AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

2019 ESOO Input Data Package and Model Instructions

August 2019

A Guide to the Input Data and Model of the 2019 National Electricity Market Statement of Opportunities

Important notice

PURPOSE

AEMO has prepared this document to assist stakeholders in interpreting and using the input data produced for the purpose of modelling the National Electricity Market (NEM) using the assumptions and approach applied in the 2019 Electricity Statement of Opportunities (ESOO).

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VERSION CONTROL

Version	Release date	Changes
#	22/08/2019	Release for 2019 ESOO

1. Configuring the 2019 NEM ESOO Model

1.1 Running the Central Scenario

This chapter contains the steps needed to set up the 2019 ESOO PLEXOS market model, including configuration of the input data package used in the simulation model. The step by step guide is documented below.

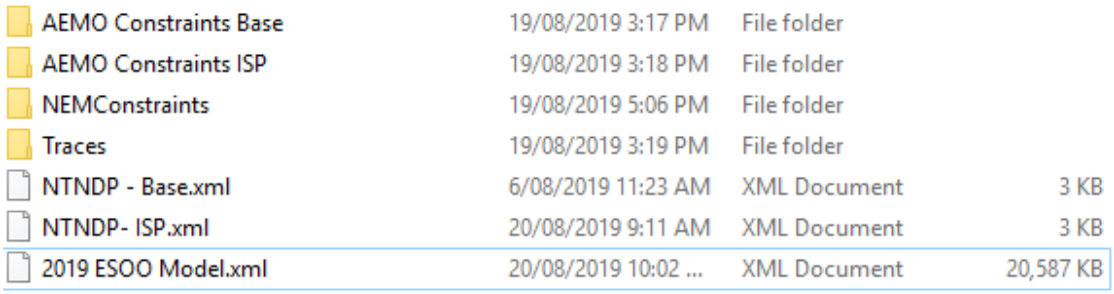
1. Download the zip files from AEMO's 2019 Electricity Statement of Opportunities webpage. The list of zip files is summarised in Table 1.

Table 1 Zip files from AEMO's 2019 ESOO webpage

No	File	Description	Where to put the files
1	2019 ESOO Model.zip	Contains Model files, constraint equation workbooks and associated parameter files.	
2	2019 Solar Traces.zip	Contains half-hourly generation traces for solar.	Place into the 'Traces\solar' folder
3	2019 Wind Traces.zip	Contains half-hourly generation traces for wind.	Place into the 'Traces\wind' folder
4	2019 Constraint Ratings.zip	Contains half hourly line ratings for Victorian transmission lines.	Place into the 'Traces\rating' folder
5	PV_TOT.zip	Contains half hourly regional generation traces for embedded PV, including rooftop PV and PVNSG.	Place into the 'Traces\demand folder
6	OPSO_PVLITE.zip	Contains half-hourly regional demand traces for operational demand (demand before the impact of rooftop PV and PVNSG).	Place into the 'Traces\demand folder
7	OPSO.zip	Contains half-hourly regional demand traces for operational demand (demand after the impact of rooftop PV and PVNSG).	Place into the 'Traces\demand folder

2. Unzip the file *2019 ESOO Model.zip*. This will generate the 2019 ESOO Model folder. The contents of the 2019 ESOO Model folder are illustrated in Figure 1.

Figure 1 Contents of the 2019 ESOO Model file



3. Open the *Traces* folder.
4. Extract the other 6 zip files into their respective sub-folders as outlined in Table 1.
5. The 2019 ESOO modelling has been performed under three core scenarios and a sensitivity which includes the impact of ISP group 1 transmission augmentations. These scenarios and sensitivities contain varying outlooks for future supply and demand. The three core base scenarios are Central, Step change and Slow change. The ISP augmentations are implemented through a different set of constraints. Only the Central scenarios are set up in the *2019 ESOO Model.xml*, but these instructions explain how to configure the alternative scenarios.
6. To run the core scenario, copy and rename *NTNDP – Base.xml* to *NTNDP.xml*.
7. The model will run with the 'Outages All Average' scenario, where the rates are averaged for each respective technology type. Details of this scenario and alternate outage rate scenarios are in section 1.2.

The simulation of 2019-20 considered the potential for delayed return to service of the Mortlake and Loy Yang A units currently on extended outages. To simulate these sensitivities, either one or both of the scenarios called 'Delayed LYA RTS' or 'Delayed MPS RTS' should be enabled. If 'Delayed LYS RTS' is enabled, the 'LYA2 Outage' scenario should be disabled. A horizon of only one year is required for these sensitivities.

1.2 Running alternative outage rate scenarios

For the 2019 ESOO generator forced outage rates have been modelled differently than previous ESOO publications, details on this can be found in section 4.2.1 of the 2019 ESOO Report. Outages have been calculated per station level for the 2019 ESOO results, however to ensure this information is kept confidential they have been aggregated based on the following technology types:

- Brown Coal
- Black Coal New South Whales
- Black Coal Queensland
- CCGT
- OCGT (units over 150 MW)
- Steam turbine
- Hydro
- Small peaking plant (OCGT less than 150 MW).

A description of each outage set is in Table 2.

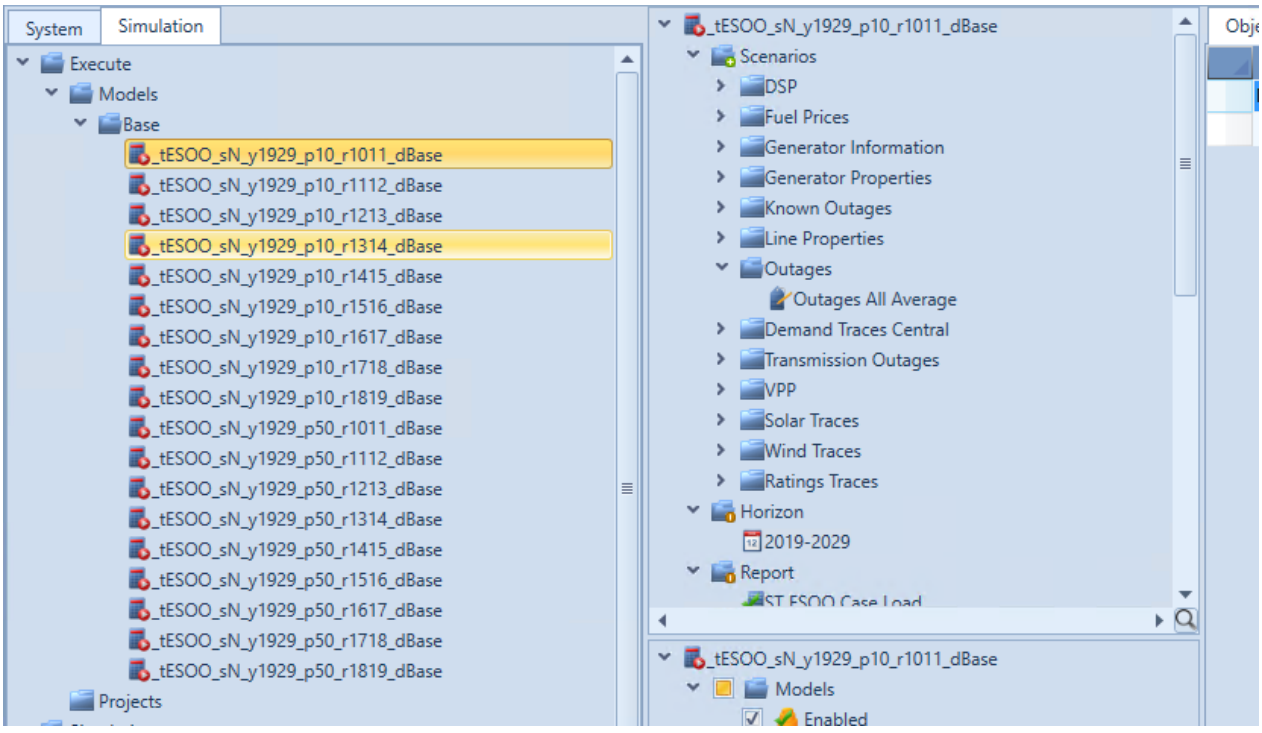
Table 2 Outage Rate Scenario Descriptions

Scenario Name	Description
Outages All Average	This represents the average outage rate for each respective technology type (as described in above), aggregated across historical years 2015-16, 2016-17, 2017-18 and 2018-19.
Outages Average Set 1	This represents the average outage rate for each respective technology type for historical year 2015-16.
Outages Average Set 2	This represents the average outage rate for each respective technology type for historical year 2016-17.
Outages Average Set 3	This represents the average outage rate for each respective technology type for historical year 2017-18.
Outages Average Set 4	This represents the average outage rate for each respective technology type for historical year 2018-19.

For the 2019 ESOO results outage sets 1 to 4 were simulated (however at a confidential station level) for 25 iterations for each set, and for each POE (10 and 50) and reference year (reference years 2010-11 to 2018-19). This gave a total of 1,800 simulation outcomes.

The published Plexos model is set up to run the Central scenario with the "Outages All Average" set for 100 iterations. If you select any of the models, you will see the scenario 'Outages All Average' is attached, as shown in Figure 2.

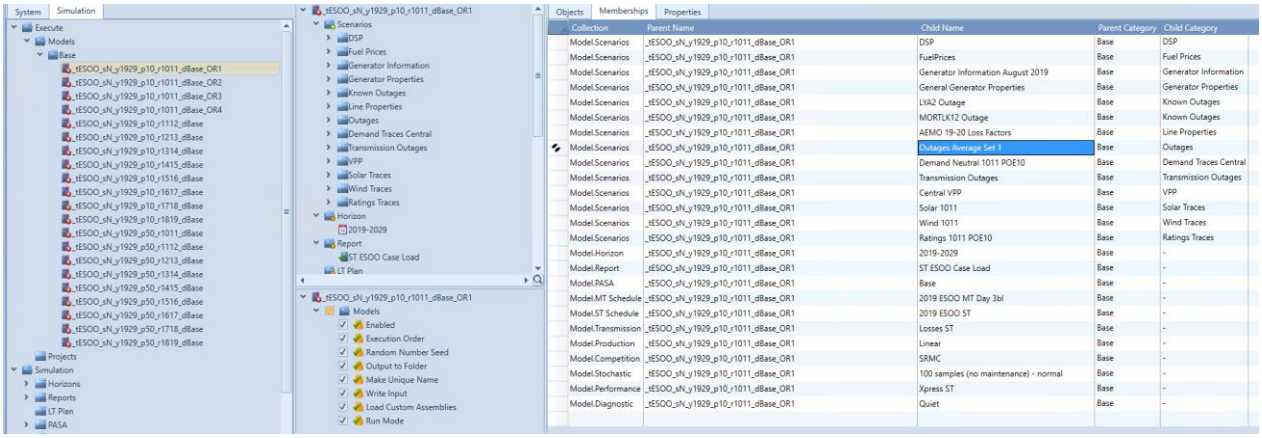
Figure 2 Outages All Average scenario attachment



Should you prefer to run the model on a per outage set basis you will need to undertake the following steps for each model (the _tESOO_sN_y1929_p10_r1011_dBase model has been used as an example below):

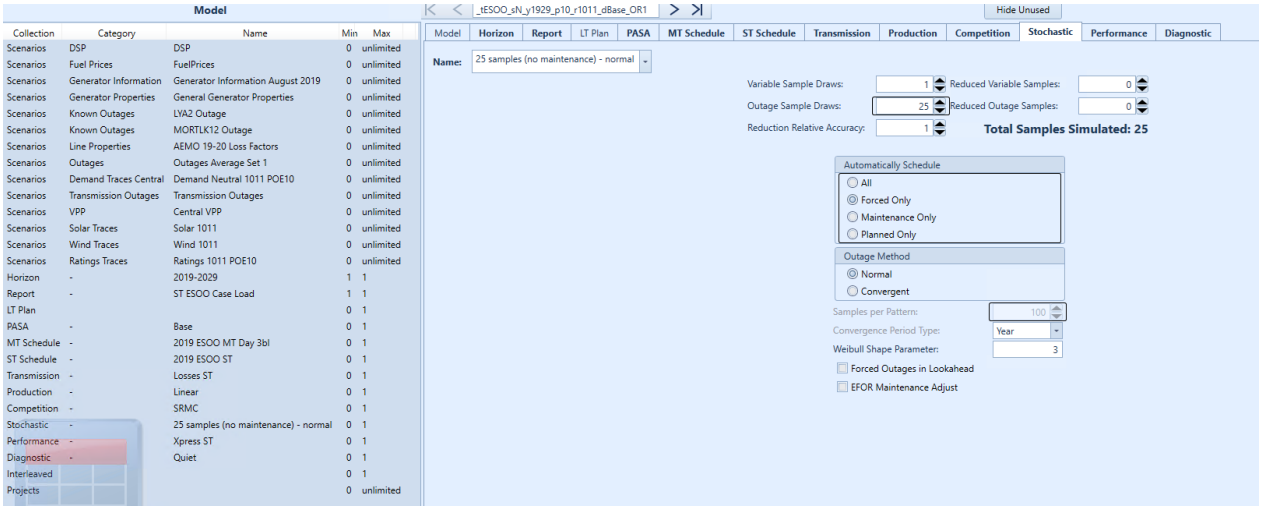
1. Rename the model _tESOO_sN_y1929_p10_r1011_dBase to _tESOO_sN_y1929_p10_r1011_dBase_OR1
2. Remove the 'Outages All Average' scenario.
3. Make 3 more copies of this model and label them _tESOO_sN_y1929_p10_r1011_dBase_OR2, _tESOO_sN_y1929_p10_r1011_dBase_OR3 and _tESOO_sN_y1929_p10_r1011_dBase_OR4.
4. For each outage set add their respective outage set from the 'Outages' scenario folder to the memberships of the model. An example of _tESOO_sN_y1929_p10_r1011_dBase_OR1 is shown in Figure 3.

Figure 3 Attaching outage set 1



5. Change the stochastic setting to 25 samples by double clicking on the model, selecting the stochastic tab and using the drop down '25 samples (no maintenance) – normal' as shown in Figure 4.

Figure 4 Changing the model stochastic settings



6. Once this is complete the models OR1-OR4 are ready to execute and run for this POE and reference year. The same process would need to be deployed for each reference year and POE, resulting in 72 models.

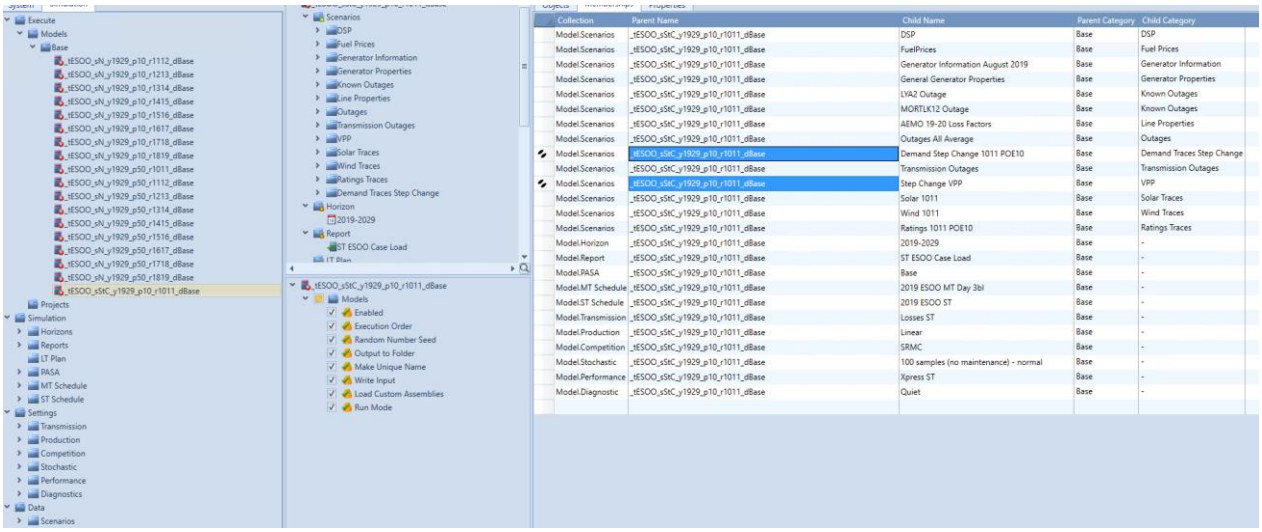
1.3 Running alternative scenarios

1.3.1 Running step change and slow change scenarios

To run the step and slow change scenarios follow these steps (using the step change scenario as an example).

1. Rename the model changing the N in "_tESOO_sN_y1929_p10_r1718_dBase" to StC.
2. Remove the current 'Demand' scenario in the 'Demand Traces Central' folder.
3. Add the relevant 'Demand Traces Step Change' scenario to their respective reference year model.
4. Remove the current 'Central VPP' scenario in the 'VPP' folder.
5. Add the VPP scenario 'VPP Step Change' to each of your models.
6. Figure 5 has an example of this setup for Step change for one reference year and POE scenario.

Figure 5 Step change set up



1.3.2 Running the ISP scenario

To run the ISP scenario:

1. Change the Base in "_tESOO_sN_y1929_p10_r1718_dBase" to ISP.
2. Add the scenario 'ISP Upgrades' in the 'Line Properties' folder to your models
3. Delete current *NTNDP.xml* file and copy and rename the *NTNDP- ISP.xml* to *NTNDP.xml*.
4. Run your models as you did in section 1.1.

2. 2019 NEM ESOO Model Naming Convention

A set of naming conventions is developed in the 2019 NEM ESOO to shorten the model names in order to comply with the maximum number of characters allowed in naming models in PLEXOS. Table 3 describes the model naming convention used in the 2019 NEM ESOO. The job sets populated in this model reflect this naming convention.

For example, the job set "_tESOO_sN_y1929_p10_r1718_dBase" represents the following assumptions:

- Central demand scenario.
- A model horizon between 2019-20 and 2028-29.
- The POE10 peak demand forecast
- The 2017-18 reference year.
- The ESOO Baw scenario that assumed only existing and committed projects.

Table 3 ESOO 2019 naming convention

Descriptor	Prefix	Options	Description
Project	_t	ESOO	2019 NEM ESOO
Scenario	_s	N StC SIC	N = Central, neutral economic conditions and pace of change. Stc= Step change, strong economic conditions and pace of change. SIC= Slow change, slow economic conditions and pace of change.
Financial Year	_y	1929	Financial year range modelled e.g. 2019-20 to 2028-29
Probability of exceedance	_p	10, 50	POE demand trace used
Reference Year	_r	1011 to 1819	Reference year traces used
Sensitivity	_d	Base ISP	Base = Core ESOO assumptions ISP= ISP Constraints implemented

3. Further details

The model is populated with the settings that were used in the 2019 ESOO modelling which was run using custom results extraction tools on a cloud simulation platform. Desktop applications may require changes to settings to reduce the size of simulations and allow for results to be produced in other forms.

Model file provided:

- 2019 ESOO Model.xml – this contains the core scenarios, Central, Step change and Slow change. As well as the ISP augmentation sensitivity.

PLEXOS 7.500 R02 x64 was used to create and run the 2019 ESOO scenarios and sensitivity.

Each model was run using a Split Execution with the number of splits equal to the number of samples.

The ESOO was run with the OpenPLEXOS NEMConstraints assembly applied. This allows the application of transmission constraint equations contained in the constraint workbooks provided.

Both the PLEXOS software and the OpenPLEXOS assemblies are available from Energy Exemplar. The models can be run without the OpenPLEXOS assembly but would not incorporate the impact of transmission constraint equations. The constraints workbooks represent the constraints that are relevant for assessing reliability.

These constraint sets do not account for all transmission limitations in the NEM. The constraint sets applied are focused on constraints that impact reliability outcomes.

The constraints workbooks also include outage constraint sets which are triggered based on outage variables specified in the model. These constraints should be ignored if simulating for another purpose, or when transmission outages are not considered.

The constraints workbooks also change depending on the model run (e.g. Base vs ISP). These are controlled through the NTNDP.xml file.