



Now You Tell Us

Satisfying Utility Modeling, Testing
and Interconnection Requirements
as the End User

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A Historic View (want some cheese with that whine?)



Microsoft is currently operating the 5th generation of Large Language Model Training data centers and has been predicting “this day will come” for the past 4.

We’ve been investigating solutions to the impact of large installations since 2022 and communicating with utilities regarding the need since 2023.

First requirements received July, 2025, servers installed in November.

- **Greater than 10:1 variation**
- **Add-ons required costing close to 10x that of a solution designed and installed at initial build**

The Proverbial Cart Before the Horse



Requirements First

Requirements inform design and equipment selection

- LV/LF RT
- Step size
- Ramp rate
- Frequency content
- Regulator stability

With proper requirements and testing, can many/most studies be eliminated?

Model Development is Onerous



Model/Build schedule is disconnected

New to every equipment supplier

Identical sites/different formats

Lack of data center industry expertise

Targeted Testing



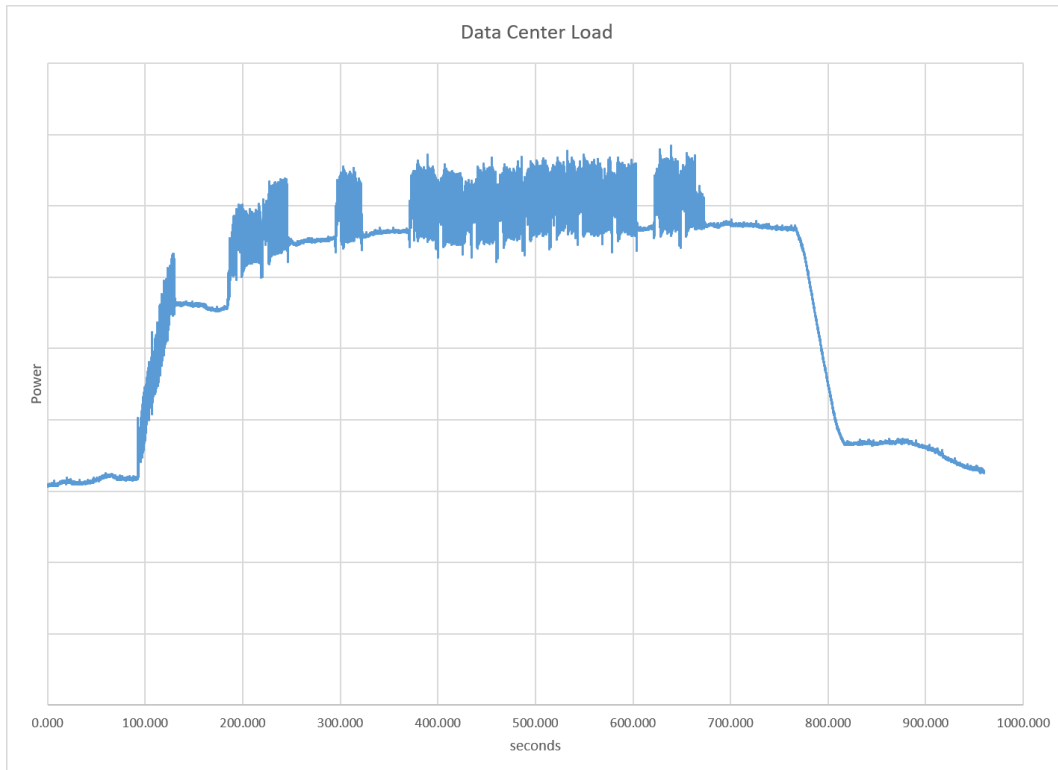
Microsoft has done targeted testing with and without the utility for the past several years

Commissioning is inwardly focused (do the design and equipment meet their specified performance)

Targeted testing serves both the consumer and the supplier

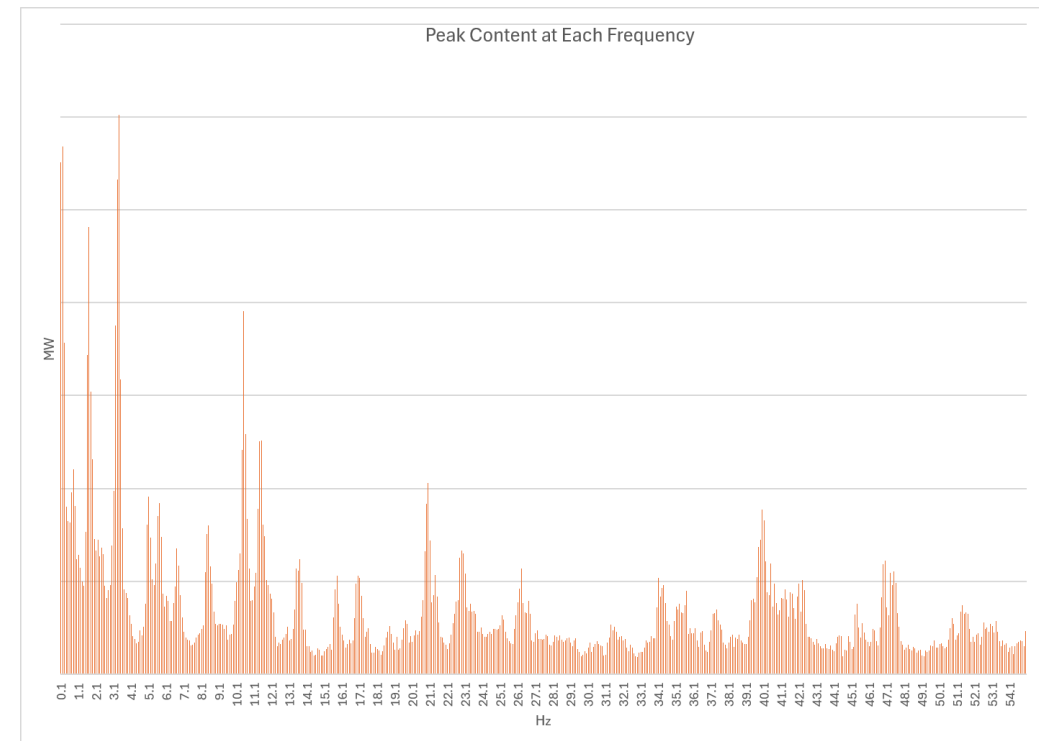
- Specific load steps and ramps
- Specific frequency content
- Performed using the production gear after installation

Today's Mitigations



No control over frequencies present

Magnitudes are depressed by wasting energy.



Requirements, Requirements, Requirements



In closing, I can't stress enough the need for requirements first