Branch Workplace Instruction

ASSET STRATEGY & PLANNING	Document No : WFB 0001 Amendment No : 2 Approved By : MAS&P Approval Date : 20/04/2016 Review Date : 20/04/2019

WFB 0001 NETWORK DEMAND FORECASTING – SUMMER AND WINTER PEAK DEMAND FORECAST

1.0 PURPOSE

This document outlines the steps involved in producing the annual summer and winter peak demand forecasts for the company total and each individual Bulk Supply Point (BSP), Transmission Substation (TS), Zone Substation (ZS) and High Voltage Customer (HVC) within the company network.

2.0 REFERENCES

Internal

Internal Paper – "Representative Weather Stations for Normalisation of Peak Demands within the Integral Energy Area"
Internal Paper – "Reference Temperatures for the South Coast Area"
Annexure A – Sample Check Sheet
Annexure B – Company Block Diagram
Annexure C – Temperature Correction and Diversity Formulae
Annexure D – Adding a new Zone Substation
Annexure E – Adding a new Transmission Substation
Annexure F – Sample Cover Sheet for Project Sign Off
Annexure G – Apply Post Model Adjustments
Annexure H – System Normal Table

External

Handbook HB 5031–2011 Records classification
PV-Wave 8.0 Users Guide (UsersWAVE80.pdf)

3.0 DEFINITIONS

Base forecast
Represents the forecast before the impact of the expected Spot Loads, Load Transfers and Lot Releases. See also Modified Forecast.

Bulk Supply Point (BSP)
(TransGrid's supply point)

Bureau of Meteorology (BOM)

Capacity
The rated continuous load-carrying ability, expressed in megawatts (MW), megavolt-amperes (MVA), or megavolt-amperes reactive (MVAR) of generation, transmission, or other electrical equipment.

Circuit breaker (CB)
A device designed to open a circuit either by manual action or by automatic action when current exceeds a value greater than permitted. A circuit breaker can provide over current protection.

Circuit breaker data
Reading electricity flow (in amps) through a circuit breaker. This data is less accurate than Meter Data and it does not take account of the direction of the flow of electricity.

However, it may be the most accurate data source available for particular regions or feeders where other metering is not available. See also Meter Data and SCADA.

Diversified
The load recorded at a point of aggregation. For instance, the load measured at a Transmission Substation that is supplying several Zone Substations. See also Undiversified

Diversified (forecast)
Calculated amount determined by multiplying the undiversified demand by a diversification factor. This factor is determined from the historical data.

Diversified (historical)
The direct load measurement at the substation.

Diversity
The tendency for customer's peak demands to occur at different times, resulting in the aggregated load for a particular time being less than the sum of the individual peak loads.

Document control
Employees who work with printed copies of documents must check the Business Management System regularly to monitor version control. Documents are considered "UNCONTROLLED IF PRINTED", as indicated in the footer.

Exports
Electricity (energy and power) being sent out of a network or part of a network (such as an individual transformer).

Firm Capacity
A substation's maximum capacity from a planning standard's perspective. If a substation has more than one transformer and is not located in a city area, then the firm capacity is defined as being its N – 1 Capacity.

If the substation has only one transformer, and is not located in a city area, then its firm capacity is the total output of its sole transformer. If a substation is located in a city area, then its firm capacity is the total output of its transformers minus the output of its two largest transformers; ie, its N – 2 capacity.

Graphical User Interface (GUI)

High Voltage Customer (HVC)

Kilovar (kVAr)
Kilovolt-ampere reactive. A unit of ac reactive power equal to one thousand Vars.

Kilovolt-ampere (kVA)
One thousand volt-amperes

Kilowatt (kW)
One thousand watts

Load transfers
Essentially, a reconfiguration of the network to change the path of supply for particular customers within a defined area. The change results in a load decrease for one substation (as it supplies fewer customers) and a corresponding load increase for another substation (as it supplies additional customers).

From a peak demand perspective, the relevant load transfers are those which are sizable (eg, above 1MW) and which are undertaken either as a permanent change, or can be expected to be active at the time of peak demand in the future. More load transfers occur at times of peak demand when the network is constrained.

Load transfers are generally undertaken to reduce the net load at risk, by transferring load from a substation with high load at risk to another substation with low or no load at risk – ie, one with greater available capacity above peak demand.

Lot releases
New developments (residential and commercial and industrial) which have a defined period of development in which the load can be expected to build over the life of the project.

Megavolt-amperes (MVA)
One thousand kilovolt-amperes

Megavolt-ampere reactive (MVAr)
One thousand kilovolt-amperes reactive

Megawatt (MW)
One thousand kilowatts

Meter data
Highly accurate, revenue class metering of the electrical load at a substation. Readings are taken as an average over a 15 minute period, and are filtered to remove 'spikes' or short term bursts of energy often associated with sudden or momentary surges in consumption resulting from changes being made to the network's configuration. See also SCADA and Circuit Breaker.

Modified forecast
The forecast after the incorporation of historical Spot Loads, Load Transfers and Lot Releases. See also Base Forecast.

Monthly peak demand data
The highest demand recorded at an individual point during the month. Readings generally include MW, MVA and MVAr.

N – 1
One major supply element out of service.

N – 1 capacity
The total output of a substation assuming that the substation's (largest) transformer is not operational.

Network Load History application (NLH)

Peak demand forecast
The Summer Demand Forecast, or the Winter Demand Forecast.

Post Model Adjustments (PMA)
Post model adjustments (PMA) are designed and used to capture future changes in demand which may not be considered fully by econometric energy forecasts.

Power Factor (PF)
PF = True Power / Apparent Power
Power Factor is a measure of the efficiency of utilisation of electrical power under load. The ideal Power Factor is equal to 1 (or 100%). For forecasting, Power Factor is expressed as megawatts (MW) divided by Megavolt Amperes (MVA).

Probability of Exceedance (PoE)
The likelihood of a value being exceeded in any one season. For instance, a 10% PoE forecast value is estimated to be exceeded by the actual value only once every 10 seasons on average. A 50% PoE value, is likely to be exceeded every second year on average.

R-square
A statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression.

Reactive power
The portion of electricity that establishes and sustains the continuous electric and magnetic fields of alternating-current equipment on transmission networks.

Reactive power is provided by generators, synchronous condensers or electrostatic equipment such as capacitors and directly influences electric system voltage. It is a derived value equal to the vector difference between the apparent power and the real power. Losses incurred in transmission from heat and electromagnetic emissions are included in total reactive power. It is usually expressed as kilovolt-amperes reactive (kVAr) or megavolt-ampere reactive (MVAr).

Recordkeeping
Making and maintaining complete, accurate and reliable evidence of business transactions in the form of recorded information. (Source: Handbook HB 5031–2011 Records classification)

Review date
The review date displayed in the header of the document is the future date for review of a document. The default period is three years from the date of approval. However a review may be mandated at any time where a need is identified due to changes in legislation, organisational changes, restructures, occurrence of an incident or changes in technology or work practice.

Supervisory Control and Data Acquisition (SCADA)
Supervisory Control and Data Acquisition (SCADA) - data acquisition system used to monitor the electrical network and provide remote operation of substations and reconfiguration of the network through control over switchgear and transformers. It is also programmed with local control routines that facilitate substation voltage control and feeder and transformer change over. SCADA is the key tool for controlling the network and restoring supply after faults and incidents.

Strategic Asset Management Plan (SAMP)
The Strategic Asset Management Plan (SAMP) is the key management tool used by the company to certify that individual program expenditures are integrated in such a way as to obtain the maximum network benefit.

Spot loads
Defined projects which are expected to draw a defined amount of load, on a specified date at a particular point in the network. They are assumed to draw their total expected demand from the day of connection. Spot loads also incorporate expected capacitor installations which have the effect of lowering the MVA required for a given level of MW demand.

Temperature Corrected Maximum Demand (TCMD)
Temperature Corrected Maximum Demand (TCMD), also known as weather normalisation, is the expected peak demand normalised by the reference weather conditions and other calendar parameters. A 10% PoE season is defined as a 1 in 10 year event. A 50% PoE season is defined as a 1 in 2 year event.

Transmission Substation (TS)
A substation with a primary voltage of 132kV and secondary voltage of 66kV or 33kV which is part of the company's transmission network and supplies the sub-transmission network.

Undiversified
The direct summation of the individual peak loads of the lower level substations connected to a point of aggregation; eg, summation of the substations' demand supplied from that point assuming their peak demands occur at the same time. *See also Diversified*

Zone Substation (ZS)
A substation with a primary voltage of 132, 66 or 33kV and a secondary voltage of 22 or 11kV which is part of the company's sub-transmission network.

4.0 ACTIONS

4.1 Update the forecast templates

4.1.1 Naming convention of the forecast folder

Each forecast is denoted by the folder named with either a 'SDF' or a 'WDF' at the beginning of the folder name which represents Summer or Winter Demand Forecast respectively. The numbers which follow the prefix of summer or winter represents the start to the end of the forecast in years. If a 'v' and a number appear at the end, it is referring to the version number. For example, SDF 2010 – 2019 v1 refers to Summer Demand Forecast starting from 2010 (09/10 Summer) and ending in 2019 and it's version one.

A typical forecast folder consists of the following files:

File Name	Contents
EE_total.xlsx	A spreadsheet containing the company total forecast summated from all BSP forecasts.
EE_total_history.xlsx	A spreadsheet containing the company total historical monthly demands.
BSP_**BSPName**.xlsx	A spreadsheet containing BSP forecast summated from TS forecasts under this BSP.
BSP_**BSPName**_History.xlsx	A spreadsheet containing BSP historical monthly demands.
TSName_forecast.xlsx	A spreadsheet containing all ZS forecasts under this TS as well as TS forecast summated from ZS forecasts.
TSName_history.xlsx	A spreadsheet containing historical monthly demands for TS and all ZSs under this TS.
details.xlsx	A spreadsheet containing planner's information including spot loads, lot releases and load transfers that will take place in the forecast.
Details_TCMD.xlsx	A spreadsheet containing all the temperature corrected values for each ZSs, TSs, BSPs and the company total. It also includes the base forecasts for each ZS.
XDF **YYYY** – **ZZZZ**.docx	A word document of the final output also known as the 'green book'.

BSPName: Name of the BSP

TSName: Name of the TS

X: S or W denotes summer or winter

YYYY: Forecast start year

ZZZZ: Forecast end year

4.1.2 Update the forecast files

The initial start up of the forecasting process involves creating the directory that will hold the forecast.

The directory that the forecasts are stored is on the drive. *'G:\Forecasting\ZS Forecasts\'*

To create the new forecasting folder, copy and paste the most recent forecast produced and rename the directory according to the convention that is outlined above.

The company block diagram (see Annexure B – IE Block Diagram) which shows a snapshot of the network is to be completed by planners and given to the forecasting team before the forecast takes place.

The current structure in the company block diagram must be incorporated to the BSP and TS forecast excel files (BSP_**BSPName**.xlsx and **TSName**_forecast.xlsx). Within each of the forecast spreadsheet, locate the 'TCMD Summer' tab and update the worksheet according to the company block diagram. For example the Block diagram might read Granville ZS under Camellia TS until 2011 (see screenshot 1). This translates to show all values up to 2011 and then blank afterwards (see screenshot 2). The reason being is the zone is either decommissioned or it moves Transmission substation in 2012.

Camellia
Granville (until 2011)
ING Alcan
Lennox
Parramatta (until 2012)
Rosehill
Shell
Shell Generator
Bio Mass Generator

Screenshot 1: IE Block Diagram (Camellia TS)

Location		Actual						Forecast				
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Actual	MVA	16.3	16.6	15.5	17.4	17.6	15.8					
Granville		15.0	16.1	15.8	17.2	16.2	16.4	21.1	21.4			
	MVAr	4.7	1.7	0.4	2.2	1.9	2.3	3.4	3.4			
10% POE	MVA	15.7	16.2	15.8	17.3	16.3	16.5	21.4	21.6			
	PF	0.954	0.995	1.000	0.992	0.993	0.990	0.987	0.987			
	MW	14.3	15.2	15.2	16.0	15.5	15.5	20.2	20.4			
	MVAr	4.5	1.6	0.4	2.1	1.8	2.2	3.3	3.3			
50% POE	MVA	15.0	15.3	15.2	16.1	15.6	15.7	20.4	20.7			
	PF	0.954	0.995	1.000	0.992	0.993	0.990	0.987	0.987			

Screenshot 2: Granville until 2011 (Summer TCMD worksheet)

If there are new zone substations or transmission substations that need to be added to the forecast, follow the steps detailed in Annexures E (Adding a new Transmission Substation) and Annexure F (Sample Cover Sheet for Project Sign Off) at the end of this document.

4.2 Extract NLH data

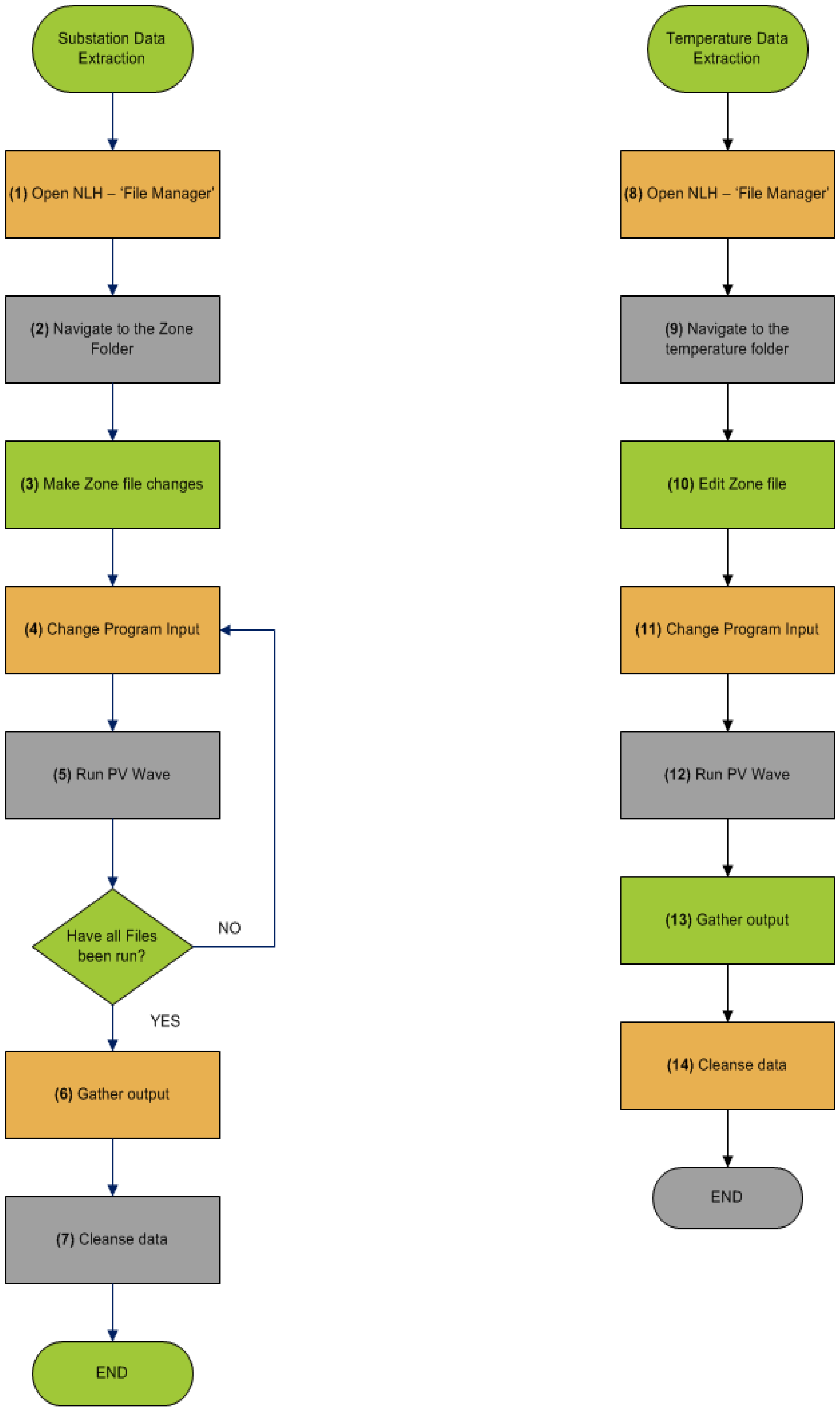
The summer forecast is based on the season starting from **1st of November to 31st of March**.
The winter forecast is based on the season starting from **1st of May to 31st of August.**

These date ranges are required to be placed in the scripts in the extraction process that is outlined in this section.

The NLH database contains all the various substations, generation and HVC's necessary to carry out the forecast. Up to three different sets of data can be found in the NLH database for a given substation or HVC. These three datasets can be in the form of meter, SCADA or circuit breaker (CB) data. For forecasting purposes the meter data is more accurate and is the preferred source of data for the calculation of the forecast. However, if meter data is not available SCADA is the second preference with CB data being the third preference in terms of quality.

The NLH database also contains Bureau of Meteorology (BOM) temperature data for various weather stations.

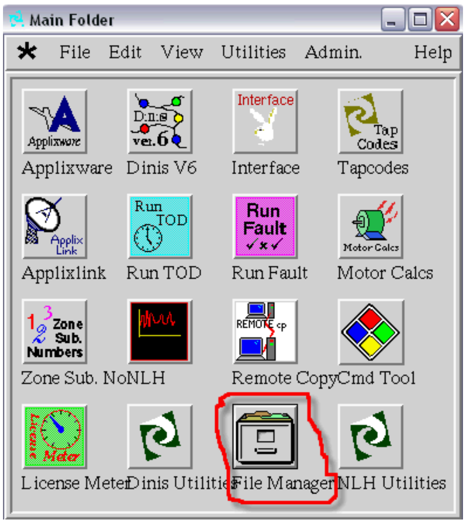
The procedure for the NLH data extraction has been broken up into two areas: substation demand data and temperature. Both procedures are completed in order to progress further into producing the forecast.


Substation Data Extraction
(1) Open NLH – 'File Manager'
(2) Navigate to the Zone Folder
(3) Make Zone file changes
(4) Change Program Input
(5) Run PV Wave
Have all Files been run?
NO
YES
(6) Gather output
(7) Cleanse data
END
Temperature Data Extraction
(8) Open NLH – 'File Manager'
(9) Navigate to the temperature folder
(10) Edit Zone file
(11) Change Program Input
(12) Run PV Wave
(13) Gather output
(14) Cleanse data
END

4.2.1 Demand Data Extraction

- Open NLH – 'File Manager'

Using the *Morse* GUI click on the *File Manager* button to open a window displaying directory setup on the UNIX server.

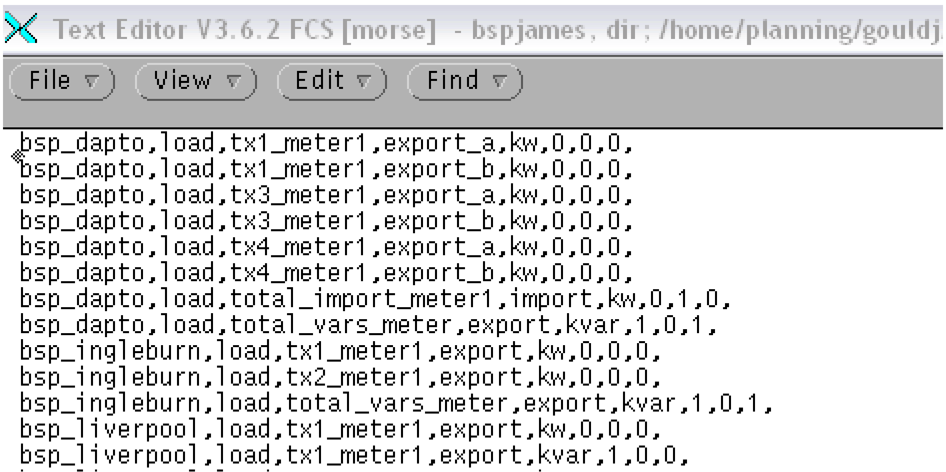


- Navigate to the Zone folder

The zone folder can be found by navigating the title bar to:
/home/planning/<*username*>/wavescripts/zonesfolder

- Make Zone File Changes

To create a zone file, decide the file you to edit by either selecting the zone, transmission, bulk supply point, company total file (The figure below is an example of a typical zone file – this file is the bsp file).


Text Editor V3.6.2 FCS [morse] - bspjames, dir; /home/planning/gouldj
File View Edit Find

```
bsp_dapto,load,tx1_meter1,export_a,kw,0,0,0,
bsp_dapto,load,tx1_meter1,export_b,kw,0,0,0,
bsp_dapto,load,tx3_meter1,export_a,kw,0,0,0,
bsp_dapto,load,tx3_meter1,export_b,kw,0,0,0,
bsp_dapto,load,tx4_meter1,export_a,kw,0,0,0,
bsp_dapto,load,tx4_meter1,export_b,kw,0,0,0,
bsp_dapto,load,total_import_meter1,import,kw,0,1,0,
bsp_dapto,load,total_vars_meter,export,kvar,1,0,1,
bsp_ingleburn,load,tx1_meter1,export,kw,0,0,0,
bsp_ingleburn,load,tx2_meter1,export,kw,0,0,0,
bsp_ingleburn,load,total_vars_meter,export,kvar,1,0,1,
bsp_liverpool,load,tx1_meter1,export,kw,0,0,0,
bsp_liverpool,load,tx1_meter1,export,kvar,1,0,0,
```

Note1. *When putting together some transmission substations there is no meter located at the transmission level. Consult the current company network diagram to make up the configuration of zone substations.*

Note2. *There is also no meter for the company total it is simply a summation of BSP meters and Generation.*

- Change Program Input

Navigate to:
/home/planning/<*username*>/wavescripts/data_dump

Open up the file named “data_dumpind.pro”

In the “data_dumpind.pro” file, the top part has the information regarding which file to run. Simply edit the line to make sure the program will run the desired file, whether it’d be the company total, BSP, TS or Zone substations that you created in step (3).

Text Editor V3.6.2 FCS [morse] - data_dumpind.pro, dir; /home/pl

File View Edit Find

```
.run readzones
.run remove_nan
.run remove_zeros
.run filtered_max


@nlh_init
zones = readzones('../../wavescripts/zonesfolder/bspjames')
```

Navigate down towards the end of the file where there are date ranges for editing to your required time period.

```
compute

;select.startdate = '01-jan-2000'
;select.enddate = '30-sep-2007'

select.startdate = '01-jul-2008'
select.enddate = '01-mar-2009'

percentage = 75
create_datadumpindreport, select, sample, zones, 'datareport', 'output/',
percentage = percentage
```

- Run PV Wave

Using the morse GUI (see step (1) for diagram of applications) click on the *Command* button to open a window displaying directory setup on the UNIX server. In the command line go to /home/planning/<*username*>/wavescripts/data_dump

Type the word ‘**pvw**’ and press ‘enter’. This will initiate the pv wave program.

Now type “**@data_dumpind.pro**” and press ‘enter’ this will initiate the files that are linked to run in step (4).

- Gather Output

Once the program has finished its first run, repeat steps (4) & (5) to collect all information for the season on the BSP’s, TS’s and Zone Substations.

All the data that has been processed can be found in the directory:

/home/planning/<*username*>/wavescripts/data_dump/output

Copy these files to your specific working directory. Run an ftp to morse directly from command prompt to have the data on your windows machine.

eg = ftp -s:x:\Exceed\FTP\getDir.ftp -i morse

- Cleanse Data

Once the extraction is complete it is important to validate the data before continuing into the calculation of the TCMD. This helps eliminate possible issues with temperature corrected data. Capacity Planners can provide more information to validate the data. Time series plots and plots showing MW versus temperature help identify inconsistencies within data.

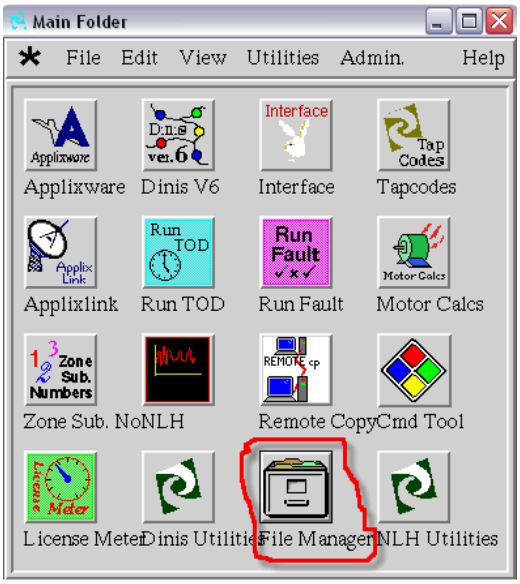
Note. For SCADA data, use the script **@data_dumpindscada.pro,** the zone file will also be different and will be in the following format:
<zone name>, load, station,total,mvar,1,0,0,
<zone name>, load, station,total,mavar,0,0,1,
For example:
windsor,load,station,total,mvar,1,0,0,
windsor,load,station,total,mw,0,0,1,

For CB data, use SOPS to gather the CB numbers then follow the prompts on the "NLH Utilities" GUI on the main menu as seen in step (1). Outputs from the CB data will be found in the dir /home/planning/<*username*>/wavescripts/ouput

4.2.2 Temperature data extraction

- Open NLH – 'File Manager'

Using the *Morse* GUI click on the *File Manager* button to open a window displaying directory setup on the UNIX server.



- Navigate to the temperature folder

The temperature folder is found by navigating to:

/home/planning/<*username*>/wavescripts/weather/temperature

- Edit Zone File

Open and Edit the ‘zones’ file found in the temperature directory.
Make sure the file contains:

richmond,weather,bureau,ambienttemperature,degrees,
richmond,weather,bureau,dew_point,degrees,
south_nowra,weather,bureau,ambienttemperature,degrees,
south_nowra,weather,bureau,dew_point,degrees,

- Change Program Input

Open and edit the ‘temperature file’ change the date range in the file to the range that you require to reflect the season you want you retrieve the data from. After you have completed that then close the file.

- Run PV Wave

Using the *Morse* GUI click on the ‘*Command*’ button to open a window displaying directory setup on the unix server. In the command line go to

/home/planning/<*username*>/wavescripts/weather/temperature

Type the word ‘**pvw**’ and press ‘enter’. This will initiate the pv wave program.

- Gather Output

Temperature data is in the following directory:
/home/planning/<*username*>/wavescripts/weather/temperature/output

Simply copy this file to your specific working directory. Run an ftp to morse directly from command prompt to have the data on your windows machine.

eg = ftp -s:x:\Exceed\FTP\getDir.ftp -i morse

- Cleanse Data

Check the data for anomalies within the maximum temperatures.

4.3 Calculate the TCMD

Weather correction is applied to the peak (summer and winter) demands at substations where there is a strong relationship between demand and temperature. Summer demands at zone substations in the Blue Mountains and demands of all high voltage customers are not subject to any weather normalisation.

4.3.1 Model Development

A new improved weather normalisation method based on a simulation approach has been developed and adopted. This is used to normalise peak demands for the EE network area. For summer, two reference weather stations are employed for temperature correction of the maximum demand (TCMD). One weather station at Nowra is used for the South Coast area which covers the Dapto BSP Region and the other weather station at Richmond is used for the remaining EE areas. For winter, one weather station at Richmond is used for the whole EE areas.

The temperature correction method is basically divided into the following steps:

- To develop/update a regression model for estimating the relationship of demand, weather and periodic patterns (calendar effects) of demand; and
- To simulate the demand using multi-years of historical weather data to produce 10% and 50% normalised demand.

The regression model uses the most recent six years of daily maximum demand and temperature to determine the relationship between demand, weather and periodic patterns of demand. Various other calendar input parameters are employed for the model. Day of the week variables will account for the difference between daily peak by day of the week and workday/non-workday. For summer, a set of holiday variables are included to describe the load reductions associated with holidays. Separate variables are used for the following days: New Year's Day, Australia Day, and Christmas. In addition, a school holiday variable is introduced to capture the reduced loads (increased loads in some south coast zone substations) occurring during the school holiday period in December and January. For winter, Queen's Birthday holiday was treated as a non-workday. Monthly and bimonthly variables capture some of the seasonal demand variations. Year variables describe the changes in base load level for each year. Previous hot/cold day effect variables are included to explain the impacts of the successive hot/cold days on daily peak demand.

The regression model takes the following form:

PD = a * f(weather) + b * g(calendar) + c + AR

where PD	= daily peak demand
f(weather)	= function of weather variables
g(calendar)	= function of calendar variables
a,b and c	= regression coefficients
AR	= auto regression correction terms

From the regression model, daily demands were estimated using 24 years of daily weather data available at the reference weather stations. Annual seasonal maximum demands were derived from the calculated daily demands. The 10% and 50% demand values were computed from the distribution of annual seasonal maximum demands to give the 10% and 50% PoE TCMD values. The TCMD values for the latest year are the starting points of the peak demand forecasts.

4.3.2 Yearly Update Process

The weather normalisation process involved the yearly update of the regression equation (peak demand model) with the most recent season data. This would result in a small adjustment in the equation coefficients. The updated model was then used in the simulation analysis with the same 24-year of weather data to produce the 10% and 50% PoE TCMD figures for each zone substation, transmission substation, bulk supply point and the company total for the current year. The 10% and 50% PoE TCMD figures produced are the starting points for the demand forecast for each connection point. The steps to produce the seasonal weather corrected peak demand for each connection point are shown below.

Step 1: Coefficient Update

The latest years demand, temperature and calendar data are collated for the latest season to be forecast. The latest six years of data is used to develop the parameter relationship and update the coefficient for each parameter. An updated model is obtained.

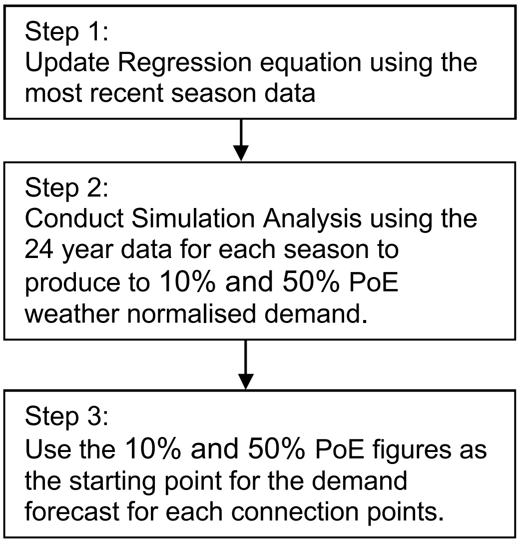
Step 2: Apply Simulation

The same 24-year of weather data is passed through the updated model to obtain the 24 years of peak demand statistics.

Step 3: 10% and 50% TCMD Figures for Forecasting

From this data set the 10% and 50% PoE TCMD figures are obtained and used as the starting points for the current season forecast for the connection point.

Included below is the flowchart showing the yearly weather normalisation process.



If the R-square (between daily peak demand and temperature) at a station is greater than 0.3 for more than three of the six years, that station is deemed to be temperature sensitive. If the R-square at a station is greater than 0.3 for less than three of the six years, that station is considered to be not temperature sensitive.

If the R-square at a station is greater than 0.3 for three years and less than 0.3 for the remaining three years, then take the most recent year as the deciding factor whether the substation is temperature sensitive or not. In other words, if the R-square at the most recent year is greater than 0.3 then that station is temperature sensitive, otherwise its not temperature sensitive (see the following table).

R^2	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Comments
Station 1	0.50	0.31	0.25	0.9	0.88	0.68	Temperature Sensitive
Station 2	0.27	0.65	0.14	0.28	0.30	0.19	Not Temperature Sensitive
Station 3	0.26	0.41	0.22	0.57	0.57	0.58	Temperature Sensitive

If the station is deemed not temperature sensitive or the station is a HV customer, the maximum demand at that station will not be corrected. The maximum MW demand for the season will be used for calculating the future trend of the substation. The 10% and 50% value will be the same and represent the season peak. If the station is deemed temperature sensitive then the temperature corrected values are **10% and 50% TCMD figures obtained from Step 3 of Section 5.3.2.**

In the forecasting directory there is a spreadsheet called "details TCMD.xlsx". Forecasts for each Zone Substation is under its respective Transmission Station as denoted by the company block diagram. Update each of the 10% and 50% TCMD values into the spreadsheet.

4.4 Apply Post Model Adjustments(PMA)

Post Model Adjustments (PMA) are designed and used to capture future changes in the peak demand which may not be considered fully by econometric energy forecasts. PMA include the demand impacts from different state and national energy policies and programs, such as Minimum Energy Performance Standards (MEPS), NSW Energy Savings Scheme (ESS), change of building codes(e.g. BASIX) and NSW Solar Bonus Scheme (SBS).

PMA are applied to each year of the forecast for each zone substation based on the zone substations residential, commercial, industrial mix and its peak demand for the season.

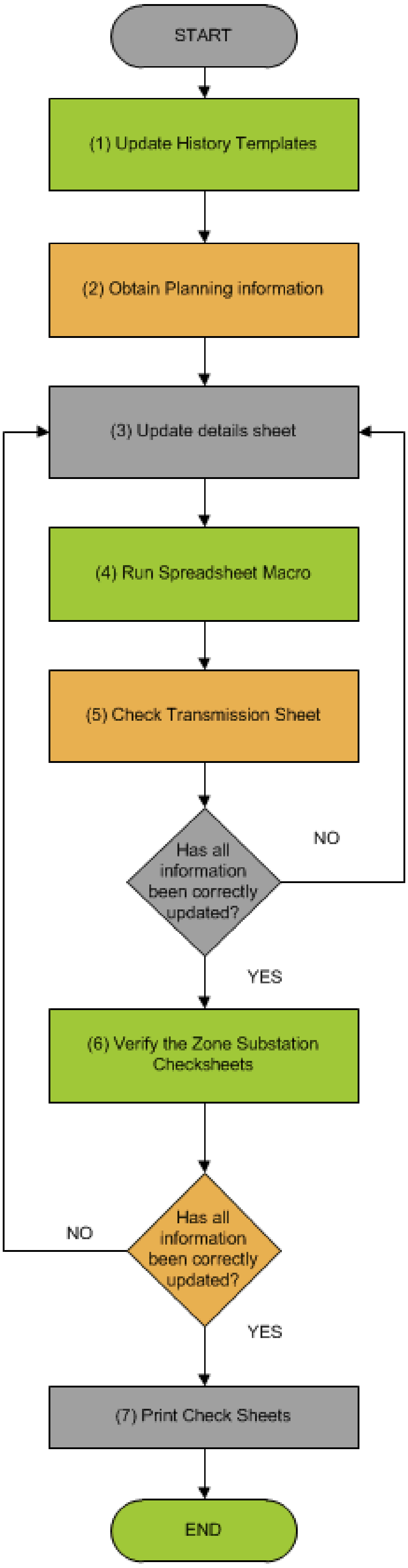
The three main data inputs required to apply the adjustments are substation load data, load splits (residential, commercial & industrial) for each zone substation and a ten year forecast horizon displaying absolute MW adjustments for the company area.

All substation data can be obtained from NLH. Substation load type splits can be obtained from DINIS / GIS. Ten year forecast horizon displaying absolute MW adjustments for the company area can be obtained from external consultants.

Annexure G – (Apply Post Model Adjustments) details the inputs described above and how to calculate the adjustments for each substation.

4.5 Apply the Planners input

The processes to apply the Planners input is shown in the following flowchart.



4.5.1 Update History Templates

For each demand history file (EE_total_history.xlsx, BSPName_history.xlsx and TSName_history.xlsx) update each of the history spreadsheets (see Figure 4) by calculating the monthly maximum from the NLH extracts.

A	B	C	D
	Glenmore_Park		
Date	MVA	KW	KVAR
Sep 2007			
Oct 2007			
Nov 2007	23.9022	23160	5910
Dec 2007	25.1752	24270	6690
Jan 2008	30.0711	28830	8550
Feb 2008	28.7065	27540	8100
Mar 2008	25.0228	24240	6210
Apr 2008			
May 2008	18.14007	17910	2880
Jun 2008	21.86917	21719.99	2550
Jul 2008	27.42705	27030	4650
Aug 2008	24.86364	24570	3809.999
Sep 2008			

Figure 1: Updating History

4.5.2 Obtain Planning Information

The Planners are asked to collate the latest information from customer connections which identify spot loads. Each planner provides information on lot release developments in various zone/transmission areas that are likely to go ahead in the near future and also proposed load transfers to take place. A probability factor of 0.8 is applied to the demands of future land releases and spot loads to address uncertainty regarding whether the projects will proceed. Insignificant projects of spot loads and lot releases are not included in the forecast.

Yearly demands for lot releases are projected with the help of an S-curve for the period between the proposed start and end years. Demands for spot loads are applied at the proposed year. This process will be executed automatically by running the built-in macro described in Step (4) below.

4.5.3 Update details sheet

Each Worksheet in the 'details' excel workbook contains information on Spot Loads, Load transfers and Lot releases. These worksheets are updated by copying the supplied Capacity Planners information to the relevant load transfer, spot load or lot release worksheet.

Check for spelling of zone names as this effects the spreadsheet linking. No substation name contains a space ( ). If there is any space required an underscore (_) is used (eg, "Nepean_ZS"). For any new zone substations or transmission zones that need to be added use the outlines found at the end of this instruction.

For the winter forecast only, load transfers are adjusted for a winter load equivalent unless the planner has indicated otherwise. To calculate a winter equivalent load (Eq.5.5.1), take the latest summer and winter peak demand for the zone substation and divide the summer value into the winter value and then multiply the ratio by the load transfer amount to obtain the winter equivalent.

$$W_{LT} = (PD_w / PD_s) * S_{LT} \tag{5.5.1}$$

where W_{LT} = the winter load transfer equivalent (MVA)
S_{LT} = the summer load transfer amount (MVA)
PD_w = the latest winter peak demand (MVA)
PD_s = the latest summer peak demand (MVA)

4.5.4 Run Spreadsheet Macro

“RunCalcs” is a macro linked in the forecast spreadsheet (See Figure 2: RunCalcs Macro) to run on each Transmission Substation workbook individually. (This updates all the information from the details workbook into each of the zone and transmission substations where applicable). Alternatively, “RunCalcs” can be run on the “Details” files to update the information for all zone substations.

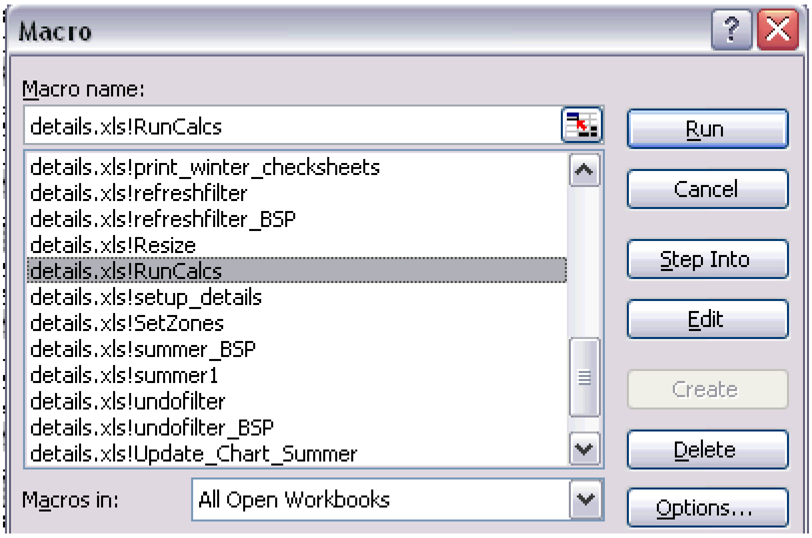


Figure 2: RunCalcs Macro

4.5.5 Check Transmission Sheet

In each transmission substation workbook, check the ‘details’ worksheet within the workbook that all the information was correctly transferred from the details workbook. Secondly, check that the information contained in the details worksheet is correctly copied by the macro to the relevant zone substations under the zone substation name’s worksheet. The columns (BF:CN) contain the projects have been added into the forecast.

4.5.6 Verify the zone substations check sheet

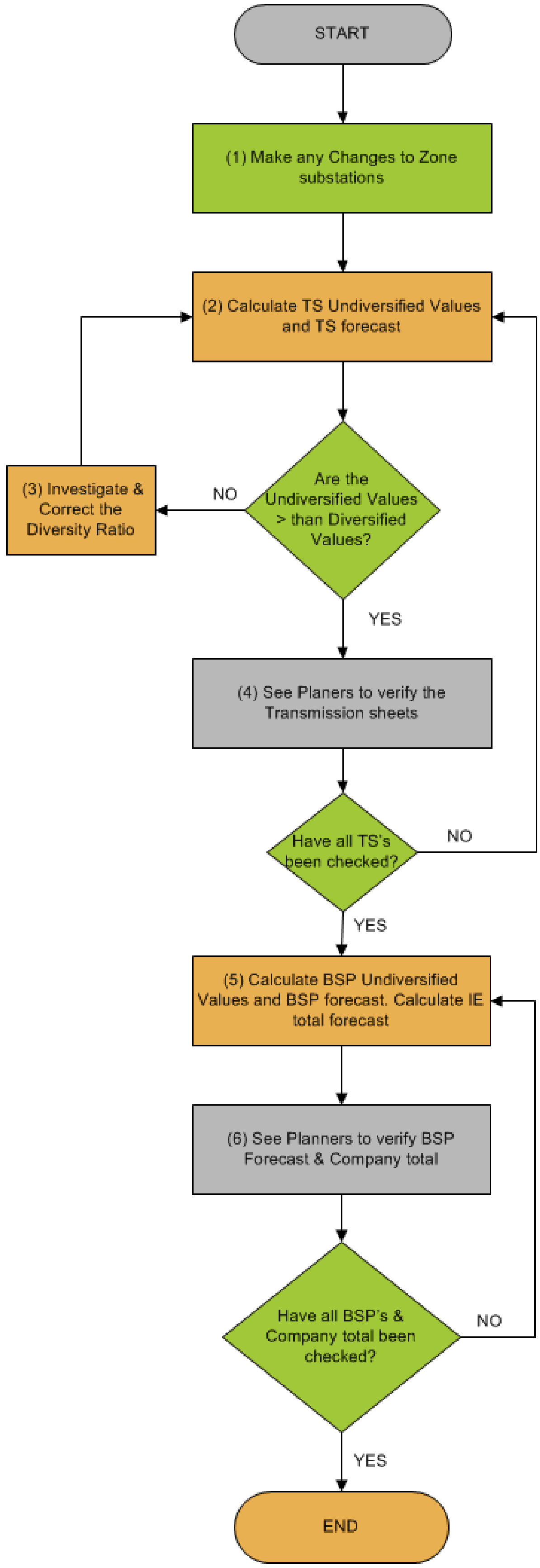
Within each transmission forecast workbook, there are check sheets (see Annexure A - Sample Check Sheet for an example) for each zone that shows the trendline and the additional project information. Print each of these zones off to submit to the planners to verify the inputs and the forecast.

4.5.7 Print Check Sheets

For each Transmission forecast sheet, print each of the zone substation check sheets. Once the zone substations have been checked the Transmission, Bulk Supply Points and company total are to be printed off and checked.

4.6 Checking

The following flowchart shows the checking processes for the summer and winter peak demand forecasts.



4.6.1 Make any Changes to Zone Substations

Finalise the changes to the zone substations as per planner's recommendations.

4.6.2 Calculate TS Undiversified values and TS forecast

Within the forecast spreadsheets on the 'TCMD Summer' tab calculate the undiversified values by summating all the zones. Initially, before starting the forecast the block diagram is given by planning and changes in the block diagram are reflected in the forecast spreadsheets, thereby making the summation process easier. All winter and summer forecasts will take place on the 'TCMD Summer' tab.

The forecast part of the transmission substation (ie, diversified forecast) is calculated by using the average ratio of the six years undiversified values over diversified values. Multiply this ratio by the undiversified forecast values to obtain the diversified forecast for both 10% and 50% PoE. (see Annexure D – Adding a new Zone Substation for further details)

4.6.3 Investigate and Correct the Diversity Ratio

The diversity issue where diversified values are greater than undiversified values is created from the difference in the configuration at time of the transmission substation peak and the static block diagram.

Where a transmission substation has diversified values greater than undiversified values, it's important to establish the correct diversity ratio for the forecast going forward.

For each substation with the diversity issue shown in more than two historical years, use single line diagrams to establish the potential switching points and retrieve the loads at the switching points. Revise the diversified values by creating a system normal table (see Annexure H) which brings the network back to the static block diagram. The system normal table will be used in the calculation of the diversity ratio for the forecast horizon.

The calculation for the TCMD in the System Normal table is devised by taking a ratio of the System Normal actual and dividing by the TS actual for each historical year and multiplying each of these values by its corresponding diversified TCMD value.

If the substation has two or less years of diversified values greater than undiversified values in the six historical years then do not use these years in the calculation of the diversity ratio and a System Normal table is not required.

4.6.4 See Capacity Planners to verify the Transmission Sheets

Asset Strategic & Planning will check the transmission sheets and advise of any changes to make.

4.6.5 Calculate BSP undiversified values and BSP forecast. Calculate the company total forecast.

Similar to 4.6.2, all the BSP's are to be summated to calculate the company total and the undiversified BSP's is the summation of TS diversified values.

4.6.6 See Capacity Planners to verify BSP & the company forecast

Similar to 4.6.3 this time have the company total checked off along with each BSP forecast.

4.6.7 Check against information provided by external agencies

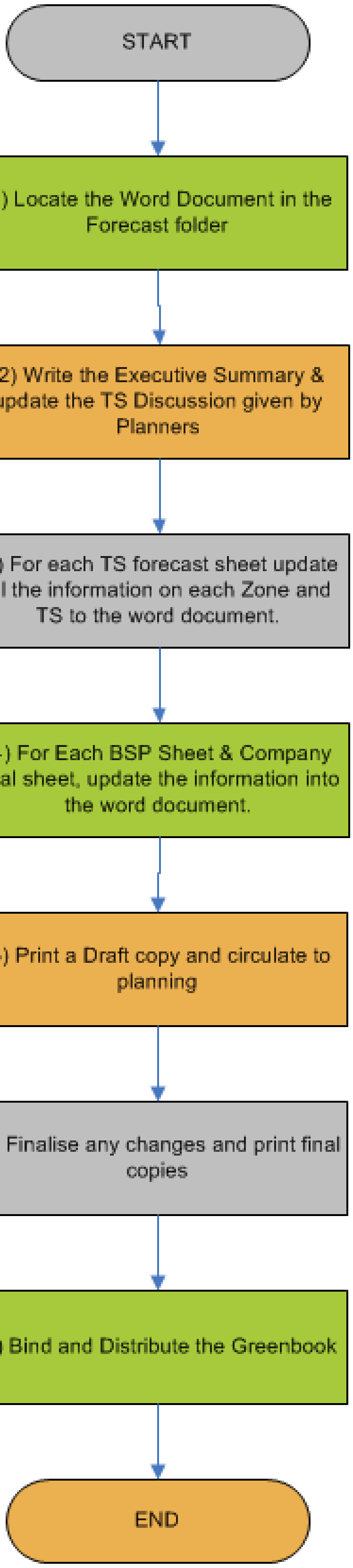
The information on proposed projects is further checked against the latest figures released by ABS (population growth projections, numbers of development approvals and dwelling unit commencements) and other relevant forecasts by public and private agencies.

4.6.8 Project list signed off

Once the cheeksheets for each zone, transmission, bulk supply point and company total have been agreed upon, the project list as per the planners input must be signed off by the Capacity Planning Manager. A sample cover sheet can be found in Annexure F (Sample Cover Sheet for Project Sign Off) of this document.

4.7 Forecast Report

The flowchart below shows the processes in preparing the peak demand forecast report.



4.7.1 Locate the word document in the forecast folder

From the forecast directory locate the word document from the previous forecast and open it up.

4.7.2 Write the executive summary & Update TS discussion given by Capacity Planners

Write an executive summary following the outline of the last forecast. Planners provide the Transmission discussion which can be found on each page introducing the next transmission substation.

Note. Each transmission substation page with discussion begins on an even page number with the forecast tables beginning on an odd page number.

4.7.3 For each TS forecast sheet update all information on each zone and TS to the word document

Upon opening up each transmission substation forecast sheet copy and paste the values from the "TCMD Summer" tab into the word document and add/subtract tables where necessary. Update the information which is contained in the details sheet such as the spot loads, lot releases and load transfers. The project information is also found in the appendix and will need to be copied there too.

4.7.4 For each BSP and the company total sheet update information to word document

Update all the BSP's & the company total information, including the table in the executive summary. Update the table of contents, update the index.

4.7.5 Print a draft copy and circulate to Asset Strategy & Planning

Print a draft copy of the report and circulate the report to the Manager Asset Strategy & Planning for review.

4.7.6 Finalise any changes and print final copy

Finalise any changes that need to be made and obtain the key signatures from the front of the page. Print & bind enough copies for the distribution list.

4.7.7 Bind and distribute the Peak Demand Forecast.

Create a hard copy for each signatory of the Peak Demand Forecast and place a copy of the Peak Demand Forecast in pdf on the Company intranet.

4.8 **PREREQUISITES AND TOOLS**

4.8.1 Forecasting pre requisites

Forecasting peak demand is a challenging task that requires a great deal of statistical, and network expertise. It is therefore assumed that the person preparing the Peak Demand Forecast has a working knowledge of the company network in regards to the terminology such as company Total, Bulk Supply Point (BSP), Transmission Substation (TS) and Zone Substation (ZS).

Knowledge of the issues involved in power system planning, including an understanding of financial and economic issues, and knowledge of forecasting methodologies and energy management technologies and strategies as well as familiarity with metrics associated with network performance are also essential.

The minimum technical skills required prior to attempting to produce a Peak Demand forecast include:

- Understanding of energy metadata
- Well developed analytical capability, particularly in relation to mathematical modelling
- Understanding of the NLH application
- Working knowledge of Unix
- Working knowledge of PV-WAVE and ability to modify scripts
- Complete understanding of the SAS (Statistical Analysis System) application
- Proficiency in Excel

4.8.2 Tools

Preparation of the Peak Demand forecast requires specific software and system tools. These include the following:

- Excel software
- Launcher
- Command prompt for Morse server
- Unix File manager
- PV-Wave software
- SAS software

These tools were installed by completing an IT&T System application form (FDS0002). The person conducting the forecast completes an application form for the software and system tools and email to their manager.

5.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Type of Record	Storage Location	Retention Period*
Forecast Reports	Intranet	Required as State archives as determined by GA40 section 6.1.
Internal Papers	G:\Forecasting\ZS Forecasts\Documentation\Internal Papers\weatherStation.doc	Required as State archives as determined by GA40 section 6.1.

* The following retention periods are subject to change, eg if the records are required for legal matters or legislative changes. Before disposal, retention periods must be checked and authorised by the Records Manager.

6.0 AUTHORITIES AND RESPONSIBILITIES

Manager Asset Strategy & Planning has the authority and responsibility for the presentation of the Peak Demand Forecast to the Executive.

Network Demand Manager has the authority and responsibility for:

- the review of all calculations undertaken to produce the Peak Demand Forecast;
- the methodology used in the forecasting process;
- timely notification to the Senior Forecasting Analyst of any changes in assumptions or forecasting policy he requires to be used in the preparation of the forecast;
- the review and approval of the Peak Demand forecasts;
- discussions and advice to the Capacity Planning Manager, the Manager Asset Strategy & Planning and the General Manager Asset Management concerning the assumptions, accuracy, timeliness and limitations of forecasts produced by the branch;
- the review of all calculations undertaken to produce the Peak Demand Forecast; and
- the presentation of the Peak Demand Forecast to the Capacity Planning Manager, the Manager Asset Strategy & Planning and the General Manager Asset Management.

Senior Forecasting Analyst/Forecasting Analyst has the authority and responsibility for:

- ensuring that all linkages between files are maintained and producing the peak demand forecast;
- updating and editing all directories, files, scripts and macros;
- downloading Zone Substation, Transmission Substation and Bulk Supply Point readings and other weather parameters from the Unix system;
- ensuring that all linkages between files are maintained (as outlined in this procedure) to produce the Peak Demand Forecast; and
- Summer and Winter Forecasts at the ZS, TS, BSP and Total System level as described in this procedure for a 10 year horizon.

Capacity Planning Manager has the authority and responsibility for:

- providing relevant information to the Senior Forecasting Analyst/Forecasting Analyst and undertaking a reasonableness check of the forecast including:
- updating the company block diagram of the network;
- providing information regarding the future activities at each zone substation. This includes new developments to occur (lot releases), new load increases expected from customer applications (spot loads) and also information regarding the transfer of load from one zone substation to another;
- undertaking a reasonableness check of the draft forecast; and
- signing the ‘check sheet’ to reflect that the Capacity Planner’s information has been accurately recorded and that the documented forecast is reasonable.
- Endorsing the forecast.

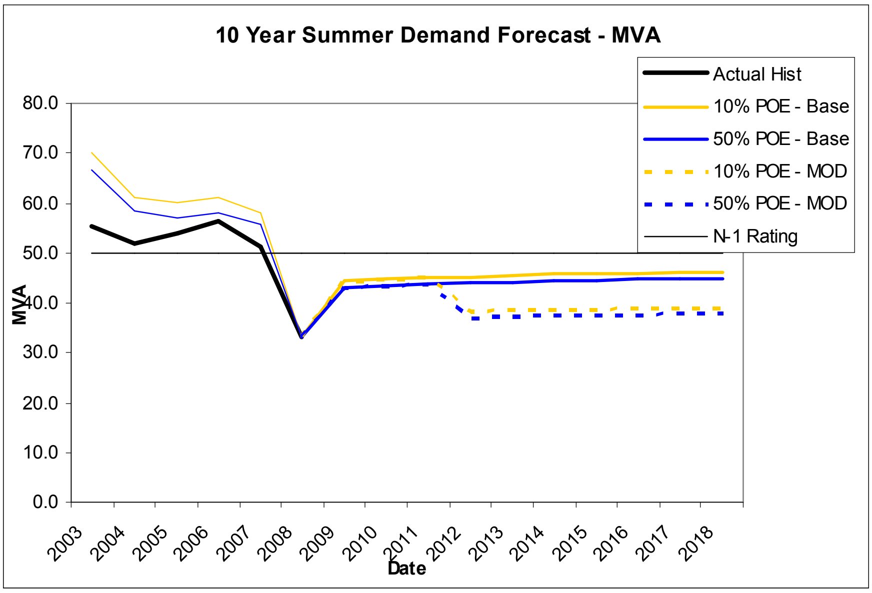
7.0 DOCUMENT CONTROL

Content Coordinator : Network Demand Manager

Distribution Coordinator : Branch/Process Coordinator

Annexure A – SAMPLE CHECK SHEET
EXAMPLE REVIEW AND FEEDBACK SHEET

Jasper_Road Baulkham_Hills



Summer Actual						Projects = 1									
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
55.3	52.0	54.0	56.3	51.3	33.2	0.0	0.0	0.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0

10% and 50% POE Respectively - BASE

70.0	61.2	60.2	61.4	58.2	33.2	44.3	44.7	45.0	45.3	45.5	45.6	45.8	45.9	46.0	46.0
66.7	58.3	57.2	58.2	55.9	33.2	43.2	43.5	43.8	44.1	44.3	44.4	44.6	44.7	44.8	44.8

10% and 50% POE Respectively - MODIFIED

70.0	61.2	60.2	61.4	58.2	33.2	44.3	44.7	45.0	38.3	38.5	38.6	38.8	38.9	39.0	39.0
66.7	58.3	57.2	58.2	55.9	33.2	43.2	43.5	43.8	37.1	37.3	37.4	37.6	37.7	37.8	37.8

Do you agree with Modified Forecast? Y N Comment: ______________________

Notes: ____

____

Spot Loads

Zone Substation	Customer Name	Date	MW	MVAr	MVA	DIV

Load Transfers

Date	From ZS	From TS	To ZS	To TS	MVA	DIV
Apr-11	Jasper_Road	Baulkham_Hills	WCH_Vineyard	Vineyard	7	1

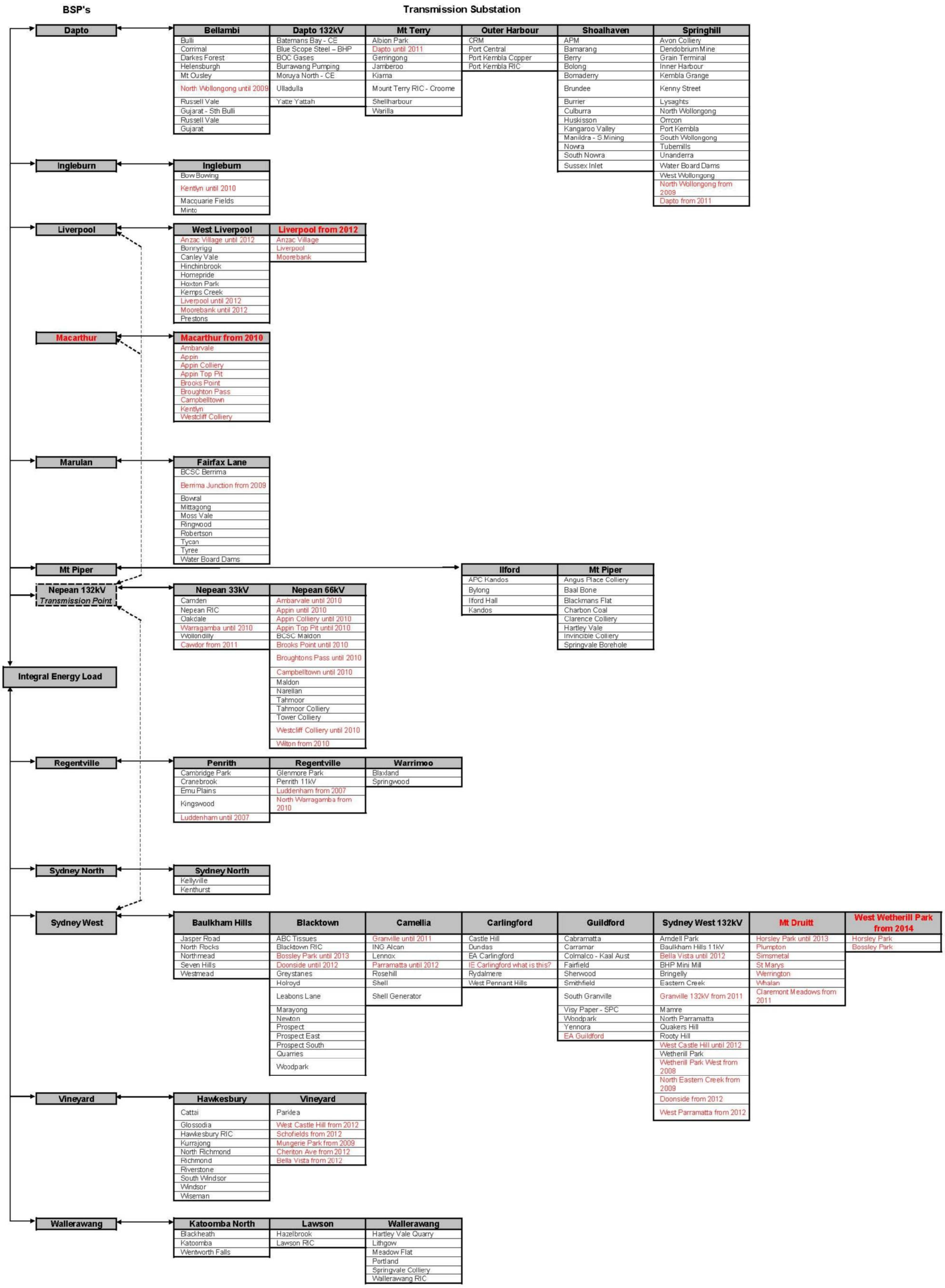
Lot Release and Redevelopment

Zone Substation	Description	Date	MVA	Year	DIV

Signature ______________ Name ______________ Date ______________

Annexure B – COMPANY BLOCK DIAGRAM

Block Diagram of IE Structure - as at 17th July 2008



Annexure C – TEMPERATURE CORRECTION AND DIVERSITY FORMULAE

This series of steps is pre-coded within the various spreadsheets and do not require any user intervention. They are provided for information purposes only in case changes are required in the future. As the base year ‘x’ here = 8 ie: 200_X = 2008.

Steps to forecast peak demand at a transmission substation (TS) & Bulk Supply Point (BSP)
(For BSP calculations, substitute TS for BSP in the following steps)

Temperature correction

Temperature corrected peak demand at transmission substation calculation.

1.1 Repeat the temperature corrected procedures for each historical year, ie, 200_{X-6} to 200_{X-1}. For each year i, we have:

$TCMD_{TS,i}$

where: $TCMD_{TS,i}$ is the temperature corrected peak demand at transmission substation TS for year i

TS is index for transmission substation

i is the index for year (200_{X-6},200_{X-5},…,200_{X-1} ~ 2002,2003,….,2007)

Historical data

1.2 For each historical year i, calculate the diversify ratio at transmission substation

$$DR_{TS,i} = \frac{DPD_{TS,i}}{UPD_{TS,i}}$$

where: $DR_{TS,i}$ is the diversity ratio at transmission substation TS for year i

$DPD_{TS,j}$ is the diversified peak demand at transmission substation TS for year i

$UPD_{TS,i}$ is the undiversified peak demand at transmission substation TS for year i

TS is index for transmission substation

i is the index for year (200_{X-6},200_{X-5},…,200_{X-1})

1.3 For each historical year i, calculate the power factor at transmission substation

$$PF_{TS,i} = \frac{DPD_{TS,i}\text{ (in MW)}}{DPD_{TS,i}\text{(in MVA)}}$$

where: $PF_{TS,i}$ is the power factor at transmission substation TS for year i

$DPD_{TS,j}$ is the diversified peak demand at transmission substation TS for year i

TS is index for transmission substation

i is the index for year (200_{X-6},200_{X-5},…,200_{X-1})

1.4 For each historical year i, calculate the power factor at zone substation

$$PF_{ZSk,i} = \frac{PD_{ZSk,i}\text{ (in MW)}}{PD_{ZSk,i}\text{(in MVA)}}$$

where: $PF_{ZSk,i}$ is the power factor at zone substation k for year i

$PD_{ZSk,j}$ is the peak demand at zone substation k for year i

ZSk is index for zone substation

i is the index for year ($200_{x-6}, 200_{x-5}, \ldots, 200_{x-1}$)

1.5 Calculate the average diversity ratio from the historical values

$$MDR_{TS} = \frac{\sum DR_{TS,i}}{\sum i}$$

where: MDR_{TS} is the average diversity ratio for transmission substation TS

1.6 Calculate the average power factor for zone substation from the historical values

$$MPF_{ZSk} = \frac{\sum PF_{ZSk,i}}{\sum i}$$

where: MPF_{ZSk} is the average power factor for zone substation ZSk

1.7 Calculate the average power factor for transmission substation from the historical values

$$MPF_{TS} = \frac{\sum PF_{TS}}{\sum i}$$

where: MPF_{TS} is the average power factor for transmission substation TS

1.8 Convert $TCMD_{ZSk,i}$ (in MW) into MVA by historical power factor from **1.4**.

$$TCMD_{ZSk,i}\,(\text{in MVA}) = \frac{TCMD_{ZSk,i}\,(MW)}{PF_{ZSk,i}}$$

Annexure D – ADDING A NEW ZONE SUBSTATION

Steps to add a new Zone Substation to the existing Excel linked Worksheet

In this example we will add Nepean zone to Nepean 66kv transmission substation.

Note 1. Because the excel macros don't use spaces, we replace spaces with underscores. So, instead of Nepean zs, we will use Nepean_ZS. 'Nepean_ZS' must be used in all renaming as an exact string so all linkages in the workbook are correct.

Note 2. Some transmission substations have a 'Major_Customers' tab. This tab is no longer used for adding new HVC's. Instead follow the steps outlined below.

Update Transmission Forecast Sheet

(1) Open up the transmission forecast sheet (eg. Nepean 66kV) to where the new Zone or HVC (major customer) is added too.

(2) Make a copy an existing zone substation worksheet (eg. Narellan). Rename the copied spreadsheet to the new zone substation or HVC name (Nepean_ZS).

(3) Go to the 'TCMD summer' tab of the workbook and insert nine rows within the worksheet to represent the new zone substation. (zones/HVC's are usually listed alphabetically)

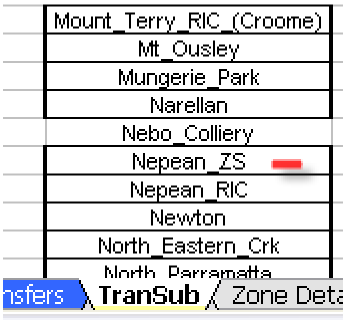
	Actual	MVA	25.6	25.9	30.0	37.4	38.2	36.4
Narellan		MW	25.4	25.2	29.2	32.1	28.9	37.6
		MVAr	8.4	9.4	10.7	12.4	10.1	12.2
	10% POE	MVA	26.7	26.9	31.1	34.4	30.6	39.5
		PF	0.949	0.936	0.939	0.933	0.944	0.951
		MW	23.9	23.3	27.4	30.2	28.1	35.0
		MVAr	7.9	8.7	10.1	11.7	9.8	11.3
	50% POE	MVA	25.1	24.9	29.2	32.4	29.7	36.7
		PF	0.949	0.936	0.939	0.933	0.944	0.951
	Actual	MVA						
Nepean_ZS		MW						
		MVAr						
	10% POE	MVA						
		PF						
		MW						
		MVAr						
	50% POE	MVA						
		PF						
	Actual	MVA	11.5	12.1	11.0	16.0	14.9	14.7
Tahmoor		MW	11.5	11.0	10.9	14.7	14.2	15.5
		MVAr	4.1	3.7	3.6	5.1	0.0	1.0

(4) Still on the 'TCMD summer' tab copy and paste the formulae from another zone substation (eg. Narellan). If your zone is a major customer then add the words of 'major customer' below the zone name.

Update Details spreadsheet

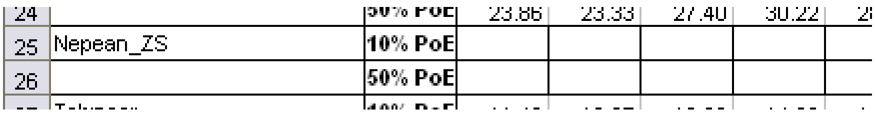
(5) Open up the 'details.xlsx' spreadsheet and go to the 'zone details' tab. Input the new HVC or zone substation information under the Transmission Substation.

(6) Now select the 'Transub' worksheet. Under the list of ZS's add the Zone to the list.



Update Details TCMD spreadsheet

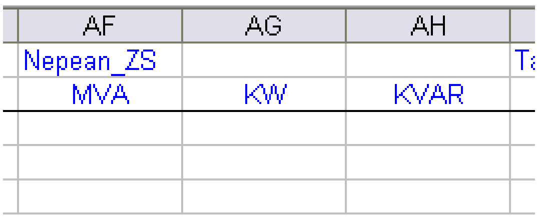
(7) Open the “details TCMD.xlsx”. Navigate to the transmission substation tab (eg. Nepean 66kV) to which your zone belongs too. Insert two rows where the new zone substation fits in alphabetically. This will be its 50% and 10% Poe. Lastly, take note of the row numbers (i.e 25, 26).



In this screenshot above the row numbers 25 and 26 will be used as a link into the zone substation worksheet on the transmission substation workbook.
Any zone substations below Nepean_ZS will also need to have there row numbers updated.

Update the History spreadsheet

(8) Open the transmission history sheet and create three columns, MVA, KW and KVAR as per the convention to identify the new zone substation.



(9) Re-open the transmission forecast template. Now click on the new zone tab (ie, Nepean_ZS) change the old row numbers to the new row numbers (i.e 25 & 26 from above). Cells FN4 & FN8 usually contain the cell numbers which relate to the row numbers in the details TCMD spreadsheet.

		2004	2005	2006	2007	2008	2009
Nepean_ZS		C	D	E	F	G	H
25	MW	0.0	0.0	0.0	0.0	0.0	0.0
	MVAr	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
10%	**MVA**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
	PF	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
26	MW	0.0	0.0	0.0	0.0	0.0	0.0
	MVAr	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50%	**MVA**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
	PF	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
						Ave PF	**0.900**

(10) The final step is the check that your zone worksheet is picking up the history spreadsheet, the details TCMD and also the 'TCMD summer' tab has the correct information linked to it. Following that, check all zone worksheets within that workbook to make sure there aren't any errors. Allocate the correct row numbers that is stated in the details TCMD spreadsheet. Otherwise you will find the following error occurring.

		2004	2005	2006	2007	2008	2009
ERROR!! 0		C	D	E	F	G	H
10	MW	3.8	3.7	4.5	4.5	3.5	4.3
	MVAr	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
10%	**MVA**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
	PF	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
11	MW	7.2	7.0	8.0	7.4	5.9	6.0
	MVAr	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
50%	**MVA**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
	PF	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

This error highlighted above means that the rows 10 & 11 are incorrect and the numbers will need to be changed to the correct row numbers listed within the details TCMD spreadsheet that match the zone substation name.

Annexure E – ADDING A NEW TRANSMISSION SUBSTATION

Steps to add a new Transmission Substation to the existing Excel linked Worksheet

(Note: the spelling of the TS and ZS names must be exactly matched but not case sensitive. The following steps are using new West Wetherill Park TS as an example.)

1. Copy an existing TS forecast worksheet and its linked history worksheet to the forecast and history templates. (Sydney North TS is a good candidate for copy as it contains the same number of ZSs.)

Details TCMD.XLSS

2. Copy a new TCMD worksheet template (from Sydney North TS) and rename as TCMD West_Wetherill_Park.

3. Change the names of ZS1 (Horsley_Park) and ZS2 (Bossley_Park) in the worksheet.

4. Insert the formulae to summate the ZS1 and ZS2 for undiversified load.

5. Multiply the undiversified load by a ratio (say 0.95) to give diversified load.

Details.XLSS (TranSub worksheet)

6. Insert the names of ZS1 (Horsley_Park) and ZS2 (Bossley_Park) under the column of **ZS,** (if not included prior).

7. Insert the names of TS (West_Wetherill_Park) to the list of the Transmission Subs.

Transmission Subs	Transmission Subs
Baulkham_Hills	Baulkham_Hills
Bellambi	Bellambi
Blacktown	Blacktown
Camellia	Camellia
Carlingford	Carlingford
Dapto_132kV	Dapto_132kV
Fairfax_Lane	Fairfax_Lane
Guildford	Guildford
Hawkesbury	Hawkesbury
Ilford	Ilford
Ingleburn	Ingleburn
Katoomba_North	Katoomba_North
Lawson	Lawson
Mount_Druitt	Mount_Druitt
Mount_Piper	Mount_Piper
Mount_Terry	Mount_Terry
Nepean_33KV	Nepean_33kV
Nepean_66KV	Nepean_66kV
Outer_Harbour	Outer_Harbour
Penrith	Penrith
Regentville	Regentville
Shoalhaven	Shoalhaven

Springhill	Springhill
Sydney_North	Sydney_North
Sydney_West_132kV	Sydney_West_132kV
Vineyard	Vineyard
Wallerawang	Wallerawang
Warrimoo	Warrimoo
West_Liverpool	West_Liverpool
West_Wetherill_Park	West_Wetherill_Park

Detailed.XLSX (Zone Details worksheet)

8. Add the ZS details to the worksheet.

Forecast Template (TransSub worksheet)

9. Edit the cell for the name of Transmission Substation (West_Wetherill_Park).

10. Edit the cell for TCMD worksheet name (TCMD West_Wetherill_Park).

11. Edit the cell for Transmission History File name (West_Wetherill_Park_history).

Transmission Substation	West_Wetherill_Park		TCMD West_Wetherill_Park
Transmission History File	West_Wetherill_Park_history		
Base Year of Forecast	2008		
Forecast Season	Winter		
Install Caps at TS		0	MVAr

OK

History Template (Data worksheet)

12. Edit the name of the zone substations under this TS (Horsley_Park, Bossley_Park and West_Wetherill_Park).

	Horsley_Park			Bossley_Park			West_Wetherill_Park
Date	MVA	KW	KVAR	MVA	KW	KVAR	MVA

Forecast Template (TransHistory worksheet)

13. Change the name of TS (West_Wetherill_Park) in the formulae under Columns C, D and E.

Forecast Template (ZS1 Horsley_Park **worksheet)**

14. Change the name of TS (West_Wetherill_Park) in the formulae under Columns C, D and E.

15. Update the data for the graphs in the check sheet, if necessary.

Forecast Template (ZS2 Bossley_Park **worksheet)**

16. Change the name of TS (West_Wetherill_Park) in the formulae under Columns C, D and E.

17. Update the data for the graphs in the check sheet, if necessary..

Forecast Template (winter and summer worksheets)

18. Change the names of ZS1 (Horsley_Park) and ZS2 (Bossley_Park) in the winter and summer tables. The loads will pick up from those in the individual ZS's worksheets.

19. Edit the formulae for undiversified load if required.

Linking TS to BSPXXX.XLSX (Winter and Summer worksheets)

20. Insert 9 rows for actual, 10% and 50% PoE load and copy the format from existing TS.

21. Edit the link formulae for West_Wetherill_Park TS.

22. Edit the formulae for undiversified load.

Some Testing of the above procedures:

Detailed.XLSX (Spot Load, Lot Release and Load Transfer worksheets)

23. Add test spot load, lot release and load transfer to ZSs (West_Wetherill_Park TS).

24. Run the macro “RunCalcs” with opening of West_Wetherill_Park_Forecast.xlsx.

25. Add test spot load, lot release and load transfer will be appeared in the “Details” and “ModDetails” worksheets.

Annexure F – Sample Cover Sheet for Project Sign Off

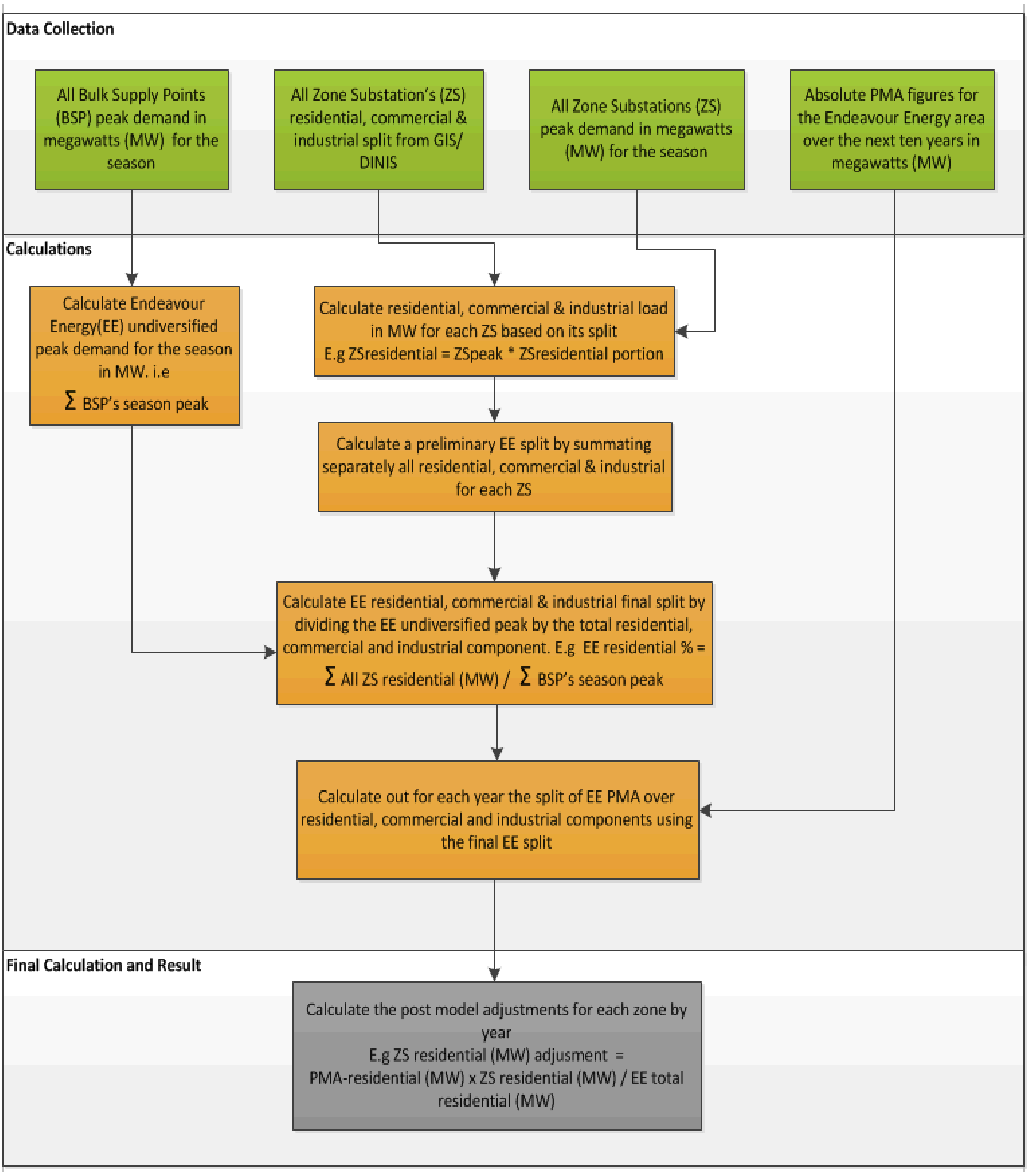
I, ……………………………………………. hereby agree that the attached project information
(Capacity Planning Manager)

provided by Asset Strategy and Planning for the …………………….. represents the currently
(Forecast Season)

known data and can be included into each of the zone substation forecasts with no changes or additional information required.

……………………………… ………………
Capacity Planning Manager Date

Annexure G – Apply Post Model Adjustments



Annexure H – System Normal Table

Winter - Baulkham Hills

Location			Actual						Forecast									
88			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	Actual	MVA	121.2	118.5	111.4	104.5	102.7	102.6										
Undiversified		MW	117.6	115.6	110.0	110.9	101.6	100.3	103.2	107.2	107.9	109.8	113.4	117.9	121.6	123.6	124.1	124.0
		MVAr	14.6	17.1	20.5	14.8	13.4	18.7	14.5	15.0	15.1	15.5	16.2	17.2	17.9	18.3	18.4	18.4
	10% POE	MVA	119.3	117.6	113.4	112.0	102.6	103.0	104.3	108.4	109.1	111.1	114.7	119.3	123.1	125.1	125.6	125.5
		PF	0.985	0.983	0.970	0.990	0.991	0.974	0.989	0.989	0.989	0.989	0.989	0.988	0.988	0.988	0.988	0.988
		MW	113.0	112.6	106.4	106.8	99.5	97.3	100.2	104.3	105.0	106.9	110.5	114.9	118.6	120.6	121.1	121.0
		MVAr	13.6	16.4	19.6	14.2	13.2	18.2	14.1	14.6	14.7	15.1	15.8	16.7	17.5	17.9	18.0	18.0
	50% POE	MVA	114.6	114.6	109.6	107.8	100.5	100.0	101.3	105.4	106.1	108.1	111.7	116.3	120.1	122.1	122.6	122.5
		PF	0.986	0.983	0.971	0.990	0.991	0.973	0.989	0.989	0.989	0.989	0.989	0.988	0.988	0.988	0.988	0.988
	Actual	MVA	121.5	139.5	152.1	115.3	104.5	108.0										
Diversified		MW	117.7	138.2	151.6	113.8	102.2	108.0	103.2	107.2	107.9	109.8	113.4	117.9	121.6	123.6	124.1	124.0
		MVAr	30.2	18.6	12.1	18.6	21.6	2.9	15.4	16.0	16.1	16.4	16.9	17.6	18.1	18.4	18.5	18.5
	10% POE	MVA	121.5	139.5	152.1	115.3	104.5	108.0	104.3	108.4	109.1	111.1	114.7	119.2	122.9	124.9	125.4	125.4
Additional Table		PF	0.969	0.991	0.997	0.987	0.978	1.000	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989
		MW	117.7	138.2	151.6	113.8	102.2	108.0	100.2	104.3	105.0	106.9	110.5	114.9	118.6	120.6	121.1	121.0
		MVAr	30.2	18.6	12.1	18.6	21.6	2.9	15.0	15.6	15.7	15.9	16.5	17.1	17.7	18.0	18.1	18.1
	50% POE	MVA	121.5	139.5	152.1	115.3	104.5	108.0	101.3	105.4	106.2	108.1	111.7	116.2	120.0	121.9	122.4	122.4
		PF	0.969	0.991	0.997	0.987	0.978	1.000	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989
	Actual	MVA	107.4	115.2	101.0	87.6	102.3	93.2										
Estimated System Normal		MW	104.0	114.2	100.7	86.4	100.1	93.2	94.7	98.4	99.1	100.8	104.1	108.2	111.6	113.4	113.9	113.8
		MVAr	26.7	15.3	8.0	14.1	21.2	2.5	14.1	14.7	14.8	15.0	15.5	16.1	16.7	16.9	17.0	17.0
	10% POE	MVA	107.4	115.2	101.0	87.6	102.3	93.2	95.8	99.5	100.2	102.0	105.3	109.4	112.9	114.7	115.2	115.1
		PF	0.969	0.991	0.997	0.987	0.978	1.000	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989
		MW	104.0	114.2	100.7	86.4	100.1	93.2	92.0	95.7	96.4	98.1	101.4	105.5	108.9	110.7	111.2	111.1
		MVAr	26.7	15.3	8.0	14.1	21.2	2.5	13.7	14.3	14.4	14.6	15.1	15.7	16.3	16.5	16.6	16.6
	50% POE	MVA	107.4	115.2	101.0	87.6	102.3	93.2	93.0	96.8	97.5	99.2	102.5	106.7	110.1	111.9	112.4	112.3
		PF	0.969	0.991	0.997	0.987	0.978	1.000	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989