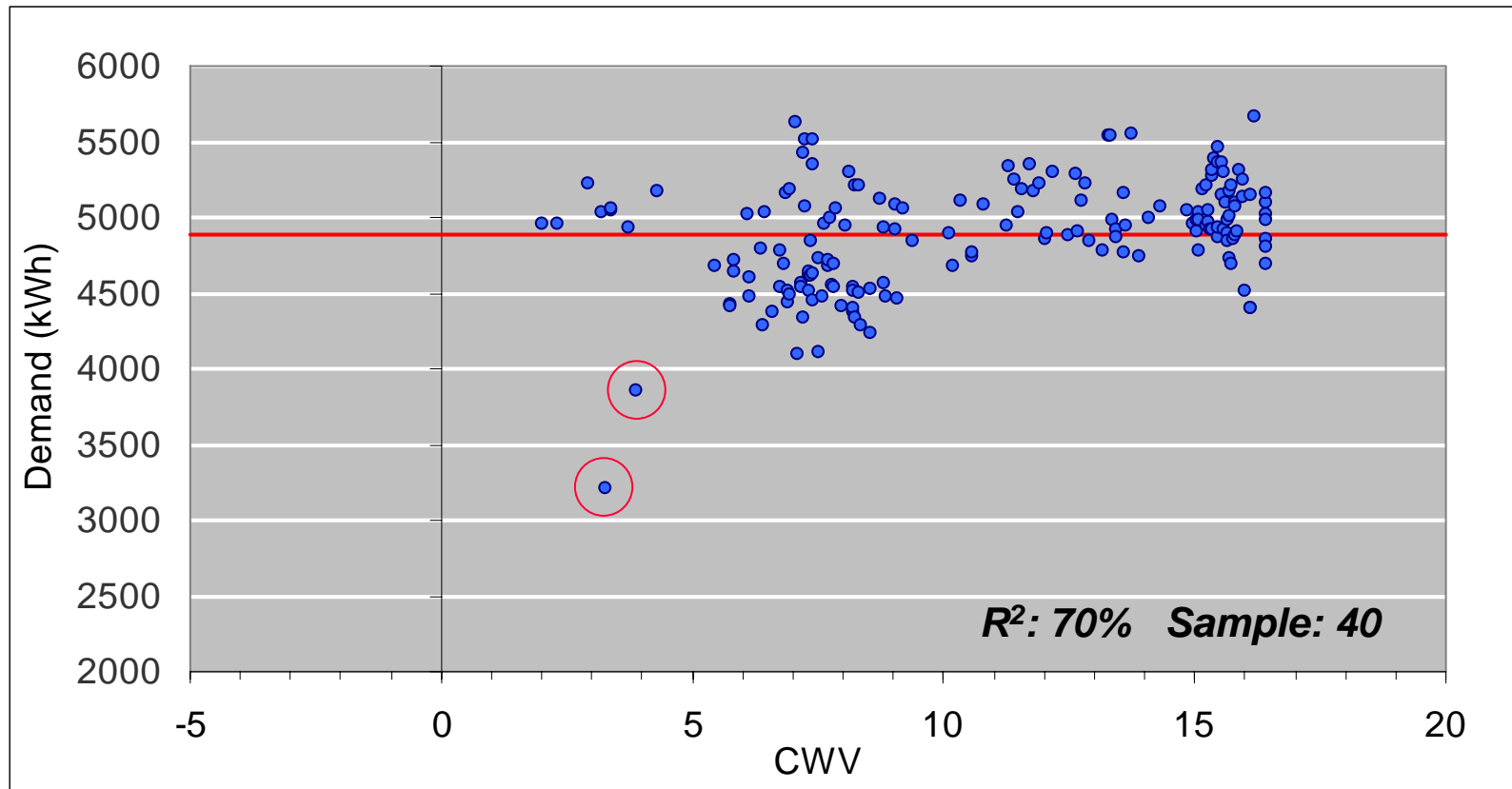
National Aggregation: Band 7 14,650 to 29,300 MWh pa: WAR Band 1: (NO CWV)



- Weather insensitive model
- Data set is reasonable resulting in the high  $R^2$  value

# Demand Against CWV (Mon-Thu : Holidays Excluded)

National Aggregation: Band 8 29,300 to 58,600 MWh pa: WAR Band 1: (WS CWV)



- Weather insensitive model
- Low  $R^2$  value is due to data set scatter = extreme weather insensitivity

# LARGE NDM: EUC Smoothed Models - Provisional Results

- Review of provisional model results

Number 'Straight' (no cut-offs, no summer reductions)	173	(165)
Number with Warm Weather Cut-Off	44	(44)
Number with Summer Reduction	46	(55)
Number with no Slope (weather insensitive)	13	(13)
Number with Cut-Offs and Reductions	3	(4)
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 (89%)
- Modelling is undertaken as reflected by the sample data

# Recommendations

## Issues for DESC Consideration

# 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 published by June 30<sup>th</sup> 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](http://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 2006/07)
- Ongoing Analysis: No significant differences to previous years analysis
- Publication of initial proposals: by 30<sup>th</sup> June
- Publication of final proposals: by 15<sup>th</sup> August



# Issues For DESC Consideration

- Band 8 (29,300 – 58,600 MWh pa) - WAR Band Analysis
  - Current analysis: sample numbers are sufficient, but low - less than 40 is considered too low

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

	0.00 – 0.33	0.33 – 0.37	0.37 – 0.45	0.45 – 1.00
ALL LDZ Aggregation	40	70	52	42

- Possibility that sample sizes will be too small in a years time to undertake WAR band analysis for Band 8 (even on a national basis)
- In addition – there may be insufficient supply points in Band 8 to include in the sample
  - 270 total population : 204 validated sample (75%)
- Options required (sample sizes to be assessed in November 07)