Power Line Analysis Cheat Sheet / Walkthrough

A Step-by-Step Guide

# Step 1: Data Collection

* + Locate the substation that’s directly feeding the site using [LandID](https://id.land/plans).
  + Locate that substation on [google maps](https://www.google.com/maps) to get the address of substation
  + Go to [MISO’s POI analysis map](https://giqueue.misoenergy.org/PoiAnalysis/index.html) and navigate to the area you want to analyze. Click on that area and select “EES”. Zoom in to the area in question and paste your substation address you retrieved from maps in the search bar at the top right-hand corner of the map. It will ping where the address is and the substation in question will be right next to it. BEFORE you click the substation, you must enter the MW’s you’re requesting in the top left-hand corner of the map. You then click the substation and select “analyze \*substation name\*”. A data set will then pop up at the bottom of the map. Click the download data icon at the bottom right of the map and it’ll download an Excel file.

# Step 2: Excel Formatting

* This first part is OPTIONAL but if you want to know to there is transformer present, create a new column at the end and label it “transformer?”. Then in the first row under the title paste this formula:

=LET(txt, TEXTSPLIT(A12, " "), nums, FILTER(txt, ISNUMBER(VALUE(txt))), valid\_nums,FILTER(nums,(VALUE(nums)>=69)\*(VALUE(nums)<=500)),IF(COUNTA(valid\_nums)>=2, IF(INDEX(valid\_nums, 1) <> INDEX(valid\_nums, 2), "Yes", "No"), "Error"))

Once the cell populates, click the cell once to highlight cell, and double click the bottom right of the cell to populate all of the data simultaneously.

* Highlight the top row of columns



* While the row is highlighted, click the “Data” tab and then click “Filter”



* Click the dropdown in the “Monitored Facility” cell and type in the substation name, it will typically be some abbreviation of the substation name. I find it helpful to just type the first letter and find what abbreviation fits.

A screenshot of a computer

Description automatically generated

* Once the filter is applied, you have every line running to and from the facility along with its load details.

# Step 3: Interpreting the Results

Below is a brief description of what each collum means

* Monitored Facility
  + Description
    - Usage: A monitored facility is a specific transmission line, substation, or other network component being observed to assess its capacity and performance.
    - Significance: Understanding the monitored facility’s limitations and its current operating conditions helps predict which parts of the grid might experience congestion or require upgrades
* MW Available
  + Description
    - Usage: This represents the current capacity available at a monitored facility (such as a transmission line or a substation) before it reaches its thermal limit. It is a starting point in estimating whether the system can handle additional power injections or withdrawals.
    - Significance: If the available MW capacity is close to zero, it indicates that the facility is already heavily loaded and may not have much room to accommodate new power injections. On the other hand, a higher MW Available value suggests that the facility has unused capacity.
* %DFax
  + Description
    - Usage: DFax indicates the impact of a specific power injection or withdrawal at a particular bus on the power flow in the network. It is used to estimate how power injections at one location affect power flow on a monitored line or facility.
    - Significance: High DFax values mean that a small change in power injection at the bus will significantly impact the monitored facility's power flow. It's crucial for determining how a proposed change will redistribute power within the grid and helps in identifying which lines might become overloaded.
  + Typical Range
    - Typical Range: 0% to 100%, but most values in practical scenarios usually fall between 1% and 20%. A high DFax isn’t necessarily bad, because it means that the one line could handle the entire load requested, any large load is going to impact the line significantly.
    - Low (1% to 5%): Indicates a minimal impact on the power flow of the monitored facility due to changes in generation or load at a specific location. This suggests that the facility is not strongly influenced by the changes.
    - Medium (5% to 15%): A moderate impact, meaning the monitored line or substation will be affected noticeably by the change in power flow.
    - High (15% to 20%+): Indicates a significant impact. A high DFax value means that even a small change in generation or load at the bus can greatly affect the power flow on the monitored facility.
* MW Impact
  + Description
    - Usage: MW Impact quantifies the expected change in the power flow on a monitored facility due to a specific power request (e.g., a new generator starting up or a load change).
    - Significance: This measure allows grid planners to predict how much extra load will be added to or removed from a particular line. If the MW Impact is close to the requested MW’s, the line may be able to handle the entire load. Like DFax, a large MW Impact isn’t necessarily bad, it just indicates that the line could theoretically handle the large load.
* % Impact
  + Description
    - Usage: % Impact translates the MW Impact into a percentage of the facility's total capacity. It shows the relative effect of the requested power injection or withdrawal on the monitored element.
    - Significance: This percentage is crucial because it directly indicates how much closer the facility gets to its maximum loading level due to the requested change. If the % Impact is large, it means that the request significantly strains the facility's capacity.
  + Typical Range
    - Typical Range: Generally, ranges from 0.1% to 10% of the monitored facility's capacity.
    - Low (0.1% to 2%): Minimal effect on the facility's capacity, indicating that the requested change is unlikely to cause any operational issues.
    - Medium (2% to 5%): A moderate level of impact on the facility's loading. This range is often manageable but might require closer monitoring to ensure that the system remains within safe limits.
    - High (5% to 10%+): Indicates a significant impact on the facility's capacity. A high % Impact suggests that the facility is getting closer to its maximum limit, and the requested change might push it into a potentially overloaded state.
    - These ranges provide a general guideline for interpreting the values in power flow analysis. Actual thresholds for what's considered "high" or "low" might vary depending on the specific grid, its design, and operational standards.
* % Loading (Before)
  + Description
    - Usage: % Loading (Before) shows the utilization level of a monitored facility before the requested power change. It's a baseline indicator of how heavily the facility is already being used.
    - Significance: This value provides context for estimating potential capacity. If the facility's loading is already high, even a small increase in power flow (as indicated by the MW Impact) could result in a significant risk of overloading.
  + Typical Range
    - Typical Range: Generally, ranges from 0% to 100%, representing how much of the facility's capacity is being used before any new power flow changes are applied.
    - Low (0% to 50%): Indicates that the monitored facility is lightly loaded. The equipment has plenty of available capacity to handle additional power flow without concerns about overloading.
    - Medium (50% to 80%): Represents a moderate level of loading. The facility is being used efficiently but still has some buffer capacity to accommodate new requests or changes in power flow.
    - High (80% to 100%): Indicates that the facility is heavily loaded and nearing its maximum capacity. Any significant additional power request might push the facility beyond its safe operating limits, requiring close monitoring or system adjustments.
* % Loading (After)
  + Description
    - Usage: % Loading (After) predicts the utilization level of a facility after the requested power injection or withdrawal is applied. It accounts for the changes based on the MW Impact and % DFax factors.
    - Significance: This value is critical for determining if the facility will remain within its operational limits after the change. If % Loading (After) exceeds safe thresholds (typically around 100%), it signals that the facility cannot handle the requested power without exceeding its thermal capacity.
  + Typical Range:
    - Typical Range: Also ranges from 0% to 100%, showing the expected loading level of the facility after applying the power request.
    - Low (0% to 60%): Suggests that even after the requested power change, the facility remains well within its safe operating range, with ample capacity to manage additional changes in the future.
    - Medium (60% to 90%): Indicates a moderate level of loading after the change. The facility is approaching its higher capacity levels but remains within acceptable operating conditions.
    - High (90% to 100%): Represents a high loading state where the facility is very close to its maximum capacity. At this level, there is a significant risk of overloading if further changes are applied, and careful attention is required to ensure stability and reliability.