Large Load Studies
LFLTF

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Background

- Large Load interconnection studies are complex
  - Providing good, timely models helps
  - Steady-state and stability studies may reveal constraints → limit load size

- At the same time, ERCOT working with TSPs to improve study process
  - ERCOT had several meetings with TSPs last few weeks to standardize approach
  - Continue to talk about improving process efficiency
  - Currently looking at tailored Subsynchronous Oscillation (SSO) study approach

Data Requirements for Large Load Studies

– Ways you can help the study process –

- Stability / steady-state:
  - Good estimate of load percentages (motor, electronic, etc.)
  - Distribution network model (schematics, transformer impedances)
  - Power-factor correction equipment model

- Subsynchronous Oscillation:
  - Required when connecting close to series capacitors
  - ERCOT survey helps determine if a study is needed
  - Need station transformer saturation models (talk to your suppliers!)
    - Prefer tested models or typical range of values
  - Computer power supplies: Request SPICE model and schematics
    - Worthwhile pursuing this data. Good models can help customer understand transients/electrical grid conditions
  - May need detailed models of facility including power-factor correction devices and line conditioning uninterruptible power supplies

Updated Load Survey Document

4. Will the load require new transmission transformers (e.g. 345 kV to 34.5 kV) or utilize existing transformers? If existing, specify the station name.	(Select transformer)
5. Provide estimated load percentages	Power Electronic / Computer: Air-Conditioning Compressor: Fans / Pumps / Motor:
6. For datacenter loads, will the data center be fed through an uninterruptible power supply (UPS)? Does the UPS have the ability to condition incoming power (e.g. if the incoming voltage is too high or low, the UPS will condition it rather than switch over to a backup energy source)?	(Select UPS) (Select UPS operation)
7. For datacenter loads, specify the approximate wattage and voltage of an individual unit	E.g. 3000 watts, 240 volts
8. How will your facility correct the power factor at the point of interconnection? (Even if the individual loads are unity power factor, step-down transformers will cause the facility to absorb reactive power.)	(Specify power factor correction)
9. Please provide the following documents. If not currently available, provide an estimate when they may be available. If unable to obtain, provide a detailed description of attempts made. Items b – e apply to datacenter computer power supplies. a. High level one-line of electrical distribution b. Model/brand of computer power supplies c. Photograph of computer power supply circuit board d. Schematic of computer power e. SPICE electrical model	(Provide as separate attachments.)

- Used to determine type of SSO study needed

Locating near a series capacitor

- Electrical risks:
  - Subsynchronous oscillations (SSO), ferroresonance (SSO involving station transformer)
  - High voltage transients exceeding 180% in some cases
  - SSO study can help understand these but keep in mind that the purpose of the study is to ensure grid reliability. It may not cover the worse case affecting equipment inside the facility. Suggest discussing with TSP and your engineering subject-matter experts. May consider performing your own SSO, harmonic, and/or transient over-voltage study.

- Subsynchronous oscillation study
  - Required if close to series capacitor. Optional if further away.
  - Datacenter load generally assumed to not interact → please help us verify this assumption, push power supply vendors for SPICE models / schematics
  - May require detailed modeling information:
    - Industrial facilities (large motors, transformers)
    - SVCs, STATCOMs, and line conditioner uninterruptible power supplies (“conditioner UPS”)

Subsynchronous Mitigation

- If issue found, will need to design correction
  - Installation of an SSO relay to trip the facility may be acceptable in certain instances. Some instances may require designing a damping filter or other configuration adjustment.
  - Engineering design and verification may take time!

- Even if no issue identified, subsynchronous relays may be worth considering
  - Would trip the plant upon detection of subsynchronous currents
  - May be a worthwhile backstop when locating very close to series capacitors

Conclusion

- Better models are needed, especially of datacenter loads.
  - Please continue to push OEM for models such as SPICE models
  - Digital fault recording once a facility becomes operational
    - Very helpful to share records if you experience a voltage disturbance

- Interconnection studies are complex, especially SSO studies
  - Connecting near a series capacitor is especially challenging
    - Voltage transients, risk of transformer ferroresonance interaction
    - Please discuss with your engineering experts. The purpose of interconnection studies is to help ensure transmission reliability. It may not be sufficient to determine risks to facility equipment.
  - ERCOT working with TSPs to continue improving study process

- Comments can be sent to Jonathan.Rose@ercot.com or largeloadinterconnection@ercot.com