

Appendix U: LARGE LOAD INTERCONNECTION STUDY PROCESS AND TECHNICAL DATA REQUIREMENTS

PG&E utilizes a multiple-phase approach related to the large load interconnection studies. The study phases and the required data to be submitted by the Interconnection Customers (ICs) are listed in the following.

Phase 1 Study

- Interconnection evaluation, steady-state power flow analysis, identifying mitigations, temporary mitigations (including RAS).
- The following data and information are required to be provided by the ICs:
 - Completed application form (TD-9101P-01)
 - Power factor shall meet the CAISO specified requirement range, 0.97 to 0.99. As part of mitigations, if applicable, PG&E may require better power factor at the Point of Interconnection (POI).
 - Load ramp data
 - Site map
 - Site control
 - Single line Diagram (SLD)
 - PG&E may request additional information for clarification

Phase 2 Study

- Transient Stability Analysis
- Bus Flow Analysis (on case-by-case basis, for selected substations)
- Remedial Action Scheme (RAS) Update (for existing RAS affected or new schemes identified in Phase 1). Study duration may be extended for complex RAS.
- Short Circuit Analysis (on case-by-case basis, for selected substations)
- Sub-synchronous Oscillation (SSO) Screening Analysis (on case-by-case basis, for selected substations)
- Data and information required to be provided by the ICs:
 - Include several categories of data, such as NERC questionnaire, dynamic modeling data, short circuit data, EMT (PSCAD) model, load profile, ramp rate, ride-through data, etc.
 - Details of the required data are listed in the Excel file, ***“PGaE_Large_Load_Technical_Data_Request.xlsx”***. This Excel file is made available to the ICs for valid interconnection requests during interconnection applications, e.g., at the start of a large load interconnection application window for a cluster study.

- All data and information listed in the Excel file, except for the EMT model, are required to be submitted during the application window. PG&E reviews the initial submittal and the updates by the ICs interactively with the ICs. All phase 2 data (except for the EMT model) should be finalized within two months after IC returns signed PES.
- The EMT model is required to be submitted within two months after IC returns signed PES report. PG&E reviews the initial EMT model and the updates by the ICs interactively with the ICs. The EMT model should be finalized within four months after IC returns signed PES.

Phase 3 Study

The following studies are required to be completed by the ICs and can be performed early during the engineering design stage since the required input data needs to be close to actual equipment data to be procured.

- Transformer Energization Analysis
 - PSCAD model of the main transformers for each large load project should be used in this study. Specific data, such as saturation data, etc., applicable to project's transformers should be included in the model.
 - IC is required to perform this study and submit to PG&E a study report that demonstrates voltage dips are well within IEEE 1453 limits during transformer energization events.
- Motor Start Analysis
 - IC is expected to provide a description of motor start process for each large load project.
 - IC is required to perform this study and submit to PG&E a study report that demonstrates voltage dips are well within IEEE 1453 limits during motor starting process.
 - Motor start analysis should be performed using project's EMT model.
 - Motor start analysis is not required for a large load project if all of its motors are connected behind VFD drive(s), or AC or DC converter generally. IC is required to show the connections of the motors on SLDs as confirmation.
- Flicker Analysis
 - Fast change load profile data (if applicable) should be used in this study.
 - IC is required to perform this study and submit to PG&E a study report that demonstrates voltage flickers are well within IEEE 1453 limits during load profile cycling.

- Flicker analysis is not required if IC confirms that the large load project's load profile is smooth and there are no fast changes (e.g., intra-second, intra-minute, intra-hour) in the project's load profile. Typically, cloud type of data centers are expected to have smooth load profiles, and AI training type of data centers are expected to have fast changes in load profiles unless compensated within the large load project.
- Harmonic Analysis
 - Current harmonic spectrum that estimates the individual harmonic current injections (up to 50th harmonic order) at the POI of each large load project is expected to be used in this study.
 - IC is required to perform this study and submit to PG&E a study report that demonstrates current and voltage harmonics at each project's POI are well within IEEE 519 requirements.
- Other
 - Note that information that will be requested from customers during engineering design stage will not be limited to those listed under Phase 3 Study above.

Phase 4 Study

- Sub-synchronous Oscillation Detailed Study
 - Need for this study is evaluated on a case-by-case basis. If SSO screening analysis in Phase 2 indicates potential of resonant oscillations/interactions, a detailed SSO study will need to be performed.
 - Project's load profile data is required for this study.
 - Project's PSCAD model is required for this study.
 - PG&E will start this study after completion of Phase 2 study.
- WECC Path Rating Study: applicable to projects connecting to 500 kV or lower voltage levels that impact ratings of WECC Paths in PG&E footprint. Need for this study is evaluated on a case-by-case basis.
- Affected System Impact Study: applicable to projects that can potentially impact transmission systems of neighboring utilities. Need for this study is evaluated on a case-by-case basis.

CAISO Requirements

- ICs may be required to provide information/data/model as requested by CAISO.