Collection of Data utility models: Usage and documentation

University of Wisconsin - Madison

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1 Model descriptions

1.1 Format conversion tools

1. `to_gdx.gms`
   Converts matpower and psse files to `gdx` format.

2. `to_matpower.gms`
   Converts a `gdx` file (of above format) to a Matpower-formatted `.m` file.

3. `to_psse.gms`
   Converts a `gdx` file (of above format) to a PSSE-formatted `.raw` file.

4. `gdx2xls.gms`
   Converts a `gdx` file (of above format) to an `.xls` or `.xlsx` output file, depending on the version of Excel installed. Versions prior to 2007 use `.xls` while later versions use `.xlsx`. To write `.xls` files when using later versions of Excel (2007 and after), the `--out` option must be specified with an `.xls` file extension. The `.xls` extension is not recommended due to sheet size limitations which were increased beginning in Excel 2007.
   All Excel files start with a "Table_of_Contents" sheet that lists all set and parameter entries of the `.gdx` inputfile in the first column. Each entry is a clickable link that guides the user to the appropriate sheet with the stored data values. All other data sheets are named after GAMS sets and parameters from the input file, and have a clickable link, "TOC", in the A1 cell that returns the user to the main "Table_of_Contents" sheet.

1.2 Other tools

1. `calc_S_matrix.gms`
   Outputs a file containing the shift matrix, for use in `dcopf_shift.gms`

2. `make_demand_curves.gms`
   Adds demandbid information to a datafile

3. `rts_demands.gms`
   Creates data for 24 hours for RTS

2 Model Options

2.1 Format conversion model options

These options apply to models that deal with format conversion as listed in 1.1. The basic model can be run from the command line with a single option, `gams model.gms --in=/path/inputfile`, as explained below. Do not include square braces [ ] in the options.

1. `--in=[/path/to/inputfile]` (Required)
   Select the input file to be converted. With the exception of `to_gdx.gms`, all input files refer to GAMS input files files with `.gdx` extensions. For `to_gdx.gms`, the extension can either be a PSSE-formated `.raw` or a Matpower-formatted `.m` file.

2. `--out=[/path/to/outfile]`
   Specify a destination for the final GDX file output. If not given, this is assumed to be the same as the input file but with the appropriate extension, i.e. `inputfile(.m,.raw,.xlsx,.gdx)`.

2.2 Model to_gdx.gms options

These options apply specifically to the data utility `to_gdx.gms`. Currently, this utility supports reading from a Matpower-formatted '.m' structure file using an awk script and from a PSSE-formatted raw text file using an awk script for comma delimited files or a C++ application for comma or space delimited files. Do not include square braces [ ] in the options.

Note that if line symmetry is encountered in the input datafile (i.e. two separate lines ijc and jic exist), this is replaced with lines ijc and ijc_2 in the `.gdx` file. This avoids issues with defining line losses in the ACOPF models. More information on how lines are treated in the GAMS models can be found in the Model Formulation document.

Note: Space delimited PSSE files cannot to our knowledge be parsed by awk, as they allow quoted strings with spaces for some of the fields, which makes parsing the rows using regular expressions potentially impossible.

1. `--type=[datatype]`: Specify the format of the input file.
   - `psse`: Input is a PSSE-formatted file, `inputfile.raw`.
   - `matpower`: Input is a Matpower-formatted file, `inputfile.m` (*Default*).

2. `--mode=[conversion_mode]`: Specify the reader to be used

- `awk`: Awk script (*Default*)
  Note: PSSE awk script does not currently support some features of PSSE raw data.
- `cpp`: Compiled C++ executable (Only supported for `--type=psse`).
  Note: C++ executable requires GAMS IDE and appropriate environment variables set to compile.

3. `--Sbus=[#]`
   - `0`: Do not calculate shift factor matrix (*Default*)
   - `1`: Calculate the matrix of linear shift factors for DCOPF using GAMS model `calc_S_matrix.gms`.
4. `--monitorall=[#]`: (valid only if `--Sbus=1`)
   - `0`: Only calculate shift factor matrix rows for highest voltage lines and transformers
   - `1`: Calculate shift factor matrix rows for all lines and transformers (*Default*)

2.3 Model to_matpower.gms options

Because matpower formatted files do not have support for multi-timeperiod models, an additional option is provided to facilitate converting a multi-period `.gdx` file to multiple `.m` files.

1. `--timeperiod=[#]`
   Select the timeperiod to convert (*Default=1*).

2.4 Model calc_S_matrix.gms options

The data utility `calc_S_matrix.gms` is called with a single option:
`gams model.gms --case=/path/case.gdx`

The resulting output file is `/path/case_Shift_Matrix.gdx`. Note that this model may take a while as it currently produces a dense matrix which requires $|N|$ linear program solves, where $|N|$ is the number of nodes in the network.

2.5 Model make_demand_curves.gms options

The data utility `make_demand_curves.gms` is a utility for adding auxiliary demandbid information to `.gdx` datafiles that does not have this information. Note that this may not work accurately if a datafile already has demandbid information. It requires two files, the original input file (without demandbid information) and a solution file. The solution file should be generated using the `--savesol` option from one of the opf models in the model archive, and more specifically, it should provide LMP values as this is used to compute appropriate values for demand bidding. The `make_demand_curves.gms` model has the following options. Do not include square braces [ ] in the options.

1. `--in=[/path/to/inputfile]` (Required)
   Select the (gdx) input file.

2. `--lmp=[/path/to/solfile]` (Required)
   Specify a solution file with LMP values.

3. `--out=[/path/to/outfile]`
   Specify an output file name. If not required, this function will overwrite the inputfile. Note that the only difference between the two is the addition of demandbid information in the output file.

2.6 Model rts_demands.gms options

The data utility will create 6 RTS-96 `GDX` datafiles based on a single input `GDX` file that is created using `to_gdx.gms`. The reason for this utility is because Matpower formats do not support multi-timeperiods in their dataset. More information is provided in `info_rts.pdf` in the Testcase archive.

1. `--in=[/path/to/inputfile]` (Required)
   Select the (gdx) input file. The utility will output 6 `GDX` files:

   - `inputfile_winter_wday.gdx`
   - `inputfile_winter_wend.gdx`
   - `inputfile_summer_wday.gdx`
   - `inputfile_summer_wend.gdx`
   - `inputfile_spring_wday.gdx`
   - `inputfile_spring_wend.gdx`

Appendices

A Prime Mover Abbreviations

Prime mover information is contained in the `geninfo` parameter of the `GDX` file structure, where `geninfo(bus, 'PrimeMover', 'PM_ABBR')=1` if it applies to a specific generator. Below is a list of available abbreviations that are used in the data files.

Abbreviation	Description
ST	Steam Turbine, including nuclear, geothermal and solar steam (does not include Combined Cycle)
GT	Combustion (Gas) Turbine
IC	Internal Combustion (diesel, piston) Engine
CA	Combined Cycle Steam Part
CC	Combined Cycle Total Unit (plants that are in planning stage, specific generator details cannot be provided)
CS	Combined Cycle Single Shaft (combustion turbine and steam turbine share a single generator)
CT	Combined Cycle Combustion Turbine Part (type of coal must be reported as energy source for integrated coal)
HY	Hydraulic Turbine (includes turbines associated with delivery of water by pipeline)
PS	Hydraulic Turbine - Reversible (pumped storage)
PV	Photovoltaic
WT	Wind Turbine
CE	Compressed Air Energy Storage
FC	Fuel Cell
OT	Other
NA	Unknown at this time (plants that are in planning stage, specific generator details cannot be provided)

Table 1: Prime Mover Abbreviations

B Fuel Info Abbreviations

Fuel information is contained in the `geninfo` parameter of the `GDX` file structure, where `geninfo(bus, 'Fuel', 'FUEL_ABBR')=1` if it applies to a specific generator. Below is a list of available abbreviations that are used in the data files.

Abbreviation	Description
BIT	Anthracite Coal, Bituminous Coal
LIG	Lignite Coal
SUB	Subbituminous Coal
WC	Waste/Other Coal (Anthracite Culm, Bituminous Gob, Fine Coal, Lignite Waste, Waste Coal)
SC	Coal-based Synfuel and include briquettes, pellets, or

	extrusions, which are formed by binding materials and processes that recycle material
DFO	Distillate Fuel Oil (includes all Diesel and No. 1, No. 2, and No. 4 Fuel Oils)
JF	Jet Fuel
KER	Kerosene
RTO	Residual Fuel Oil (includes No. 5 and No. 6 Fuel Oils and Bunker C Fuel Oil)
WO	Oil-Other and Waste Oil (Butane (Liquid), Crude Oil, Liquid Byproducts, Oil Waste, Propane (Liquid), Re-Refined Motor Oil, Sludge Oil, Tar Oil)
PC	Petroleum Coke
NG	Natural Gas
BFG	Blast-Furnace Gas
OG	Other Gas (Butane, Coal Processes, Coke-Oven, Refinery, and other processes)
PG	Propane
NUC	Nuclear (Uranium, Plutonium, Thorium)
AB	Agriculture Crop Byproducts/Straw/Energy Crops
BLQ	Black Liquor
GEO	Geothermal
LFG	Landfill Gas
MSW	Municipal Solid Waste
OBS	Other Biomass Solids (Animal Manure and Waste, Solid Byproducts, and other solid biomass not specified)
OBL	Other Biomass Liquids (Ethanol, Fish Oil, Liquid Acetonitrile Waste, Medical Waste, Tall Oil, Waste Alcohol, and other biomass liquids not specified)
OBG	Other Biomass Gases (Digester Gas, Methane, and other biomass gases)
OTH	Other (Batteries, Chemicals, Coke Breeze, Hydrogen, Pitch, Sulfur, Tar Coal, and miscellaneous technologies)
PUR	Purchased Steam
SLW	Sludge Waste
SUN	Solar (Photovoltaic, Thermal)
TDF	Tires
WAT	Water (Conventional, Pumped Storage)

WDS	Wood/Wood Waste Solids (Paper Pellets, Railroad Ties, Utility Poles, Wood Chips, and other wood solids)
WDL	Wood Waste Liquids (Red Liquor, Sludge Wood, Spent Sulfite Liquor, and other wood related liquids not specified)
WND	Wind
NA	Not Available

Table 2: Fuel Abbreviations