



Power

Joshua Boles
Senior Manger
ICAP Market Operations

New York Independent System Operator
10 Krey Boulevard
Rensselaer, NY 12144

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Wes Hall

Principal Consultant
Power Systems Strategy
Energy Consulting

One River Road
Building 53, Room 311k
Schenectady, NY 12345

T +1 518 385 4914
M +1 716 523 4852

WesleyAlan.Hall@ge.com
www.geenergyconsulting.com

RE: Changes to the GE MARS Random Seed Generation Algorithm

In the process of performing the parametric analysis for the New York State Reliability Council's 2017 Installed Reserve Requirement (IRM) study, the NYISO identified anomalous behavior in the GE Multi Area Reliability Simulation (GE MARS) software. When adding a small thermal generating unit to the system, the model produced an increase in the New York Control Area (NYCA) Loss of Load Expectation (LOLE). All else remaining constant, the addition of any capacity resource should result in an increase in reliability (a lower LOLE).

After investigation, it was determined that the counter intuitive change in LOLE was a result of a change in random seeding. Since the reliability benefit of the unit added was so small, this change in random sequence counteracted the benefit, causing the results to move in the opposite direction of expectation.

The GE MARS model previously generated a unique random seed sequentially for every Thermal Unit, Energy Limited Type 1 (EL1) Unit, Cogen Unit, Transmission Interface, and random Hourly Modifier Shape Grouping, in that order. Each element has its own random number generator assigned which is seeded by these sequentially determined values. Because of the way this sequence was developed, adding a thermal generator caused the assignment for all subsequent elements in the seeding sequence to change.

For example, if 10 Thermal Units and 10 EL1 Units were modeled, GE MARS would generate 20 seeds in sequence, assigning seeds 1-10 to the thermal units and 11-20 to the EL1 units. If a thermal unit were then added to the system, GE MARS would generate 21 seeds, assigning 1-11 to the thermal units and 12-21 to the EL1 units. The seed for each of the 10 EL1 units would be changed, causing a change in results.

GE has revised the GE MARS Random Seed Generation algorithm to produce a random seed for the maximum number of elements in a grouping before moving on to the next grouping, only saving those that are needed for the simulation. This would ensure that each element is assigned a consistent random seed provided its relative order within its grouping doesn't change.

Assuming a maximum of 100 thermal units, GE MARS will now generate the first 10 seeds, assign them to the thermal units, generate seeds 11-100 without using them and then start assigning EL1 units at seed 101. In this case if you add a thermal unit, GE MARS will assign seeds 1-11 to the thermal units, then generate seeds 12-100 and again start assigning EL1 units at seed 101. Using this approach, the seeds for EL1 wouldn't change, and any change in results would be the result of the thermal unit which was added.

Best regards,

Wes Hall
Principal Consultant
Power Systems Strategy
Energy Consulting