

Representative Australian Electricity Feeders with load and solar generation profiles: Readme file

This file contains information about the dataset, what's included and how to use it. **New versions of this data might have been released. Please check**

<https://data.csiro.au/dap/landingpage?pid=csiro:15331> to make sure you are using the most up-to-date version.

Feeder models

This data set includes models of 19 Australian electricity feeders that were identified as representative of the Australian network in the National Feeder Taxonomy Study (NFTS) [1]. The models are available both in PSS Sincal and PowerFactory, two major industry-standard power simulation tools.

To the best of our knowledge, all of the provided models work in PowerFactory 15.1 and PSS Sincal 11.5 and above. These models are readily available to run power flow calculations and any other type of simulation requiring static data.

Time series simulations can also be run on these models. Load and solar profiles are included for the loads in these feeders. These profiles are half-hour time series spanning one year. The user also has the ability to attach their own load and solar generation profiles to the feeders.

PSS Sincal models

These models were initially released with [1]. We have incorporated real-world load and PV profiles (rather than the original generic values) to four of the feeders. The methodology to assign loads to the models is described in detail in [3].

PowerFactory models

For PowerFactory, models for all 19 of the prototypical feeders are provided. Note that model 1 has an undiagnosed issue which prevents the load flow results matching the Sincal counterpart. Model 3 has discrepancies with its Sincal counterpart due to the lack of a corresponding load model in PowerFactory. Unless stated otherwise, the Sincal models should be considered the more accurate of the two model sets for any discrepancy.

The PowerFactory models are included in *Models Release.pfd*. The models can be accessed by importing the file into PowerFactory (*File > Import > Data*). A zip file of load and solar profiles for model 14 is also provided for demonstration purposes. To run the demonstration, activate File 14 and ensure that the External Data Directory (*Edit > Project Data > Project Settings > Miscellaneous > External Data Directory*) includes the unzipped load and solar profiles. Then run a time series simulation by clicking the *Calculate Initial Conditions* button and then *Execute*. After that, press the *Start Simulation* button followed by *Execute*. For an entire year, this can take a considerable amount of time but the 5th box from the right on the PowerFactory panel at the bottom will indicate the progress of the simulation. Once finished, click on the *Subplot* tab (at the bottom of network graphic) to see the results (the warnings regarding the end of file can be ignored).

To create your own load and solar profiles to run your own customised simulations, two separate text files (one for load consumption, one for solar generation) need to be created for each load in the model – it is these text files that are referred to as the ‘load profile’ and ‘solar profile’ respectively. All of the load and solar profiles must reside within the one directory. All load profiles must be named in the form ‘XY.txt’ where X is a consistent prefix for all load profiles, and Y is the name of the load that the profile refers to. Solar profiles must be named in the same form, but X must be a different prefix. Both the solar profiles and load profiles must have the properties:

- The first line contains only a number that is equal to the number of variables (i.e. the number of columns) **excepting** the time index column (i.e. the first column) – i.e. the number is 2 by default.
- The remainder of the file consists of 3 columns, where tabs separate the columns. The 1st column is the time index (in seconds), the 2nd column is the real power consumed (generated) in kW and the 3rd column is the amount of reactive power consumed (generated) for each time step in the load (solar) profile.

The load and solar profiles for model/feeder 14 are provided as an example.

Having created the files, a script (*Create_Controlled_Loads_And_Scale*) provided within the imported file (*Models_Release.pfd*) links the profiles to the load by creating a ‘load controller’ that reads the contents of the files, subtracts solar generation from load consumption, and then changes the value of the load to simulate the time-varying nature. By double clicking the script file from within PowerFactory and reading the description (under the *Description* tab), it is clear how to run the script. If in doubt about the operation of the script, refer to model 14, for which the load controllers have already been created.

Load profiles

Time series simulations can be run on these models provided there are load profiles available for them. We have included real-world load and PV profiles for the Sincal version of feeders 4, 10, 11 and 14. The load profiles were obtained from [2] and the PV profiles were obtained from [4] (for more detailed information, see [3]). We have also included generic load profiles for all of the models (see the section “Additional Data”). Additionally, the user can specify their own load and PV profiles. The below shows the types of load profiles available for each model.

Table 1 - Representatives and types of load and PV profiles that can be used with them (A = NFTS generic load profiles, B = User-provided profiles, C = The model comes with real-world load profiles ready to be used)

Representative	PSS Sincal	PowerFactory
1	A, B	A, B
2	A, B	A, B
3	A, B	A, B
4	A, B, C	A, B
5	A, B	A, B
6	A, B	A, B
7	A, B	A, B
8	A, B	A, B
9	A, B	A, B
10	A, B, C	A, B

11	A, B, C	A, B
12	A, B	A, B
13	A, B	A, B
14	A, B, C	A, B, C
15	A, B	A, B
16	A, B	A, B
17	A, B	A, B
18	A, B	A, B
19	A, B	A, B

Additional data

The folder *AdditionalData* contains additional information that was used to generate the feeder models that is not publicly available anywhere else. Namely:

- *Commercial and Industrial load profiles*: This folder contains half-hourly load data for 78 commercial and 42 industrial customers. These load profiles can be used for the feeders that have been identified as predominantly commercial or industrial (e.g., Feeders 6, 7, 13, 15 and 16). Note that the number of customers is not enough to directly apply the method described in [3] with satisfactory results. Therefore, the user of the data will need to devise a new method to assign load profiles to loads in the models. Examples of these methods are: (1) expanding the data set with more commercial and industrial load profiles, (2) duplicating some of the provided loads, (3) combining this data with the *Generic load profiles from the NFTS*.
- *Generic Load Profiles from the NFTS*: This folder contains normalised average daily load profiles for commercial, industrial and residential customers. For each customer type, there is profiles for summer, winter and shoulder seasons. In the absence of metered customer data to populate the loads in the models, these profiles can be used to run time-series simulations.

References

[1] Berry, Adam; Moore, Tim; Ward, John; Lindsay, Stephen; Proctor, Kelvin. National feeder taxonomy: describing a representative feeder set for Australian electricity distribution networks. Newcastle, N.S.W.: CSIRO; 2013

[2] "Electricity Use Interval Reading". Smart-Grid Smart-City Customer Trial Data. Canberra: Department of Industry, Innovation and Science, 2015. Available from <http://data.gov.au/dataset/smart-grid-smart-city-customer-trial-data> (Accessed: 15/10/2015)

[3] Oliver, Erin; Perfumo, Cristian. Load and solar modelling for the NFTS feeders, technical report. Newcastle, N.S.W.: CSIRO; 2015 (available in Supporting Attachments on <https://data.csiro.au/dap/landingpage?pid=csiro:15331>)

[4] NREL. *NREL's PVWatts® Calculator*. Available: <http://pvwatts.nrel.gov/> (Accessed: 10/2015)