

ACS Demand Concept Definition & Derivation

Phil Sheppard

ACS Demand Concept Definition & Derivation

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Why ACS?

- Under Special Condition AA2 of the Electricity Licence, the licensee is required to plan, develop and operate the licensee's transmission system in accordance with "NGC Transmission System Security and Quality of Supply Standard", Issue 2 (dated November 2000) (known as the SQSS), among other standards.
- The ACS Peak Demand is used in the SQSS in the derivation of the required Planned Transfer Capacity of the Transmission System.

ACS Definition

Average Cold Spell Conditions

A particular **combination** of weather elements which give rise to a level of peak demand within a financial year (1 April to 31 March) which has a 50% chance of being exceeded as a result of weather variation alone.

ACS Definition

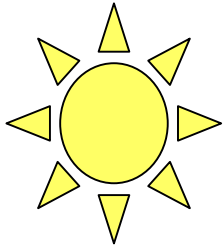
Average Cold Spell Demand

The estimated winter peak demand (MW and Mvar) on the NGC Transmission System for the Average Cold Spell (ACS) condition.

This includes both transmission and distribution losses and represents the demand to be met by Large Power Stations (directly connected or embedded), Medium and Small Power Stations which are directly connected to the NGC Transmission System and by electricity imported into the NGC Transmission System from External Systems across External Interconnections.

Demand Forecasting

Processed Weather Variables



Average Temperature [TO]

- average of 4 spot hourly temperatures up to current hour

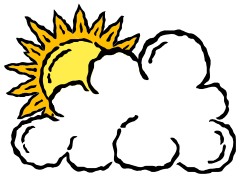
Effective temperature [TE]

- TO lagged to 50% with TE from 24 hours previous



Cooling Power of the Wind [CP]

- empirical combination of Temperature and Windspeed



Effective illumination of the Sky [EI]

- $(EI=MI - ID)$, Where ID is a function of visibility, numbers and types of cloud layers, and the amount of precipitation. MI is the Maximum Illumination assuming no cloud layers

Winter Week Day Peak Demand Modelling

Multiple Regression Model Of Demand

An econometric regression model of the weekday darkness peak is determined on the four previous winters demand & weather data

$$\begin{aligned} \text{Weekday Darkness Peak Demand} = & \text{Mean Darkness Peak Demand} \\ & + \text{Weather Dependant Demand} \\ & + \text{Day of Week} \\ & + \text{Seasonal trends} \\ & + \text{error terms} \end{aligned}$$

The days affected by Christmas & New Year holidays are excluded from the sample

Winter Week Day Peak Demand Modelling

Weather Dependant Demand

Weather Dependant
Demand function

$$f \quad \alpha TE_t + \alpha_2 TE_t^2 + \beta EI_t + \delta CP_t$$

α = coefficient on Effective Temperature at 1700 GMT

α_2 = coefficient on Effective Temperature squared at 1700 GMT

β = coefficient on Effective Illumination at 1700 GMT

δ = coefficient on cooling power of the wind at 1700 GMT

Modelling ACS Demand

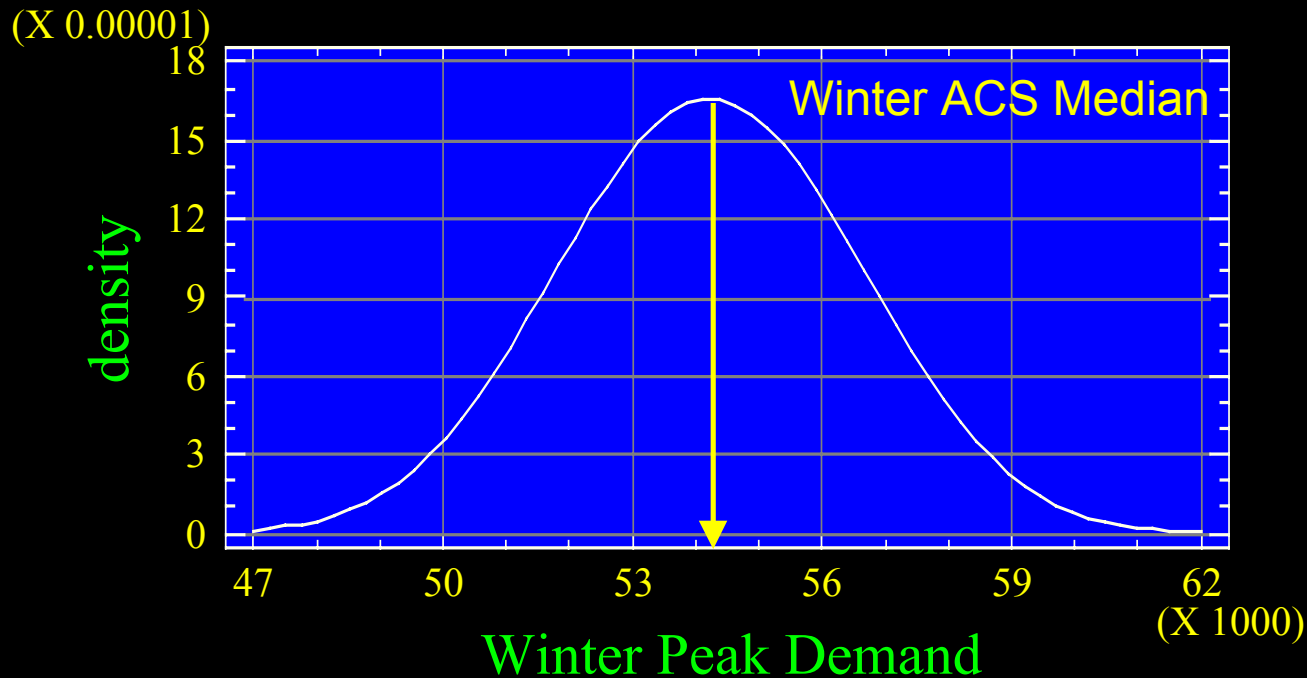
Winter Peak Demand

- Using the historic winter peak data from 1978 a mean and standard deviation is derived for the weather dependant demand
- Using these parameters at the time of winter peak, 10,000 simulations of Weather Dependant Demand are generated, giving a Winter Peak Demand Distribution

Modelling ACS Demand

Winter Peak Demand

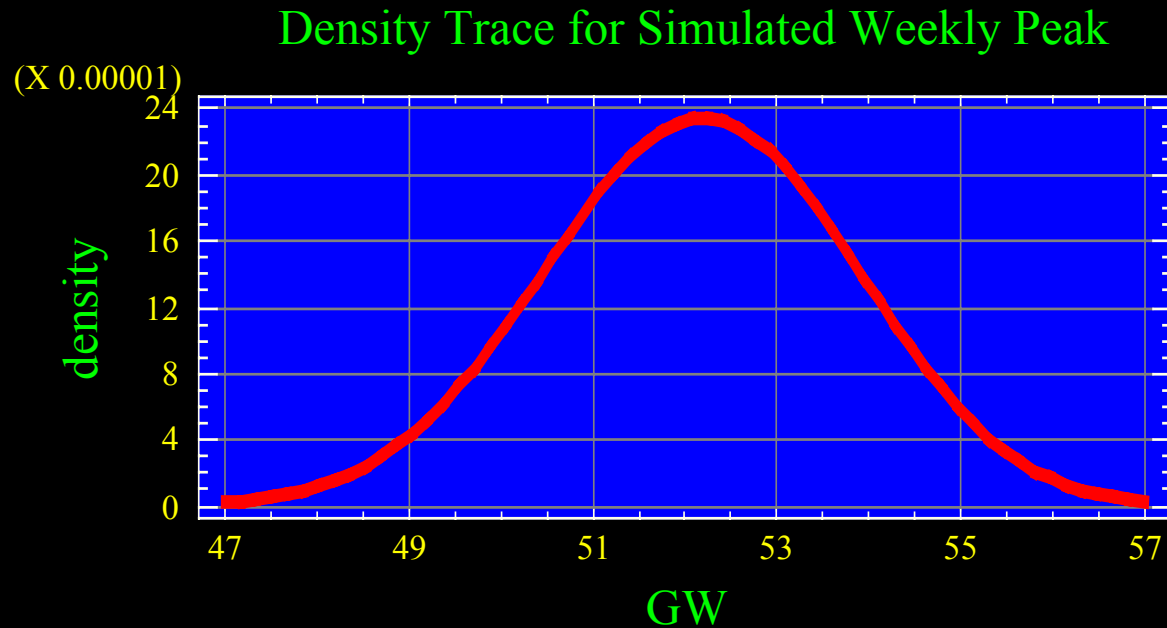
Density Trace for Winter Peak Demand



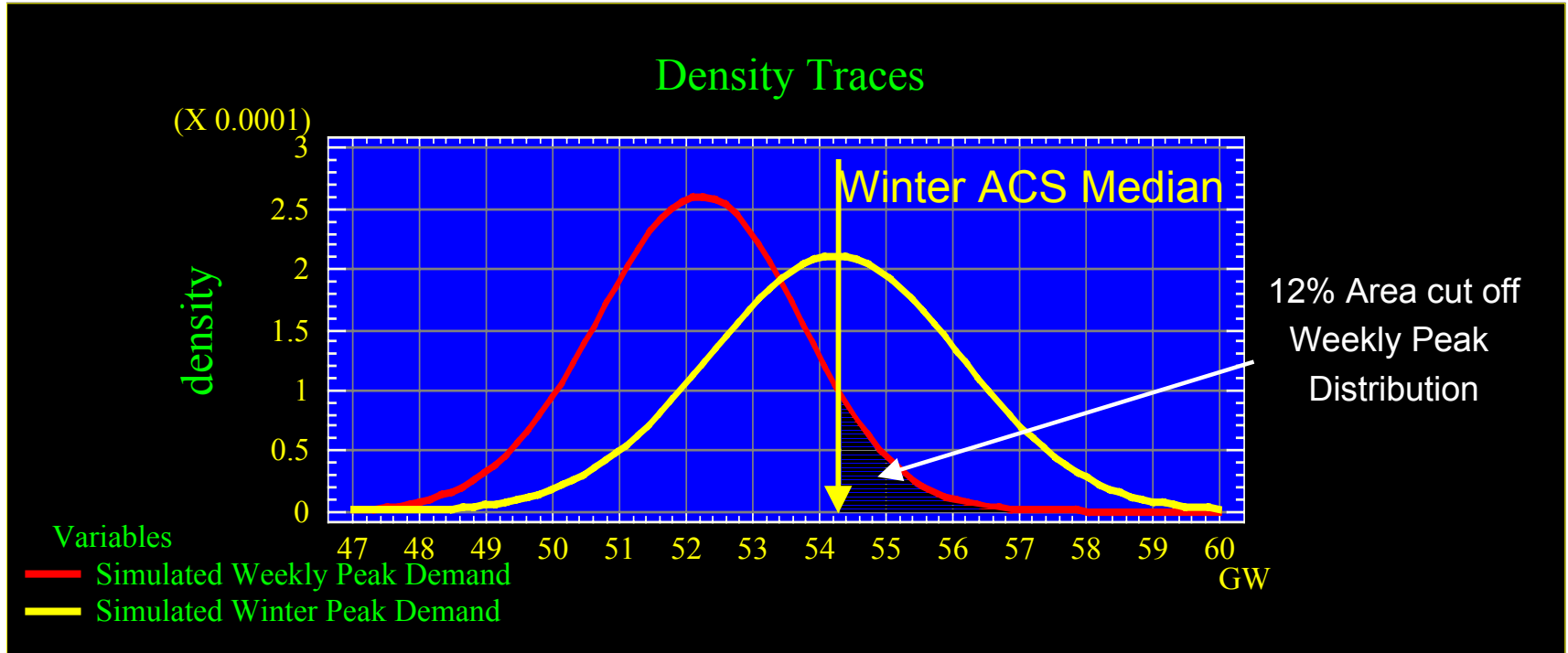
Modelling ACS Demand Weekly Winter Peaks

- Using the historic winter weekly peak data from 1983 (Weeks 50 to 3, excluding the holiday weeks) a mean and standard deviation is derived for the weather dependant demand
- Using these parameters at the time of winter peak, 10,000 simulations of Weather Dependant Demand are generated, giving a Weekly Winter Peak Demand Distribution

Modelling ACS Demand Weekly Winter Peaks



Link between Winter Peak ACS Demand and Weekly Peak ACS Demand

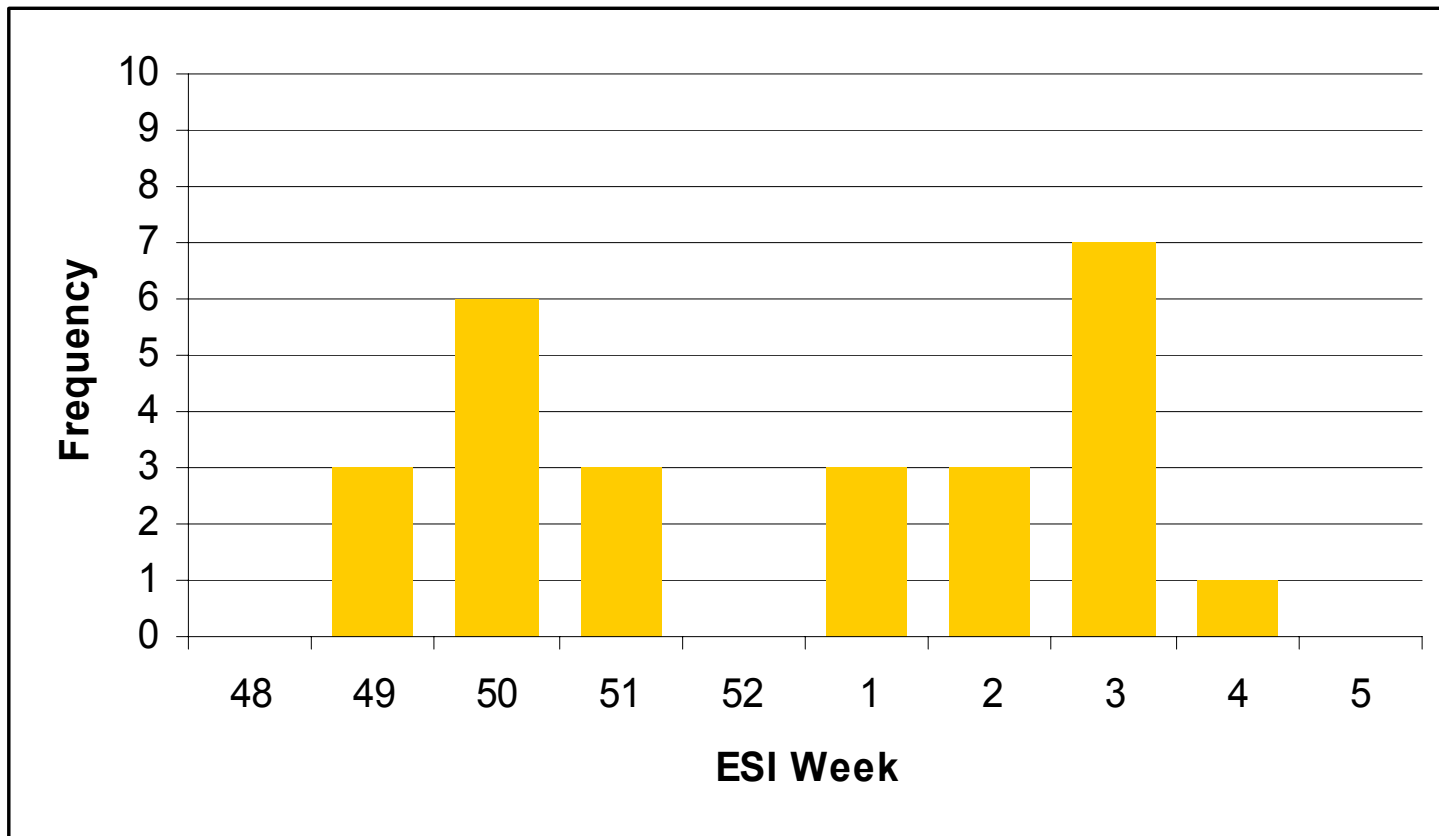


The density traces shows how the median of the simulated winter peak distribution cuts off an area of about 12% on the corresponding distribution of simulated weekly peak demands.

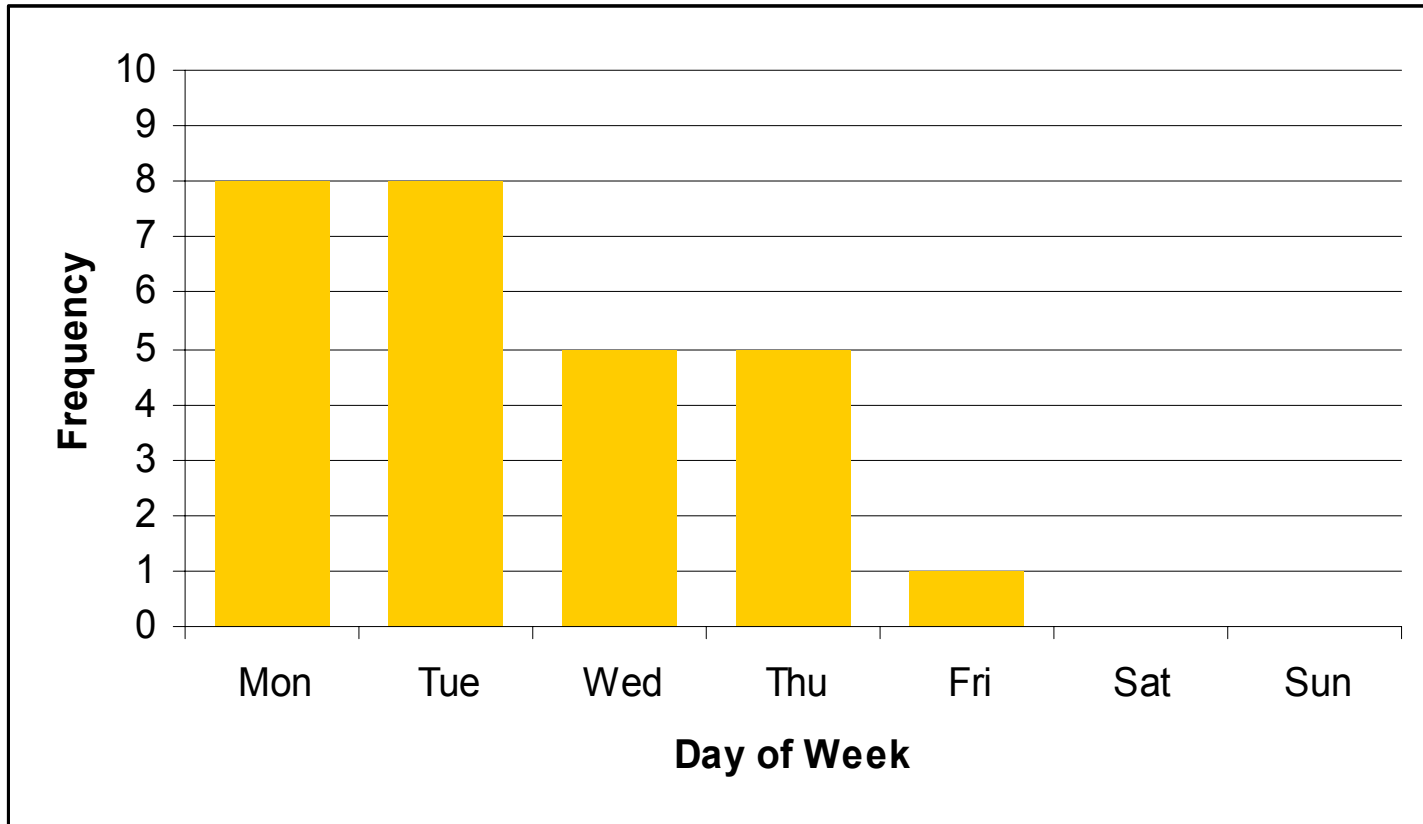
Link between Winter Peak ACS Demand and Weekly Peak ACS Demand

- The analysis shows that the median of the simulated winter peak distribution cuts off an area of about 12% on the corresponding distribution of simulated weekly peak demands
- It therefore establishes that the 50% risk criterion on a whole winter basis is equivalent to a 12% risk criterion on a weekly basis in the December - January period
- This principle was established by the CEGB in the 1960's

Incidence of Outturned Peak Demand Week of the Year

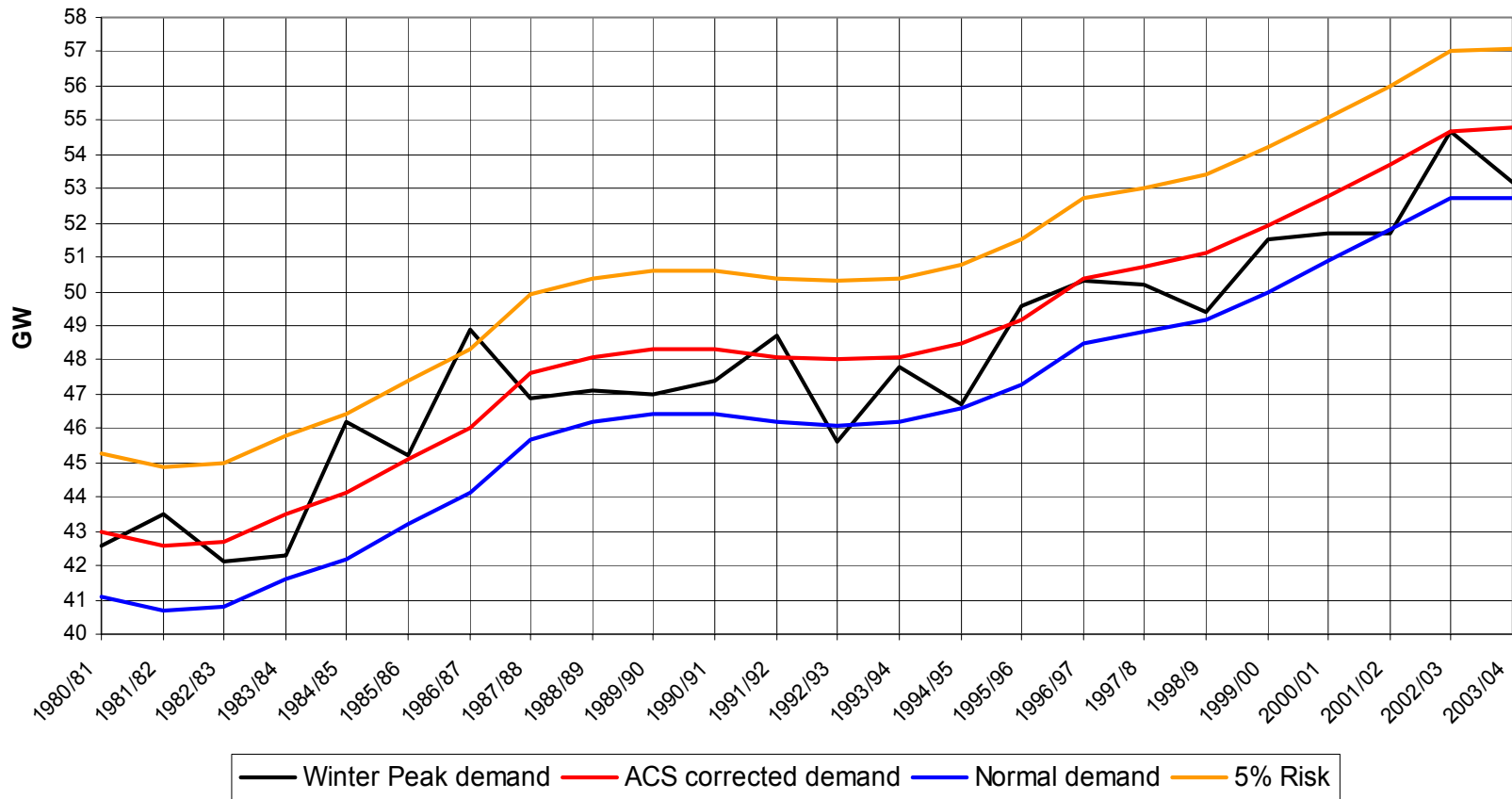


Incidence of Outturned Peak Demand Day of the Week

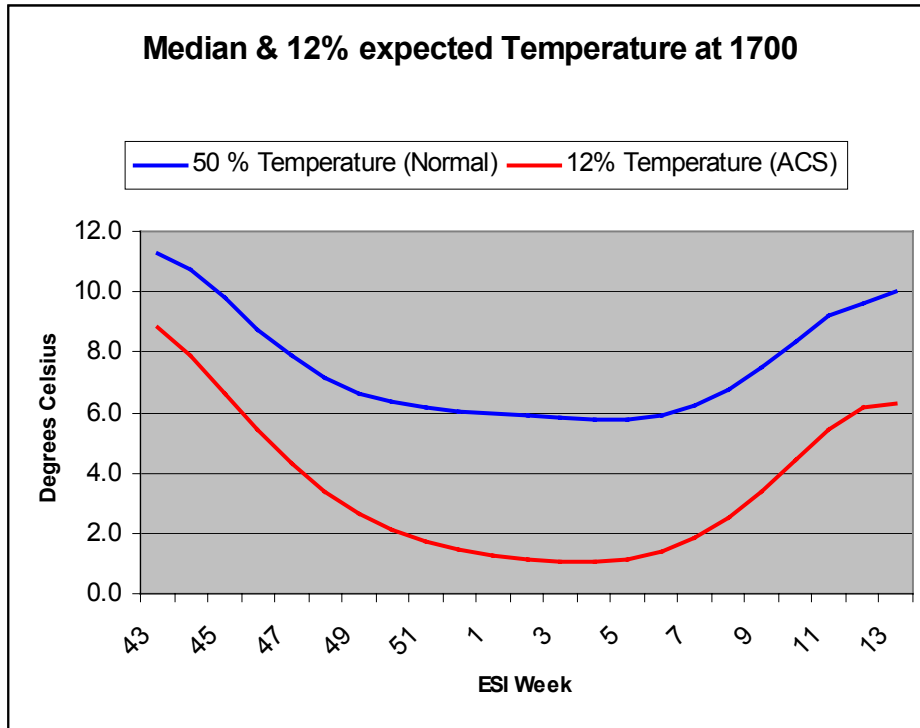


Incidence of Outturned Peak Demand

Winter Peak Outturns since 1980



How is ACS Demand Forecast



For each ESI week median values of the variables are identified and are known as Normal weather.

Similarly for each week the 12th percentile of each variable is identified and is known as ACS weather

How is ACS Demand Forecast

- To calculate a Normal Weekly Demand Forecast, the median expected weather conditions from the weekly probabilistic distribution are fed into the demand forecasting model used for operational forecasts (as published to the market on the BMRS)
- The ACS Demand Forecast is produced using the same model using the weather corresponding to the 12th percentile of the weather distribution rather than the median expected weather conditions. That is to say there is a 12% chance that the weather conditions in the week itself will be worse than those in the weekly ACS forecast

Winter 2004/05 Demand Forecasts

Winter Peak Demands and Temperatures

