ARPA-E GO COMPETITION CHALLENGE 2: MONARCH OF THE MOUNTAIN SCORING
UPDATED 2021-10-22

1.   TERMINOLOGY

The following terminology will be utilized throughout the GO Competition and in this scoring document:

- **Power system network model**: a defined topological structure and characteristics including, but not limited to, locations of generators, loads, transmission lines, transformers, equipment detail, control equipment, and operating parameters.
- **Scenario**: an operating instance in time on a power system network model. The scenarios define a demand at each bus, renewable resource availability, and other system conditions.
- **Dataset**: a collection of power system network models and scenario data on those models.
- **A scenario score:** a score calculated for each scenario of a power system network model.

2.   GO COMPETITION CHALLENGE 2: MONARCH OF THE MOUNTAIN

The Monarch of the Mountain competition will focus on the Challenge 2 Division 4 formulation including transformer and line switching, check the Challenge 2 Problem Formulation (https://gocompetition.energy.gov/challenges/challenge-2/formulation) and Challenge 2 Scoring Documents (https://gocompetition.energy.gov/challenges/challenge-2/scoring) on the GO Competition website. For this competition, Entrants will run their algorithms on their own machines in an untimed environment. Entrants must submit only their solution files to participate in this competition. The Monarch of the Mountain competition will use a similar scoring process to Challenge 2 except that within this competition, each scenario will have its own separate leaderboard.

3.   SCORING

For a given scenario, the solution provided by each entrant is assigned a score representing the increase in market surplus of that solution relative to the market surplus of the prior point solution. The market surplus of a solution is defined (details in the formulation document) as

$$MS^{total} = MS_0 + (\textstyle\sum_{k\in Kc} MS_k)/|K_c|$$

where MS_k is the market surplus in case k, $k = 0$ is the base case, K_c is the set of contingency cases, and $K = \{0\}$ u K_c is the set of all cases. The market surplus in case k is defined as

$$MS_k = \textstyle\sum_{i\in I} MS_{ik} + \sum_{j\in J} MS_{jk} + \sum_{e\in E} MS_{ek} + \sum_{f\in F} MS_{fk} + \sum_{g\in G} MS_{gk} \text{ for all } k\in K$$

where I is the set of buses, J is the set of loads, E is the set of lines, F is the set of transformers, G is the set of generators. Finally, the element-specific market surplus MS_{xk} is the sum of all benefit terms minus cost terms for a given grid element x in case k. For a given scenario s, let MS^{total}_s denote the market surplus objective of a solution on scenario s.

For each scenario s, a prior point solution is constructed by keeping all variables fixed to their values in the prior operating point in the base case and the contingencies, projecting first the base case and then the contingencies to ensure feasibility of all hard constraints (details in the formulation document). Let MS^{pp}_s denote the market surplus of the prior point solution for scenario s. This value is computed independently from the solutions provided by competitors.

For any entrant, the solution to scenario s is evaluated and a market surplus MS^{total}_s is assigned. If no solution is returned, or the solution is incorrectly formatted, or the solution is determined to be infeasible, or the evaluated market surplus is less than MS^{pp}_s, then the assigned market surplus is MS^{pp}_s.

The score MS^{gain}_s, representing the gain in market surplus relative to the prior point, is computed as

$$MS^{gain}_s = MS^{total}_s - MS^{pp}_s$$

Each scenario is scored independently of other scenarios in the Challenge 2: Monarch of the Mountain Dataset (C2MMD). A solution file will only be added to the leaderboard if it improves upon the current best-known score at the time of submission.

4. PRIZES

At the end of the competition (i.e., after the competition closes in October 2022), Entrants may receive prizes based on performance and eligibility. The criteria for prize eligibility are described in the Official Monarch of the Mountain Rules Document available on the GO Competition website.