Trinity Consultants

Intro to Data Centers and Air Quality

Susan Barnes

November 6, 2025

Susan Barnes

- Principal Consultant
- Office Manager of DC Office
- 15+ years at Trinity
  - Permitting data centers in Northern VA and Maryland since 2017

sbarnes@trinityconsultants.com

240.379.6492

Data Center Emissions Sources

Emergency Generators

Prime Generators

- Typically rated 2 to 3 MW each and diesel-fired
- Enough to power data center operations during power outages

Ancillary Generator

- Typically smaller generators (2 MW or less) and diesel-fired
- Supply backup power to other operations (lights, security, etc.)

Possible Other Emission Sources

- Prime Power (engines or turbines)
- Fire Pumps

Why So Many Generators?

- Data centers require continuous power to ensure data retention
  - For data centers supporting computations (AI), if power is interrupted, the computations being completed would be lost.
- When they lose power from the grid, the backup generators need to work
- To ensure reliable power availability the emergency generators are designed for backup redundancy.

40 CFR 63.6640(f)(1)

Emergency RICE Operational Requirements

- No time limit on emergency operation
- Examples of Emergency Operation include:
  - When electrical power from local utility or normal power supply is interrupted
  - When RICE used to pump water in case of fires, floods, etc.
- Up to 100 hours per year allowed for any combination of the following
  - Maintenance checks and readiness testing
- Up to 50 hours per year of non-emergency use allowed
  - Except those 50 hours cannot be used for peak shaving or non-emergency DR, or as part of financial arrangement or supplying power to grid

Engine Emissions Tiers

Tier 2

- Certified to EPA's Tier 2 Emission Standards
- Only can be used as an emergency generator under NSPS and MACT Regulations

Tier 4 Compliant

- Engine certified to EPA's Tier 2 Emission Standards
- After market add-on controls (SCR, CatOx, and DPF) installed
- Only can be used as an emergency generator under NSPS and MACT Regulations

Tier 4 Certified

- Engine certified to EPA Tier 4 Emission Standards
- Can be used as a non-emergency generator under NSPS and MACT Regulations

Which Engines are Data Centers Using

Smaller or Older Data Centers

- Typically using **Tier 2**
- Tier 2 engine-generators are cheaper, more readily available, and generally less monitoring, recordkeeping and testing in permits

Larger or Newer Data Centers

- Often using **Tier 4 Compliant**
- Tier 4 compliant units provide additional emissions control allowing greater available runtime while maintaining compliance with regulatory standards
- Certified Tier 4 engine-generators suffer from supply chain availability, reliability challenges, and are more

For Data Centers that are not Co-Located with Other Sources

Permitting Data Centers

- Generally permitted as synthetic minor sources
  - In Pennsylvania, NOx is the pollutant of concern in most cases
  - Facilities take site-wide emissions or operational limits to keep actual emissions below NOx major source threshold
    - Limits are typically either tons per year, hours per year, or gallons of fuel per year

Emission Calculation Methods

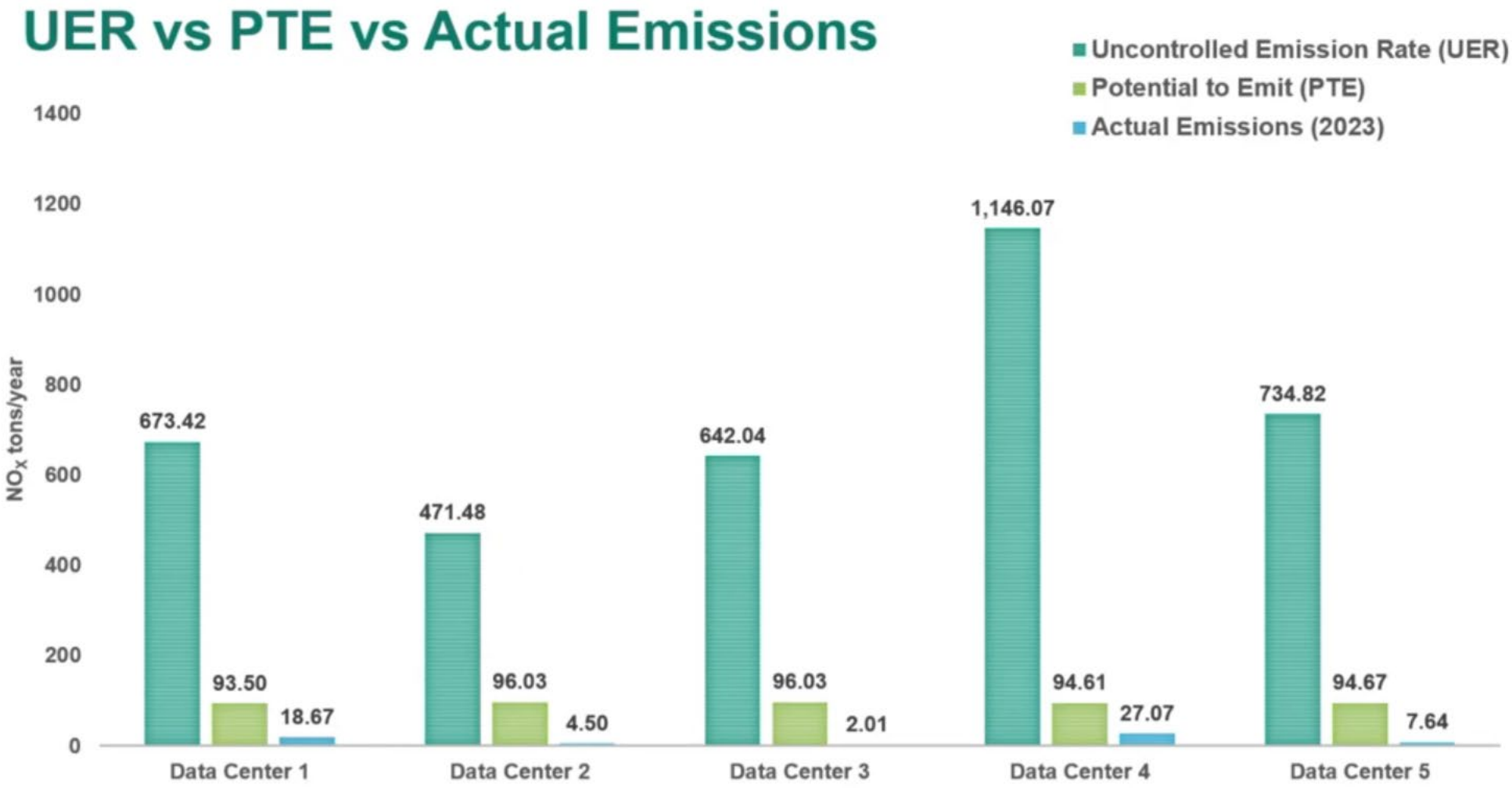
- Varies agency, permittee company internal policy, and project
- Generally using not-to-exceed (or potential site variation) emissions data from the manufacturer and evaluating across a variety of loads
- Emission factors developed based on manufacturer data:
  - Permits may allow varying emission factors depending on actual load during the operation
  - Important that the potential emissions and permit limits align with the desired compliance demonstration

Actual versus Potential Emissions

- Data Centers don’t want to run their emergency generators
- They run for annual testing and maintenance
- Typically, weekly to monthly brief runs (<30 minutes) for readiness testing and some amount of annual load testing and other testing
- Total annual testing ~10 hours per year per generator

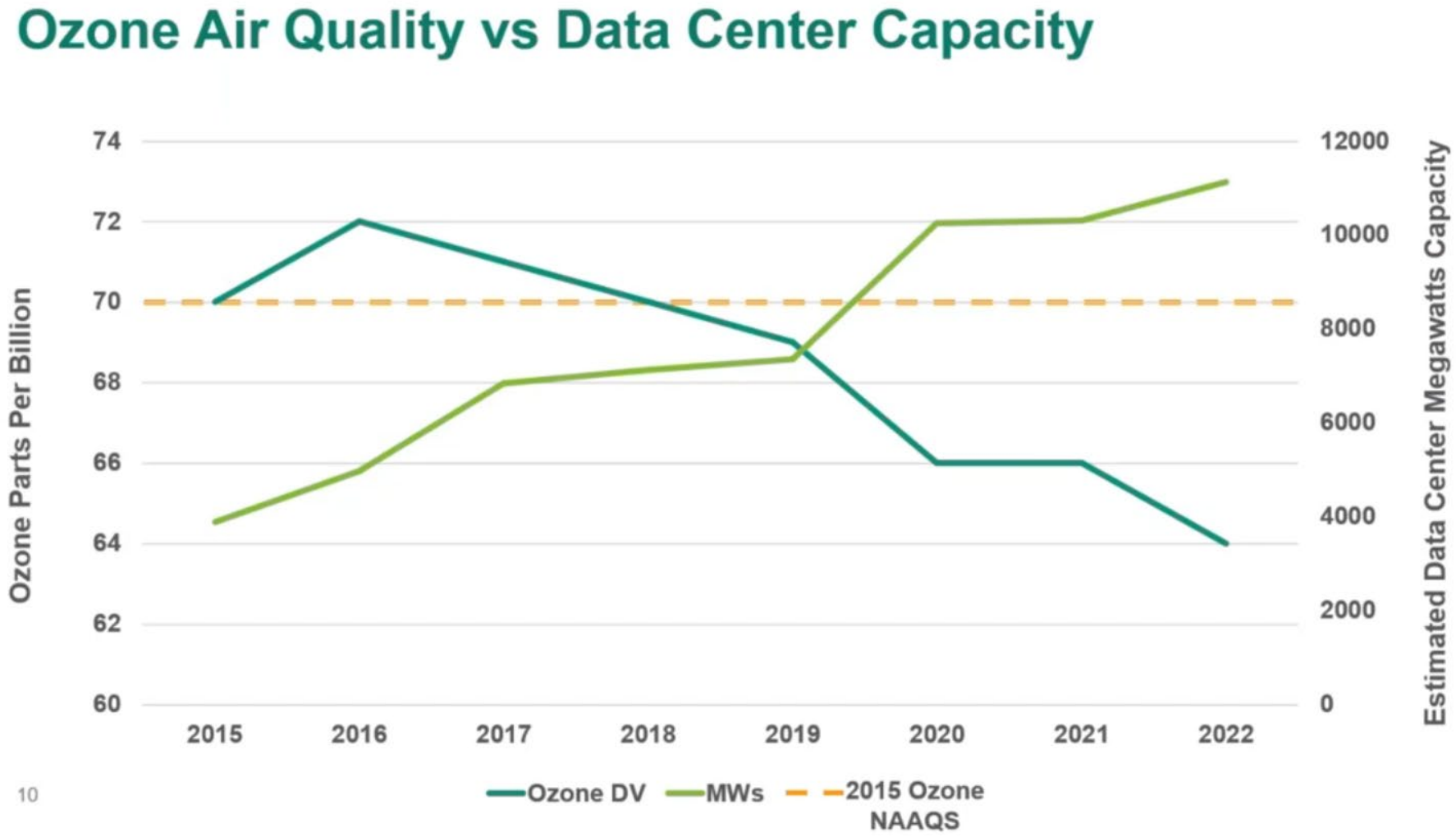
 |

Actual versus Potential Emissions in Virginia



Source: MARAMA Data Centers & Air Quality Session 2, slide from Virginia DEQ, https://www.youtube.com/watch?v=3eNqE4ORb08

Air Quality versus MWs in Virginia



Source: MARAMA Data Centers & Air Quality Session 2, slide from Virginia DEQ, https://www.youtube.com/watch?v=3eNqE4ORb08

Thank you!

Any Questions?

Trinity Consultants