Data Preparation and Execution of the RTS3 Program Without Storage

RTS3 features:

1) Generator capacities can be entered as decimal values. Integer generator convolution is an exact process whereas decimal values use interpolation.
2) Only one hourly historical data file is needed for the demand and VER (variable energy resources) profiles. Any number of consecutive years can be entered.
3) A target LOLE feature automatically seeks a demand giving that precise LOLE.
4) The generator data file can now include extensive comments for generators.
5) All data other than VER profiles is in the generator data file for easy tracking.
6) The program is available in Matlab format and two ways to run in Fortran.

Here is the format of the hourly file H2020.txt

```
55,2020 IEEE RTS hourly demand wind hydro and solar profiles
YYYYMMDDHH,D, DEMAND, HYDRO,    WIND,   SOLAR,   SOLARR,
2020010101,4,0.40740,0.1842,0.850074,0.000000,0.000000,
2020010102,4,0.39809,0.1990,0.909606,0.000000,0.000000,
2020010103,4,0.39639,0.1638,0.843176,0.000000,0.000000,
2020010104,4,0.39852,0.1678,0.819610,0.000000,0.000000,
2020010105,4,0.41540,0.1626,0.796922,0.000000,0.000000,
2020010106,4,0.44828,0.1410,0.773835,0.000000,0.000000,
2020010107,4,0.48201,0.1506,0.681646,0.000000,0.000000,
2020010108,4,0.48668,0.2886,0.541848,0.416726,0.145686,
2020010109,4,0.48862,0.2514,0.464612,0.600515,0.365249,
2020010110,4,0.49224,0.3386,0.309143,0.671727,0.531686,
2020010111,4,0.49111,0.3506,0.169146,0.703056,0.635784,
2020010112,4,0.49001,0.3498,0.093345,0.700032,0.667040,
2020010113,4,0.48595,0.3502,0.077595,0.688067,0.654641,
2020010114,4,0.48323,0.2978,0.085171,0.658154,0.587050,
2020010115,4,0.47965,0.2798,0.024722,0.580830,0.456260,
2020010116,4,0.47765,0.3438,0.045815,0.369894,0.221543,
2020010117,4,0.49530,0.3256,0.056581,0.000000,0.000000,
2020010118,4,0.55886,0.3526,0.261494,0.000000,0.000000,
: : : : :
end,,,,,
```

The first line is a title following the number 55 which means read only the first 55 characters on each line. Comments can be placed beyond column 55 and will be ignored by RTS3. D is the day of the week with 1 being a Sunday. This file includes all hours of 2020 (actual data came from 2006). The last line of the hourly data must have an end statement as shown above. The demand profile is obtained by summing the hourly MW demands of the three areas and then per unitizing the numbers to the coincident peak MW of 8191.8 MW. Likewise the hydro, wind, and solar hourly per unit values were created in the same manner as the demand profiles.

Data Preparation and Execution of the RTS3 Program Without Storage

Here is the format of the generator data file G2020A.txt

Note that both G2020.txt and G2020A.txt files are the same formats and have the same LOLE = 0.1 days per year. The difference is that G2020.txt has reduced VER capacities and no load forecast uncertainty. G2020A.txt has full VER capacities and the LFU was increased to make the LOLE = 0.1 days per year.

```
26,2020 IEEE RTS  8192 MW load  8076 MW conventi…
H2020.txt                      hourly sequential dema…
8191.8,7.68,1.E-4,             peak demand, %LFU (loa…
4,                             number of VERs (variab…
76.6, 9.3, 43.1, 37.6,    Reserve Margin Capacit…
1000,2507.9,1554.5,1161.4,installed Pmax MW for …
PMAX ,RM%, FOR, DER,DMW,  BU#,GENERATORNAM,TP,
  20.,100,.100,.000, 0.,   101,ABEL___Oil_1,CT,
  20.,100,.100,.000, 0.,   101,ABEL___Oil_2,CT,
  76.,100,.020,.000, 0.,   101,ABEL___Coal3,ST,
  76.,100,.020,.000, 0.,   101,ABEL___Coal4,ST,
  20.,100,.100,.000, 0.,   102,ADAMS__Oil_1,CT,
  20.,100,.100,.000, 0.,   102,ADAMS__Oil_2,CT,
  76.,100,.020,.000, 0.,   102,ADAMS__Coal3,ST,
  76.,100,.020,.000, 0.,   102,ADAMS__Coal4,ST,
 355.,100,.033,.000, 0.,   107,ALDER__NG__1,CC,
```

The first line is a title following the number 26 which tells RTS3 how many columns to read of data on each line following the title. Comments and notes entered after column 26 will be ignored by the program.

The second line is the hourly data file name followed by blanks. The generator file points to the hourly demand and variable energy file.

The third line is the peak demand forecast, the LFU (load forecast uncertainty) in percent, and a cutoff LOLP value. If a day has an LOLP as high as 1.E-4, the entire day is listed in file OPH.csv.

The fourth line shows there are 4 VERs in file H2020.txt.

The fifth line has the percentage capacity credits to be given to the four VERs in the reserve margin calculation. These numbers are not used in the LOLP calculations. RTS3 suggested values have been entered into this generator file.

Data Preparation and Execution of the RTS3 Program Without Storage

The sixth line is the MW of nameplate (not derated) capacity of the VERs that link to the hourly profiles in H2020.txt. These hourly MW of VERs are subtracted from the load each hour.

The seventh line is a header that is used as a header in the .csv output file reports.

The eighth line and all the rest of the lines are generator data. Each generator has a Pmax nameplate capacity, the percentage of the capacity to be used in the reserve margin (100% in this case), a FOR (forced outage rate), a derated MW state and the derated state probability of being in that state, i.e. the DER.

The order in which generators are entered does not change the reliability indices values. If generators are entered as integer values without a fractional MW, the convolution process is an exact one. If a generator has a fractional MW, the generator is treated as being fractionally in both the nearest integer states as an approximation. This is an interpolation process that should not introduce much error, but it does mean the COPT capacity outage probability table created will not be "exact", but you will never be able to see the error in practical studies.

Setting up RTS3 in a directory to do a study.

Copy the ten files in RTSLOLE.zip to your working directory.
H2020.txt is the historical hourly profiles.
G2020.txt is the generator data base case with LFU = 0% and partial VERs.
G2020A.txt is the generator data case with LFU = 7.68% and full VERs.
Both the above generator files have LOLE = 0.1 days per year.
RTSOP.txt is the output report from running the G2020.txt file as input.
RTSOPA.txt is the output report from running the G2020A.txt file as input.
RTS3.for is the fortran code which can be compiled from any F77 compiler.
RTS3.m it the Matlab code which gives the same results but runs slower than F77.
Ask g.preston@ieee.org for an RTS3.exe executable if you wish to run RTS3.for.
Watcom F77 is open source and is an excellent way to run RTS3.for.

Open a DOS window, go to the directory you put the files in, and type RTS3.exe or RTS3.m to run the program. Type in the file G2020.txt. Then press return for the target LOLE question to skip it. Hit return again to end the program. Review the output reports OP.txt, OP.csv, and OPH.csv. You can run the target LOLE and it will find the demand for that LOLE. If it does not find a solution, increase the forecast demand in G2020.txt and rerun the case.