NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

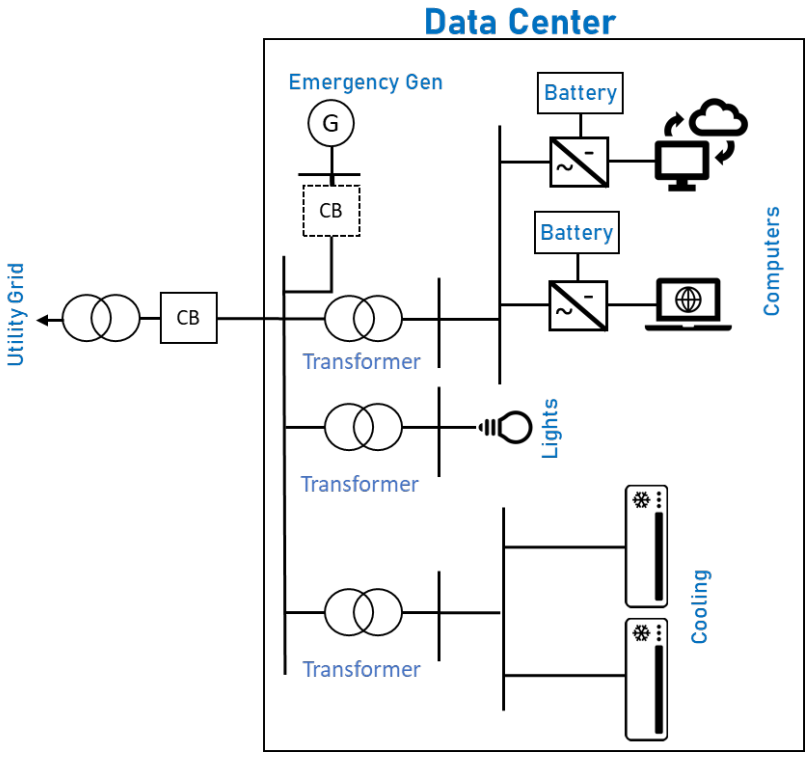
# Data Center Information Collection

## Why Do We Need Information on Data Centers?

Transmission planning simulation studies help transmission planners identify reliability challenges in the power system and then devise mitigation measures to address these. A key consideration for such simulation studies is to model the active and reactive power demand of consumer loads during grid voltage and/or frequency disturbances with a reasonable degree of accuracy. Since data centers/computation facilities are significantly large loads, transmission planners need to understand some aspects of such facilities to model them adequately for these studies.

## What Information Do We Need from Data Center Owners?

For the purposes of data center modeling in transmission studies, we expect that the information we seek is non-intrusive and non-proprietary. For the context of the data requirements in the diagram below. This is diagram just for the sake of illustration and does not represent any particular data center layout. Based on this diagram, the following questions are of interest to us. Answers may be specific to individual data centers (that may remain unidentified), or typical of a number of data centers.




Based on the schematic s above, the following questions are of interest to us. Answers may be specific to individual data centers (that may remain unidentified), or typical of a number of data centers.

1. What is the rated total MW consumption of your data center, including IT equipment, power distribution, and cooling?
2. What is the percentage of the computing/server load, the lighting load, the power distribution losses, and the cooling load of the total MW consumption of the data center? What is the overall data center power factor?
    a. Does the percentage change during different seasons and different times of the day? If yes, a gross estimate like Summer Day/ Summer Night and Winter Day/Winter Night would help.
3. If the data center has some form of forced cooling system, what is this comprised of?
    a. Computer Room Air Conditioners (CRACs) with internal compressors
    b. Computer Room Air Handlers (CRAHs) supplied with chilled water.
    c. Air-Handling Units (AHUs) dedicated to the data center space
    d. Other (please describe)
4. Are the motor-driven components of the cooling systems driven by:
    a. Single-speed motors that are operated across the line (Motors connected directly to the AC supply)
    b. Motors controlled by variable/adjustable speed drives or electronically commutated motors (ECMs)
    c. Other methods (please specify)
5. At what voltage sag levels and durations below which, the components within the data center disconnect from the grid?
    a. Voltage sag level/duration at which the computer/server load disconnects from the utility system (these may transfer to a local UPS)?
    b. Voltage sag level/duration at which the cooling load disconnects from the system (these may transfer to an emergency generator or local power source)?
    c. Are the voltage sags measured on a per phase basis for the disconnection action or are these measured as rms considering the 3 phases?
6. At what voltage swell levels and durations above which, the components within the data center disconnect from the grid?
    a. Voltage swell level/duration at which the computer/server load disconnects from the utility system (these may transfer to a local UPS)?
    b. Voltage swell level/duration at which the cooling load disconnects from the system (these may transfer to an emergency generator or local power source)?
    c. Are the voltage swells measured on a per phase basis for the disconnection action or are these measured as rms considering the 3 phases?

7. Are there any frequency thresholds below and above which the data center computer/server load may disconnect from the system?
8. If the loads disconnect from the utility grid, how do they reconnect back when the voltage and frequency returns to normal values?
    a. Do they reconnect immediately when the voltage and frequency recovers to certain levels. Please specify the voltage and frequency levels.
    b. Do they reconnect with a delay when the voltage and frequency recovers to certain levels. Please specify the voltage and frequency levels and delays.
    c. Do you reconnect manually?
    d. Do they reconnect with a ramp as or after voltage and frequency recovers to a certain level, please specify the voltage and frequency levels and ramp rate at which these loads get reconnected back (if it's in steps please approximately provide information on how that happens).
9. Is there a backup system to supply the data center in the event of disconnection from the grid?
    a. What is the size of the data center Emergency Generator (EG) and Battery Energy Storage (BESS) in relation to the data center load
    b. Can the EG and BESS be dispatched to support the entire/partial load during system events? If so, for how many hours?
    c. Can the Data center be Islanded with only the EG and BESS in event of a planned or unplanned disconnection from grid?
    d. Can the Data Center participate on demand side management in a grid emergency or as an ancillary service?
    e. How much of the server farm load could be picked up by or redistributed to redundant server sites across the world?
    f. In the event of a data center being tripped offline, how much of that load would they transfer somewhere else?
    g. How fast can this load transfer be done?

## How Does the Information Align with the Composite Load Model and Help Transmission Planning?

Questions 1 through 4 in the questionnaire allow a transmission planner to assign MWs of load in our transmission planning models to the different components of the composite load model used in transmission planning studies. This allows transmission planners to understand the response of loads to changes in voltages and frequency and how that response affects the utility grid voltage and frequency.
Questions 5 through 9 allow transmission planners to understand if certain voltage/frequency disturbances can cause the loads at the data center to disconnect from the utility grid and the manner they connect back. This information is important because if a large load like a data center disconnects/reconnects it can cause voltage and frequency changes that is consequential for transmission reliability assessment.