Frederick County Division of Energy and Environment

DATA CENTERS AND THE ENVIRONMENT

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Presented by Dawn Ashbacher
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Overview

- Existing environmental regulations
- Stormwater
- Greenhouse Gas Emissions
- Generator Emissions & Air Pollutants
- Electrical Capacity
- Noise
- Light Pollution
- Cooling and Water Consumption
- Other Factors

Existing Environmental Regulations

- **Zoning Ordinance §1-19-3.300.4 (D)** includes site plan natural features.
  - Evaluation factors include topography, vegetation, sensitive resources, and natural hazards.

- **Zoning Ordinance §1-19-6.400** includes site plan landscaping requirements:
  - Street Trees §1-19-6.400(A)
  - Land Use Buffering and Screening §1-19-6.400(B)
  - Parking Area Landscaping §1-19-6.400(D)
  - Landscaping, Screening, or Buffering §1-19-6.400(E)

- **Frederick County Forest Resource Ordinance** (FRO)– Chapter 1-21 requires a Forest Conservation Plan to include forest conservation mitigation requirements. CDIs must meet the same FRO requirements as other developments.

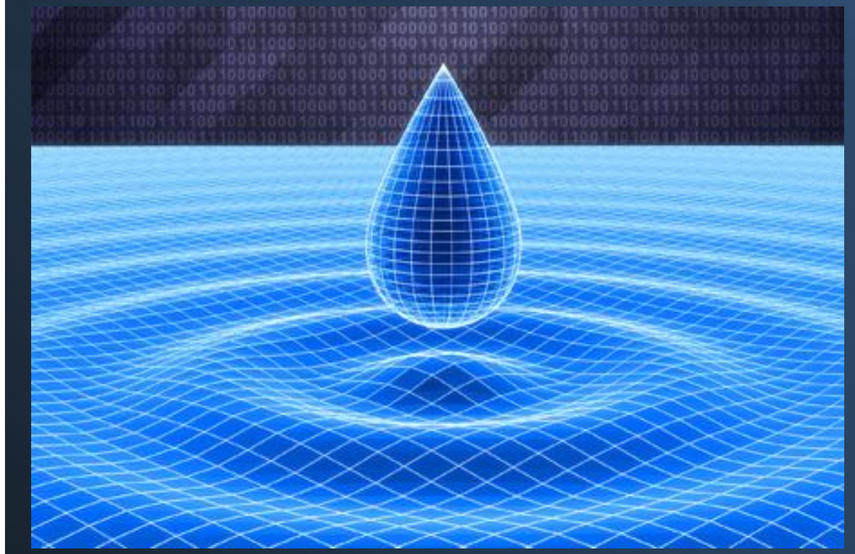
Stormwater Regulations and Considerations

- Data centers must meet County Code Chapter 1-15.2 for Stormwater Management to meet the Maryland 2000 SWM Design Regulations in accordance with the Maryland Stormwater Management Act of 2007.

- In addition, in Frederick County, large developments are required to retain a 100-year storm onsite, which exceeds the 10-year storm requirement by Maryland Department of the Environment (MDE)

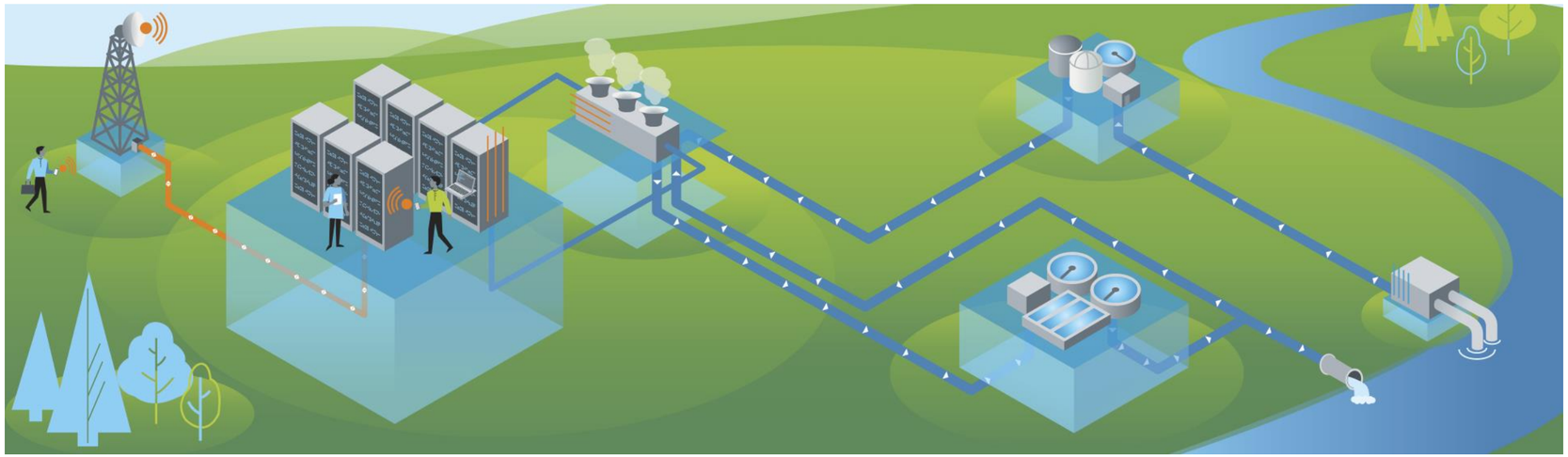
- Large impervious surfaces can contribute to higher temperature stormwater runoff. Temperature-sensitive streams are taken into account per current regulations.

- Regulations don’t allow stormwater infiltration on karst sites (limestone geology prone to sinkhole formation). Construction on karst creates risk for surface to groundwater interaction, contaminating groundwater with untreated surface water

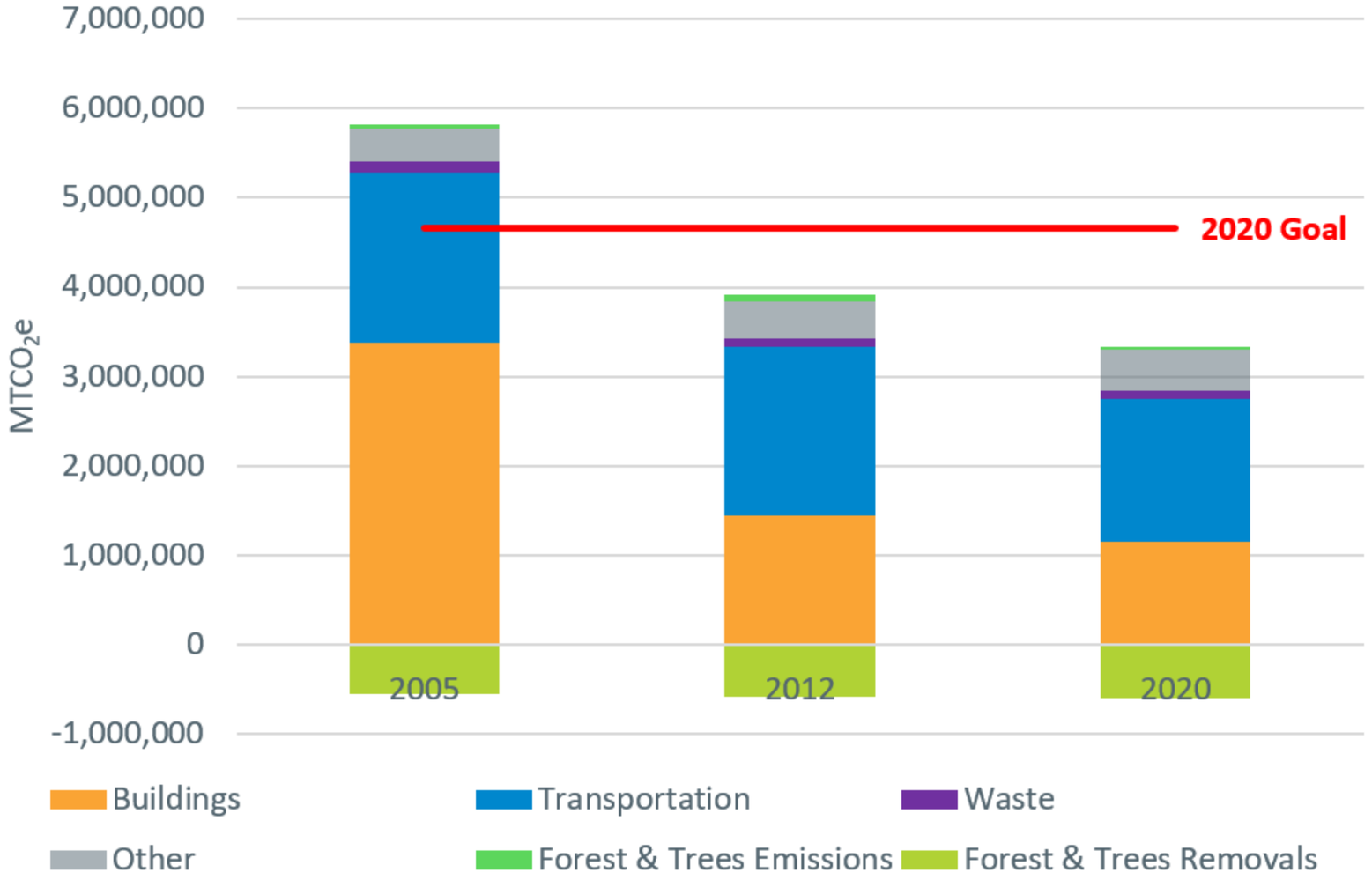


Stormwater Considerations

- Require Best Management Practices that address thermal impacts from large impervious surfaces to temperature-sensitive streams, such as:
  - Enhanced surface sand filters.
  - Submerged gravel wetlands.
  - Stream restoration with riparian forest buffers.
- Recommend aligning any code changes with MDE updates to stormwater regulations. This will occur as part of Maryland's 2021 Senate Bill 227 *(Advancing Stormwater Resiliency in Maryland (arcgis.com).*
- Avoid peak stormwater surges to streams to allow more infiltration.
- Address karst (sinkhole-prone limestone formation)



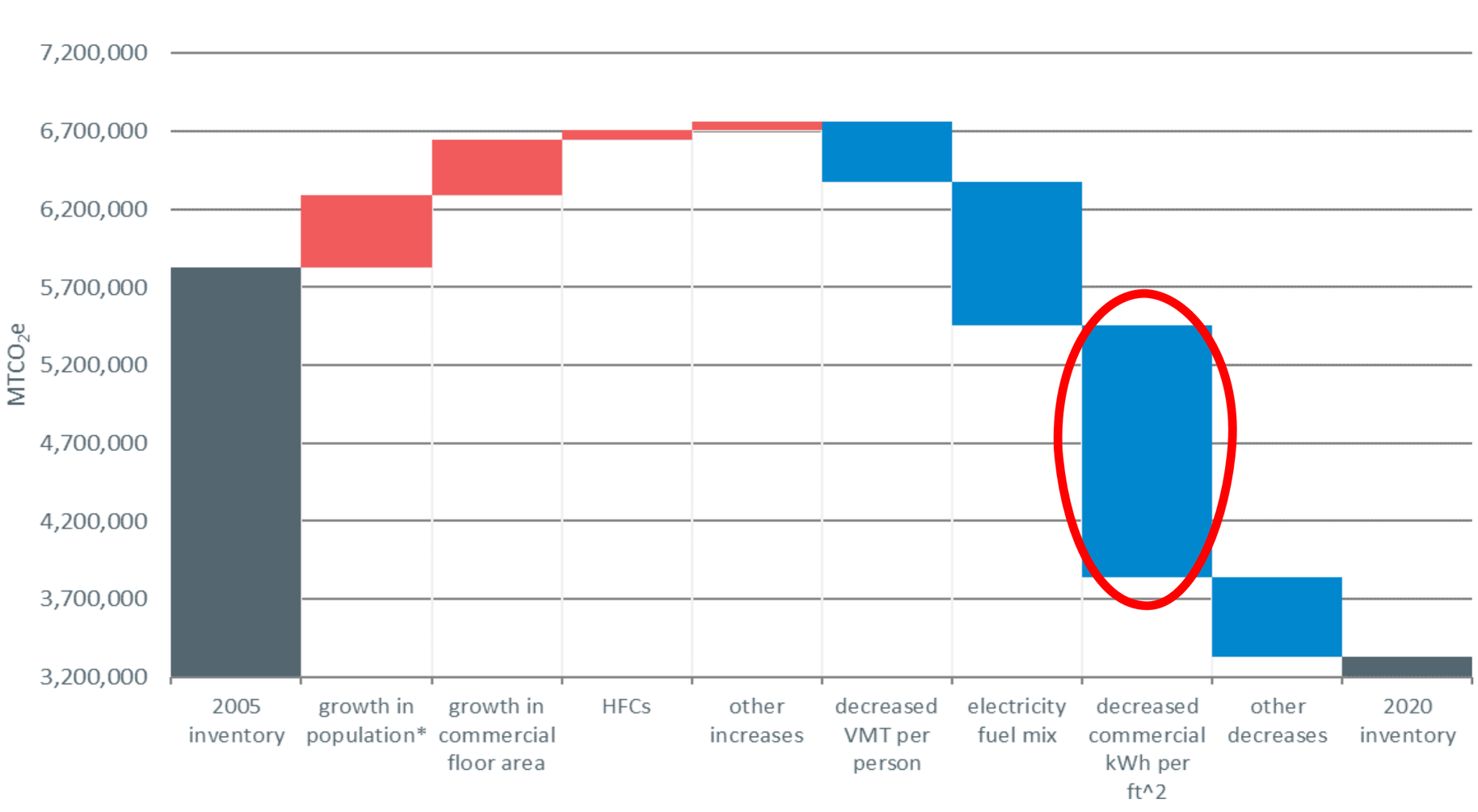
Greenhouse Gas (GHG) Emissions:
County Council goal to reduce GHG 50% by 2030, 100% by 2050



2.48

million $MTCO_2e$ emissions reduced from 2005-2020

This is the equivalent to taking >482,000 homes off the grid for one year.



2.48 million MTCO2e reduced 2005-2020:
43%

Much of the circled reduction from losing Alcoa.

Other drivers include cleaning the grid and more fuel-efficient vehicles on the road.

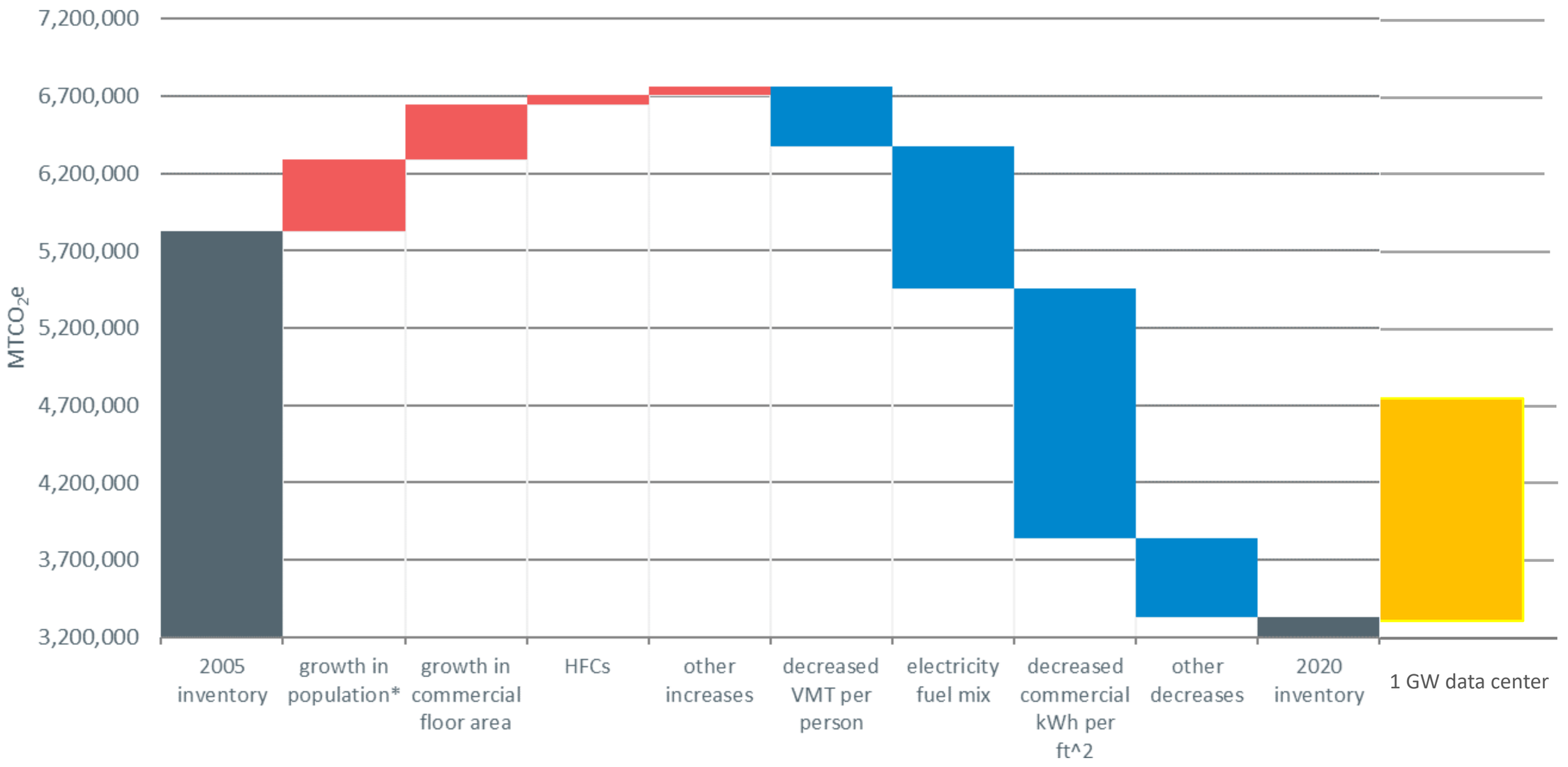
Frederick County is currently on track!

Frederick County Community-wide GHG Drivers 2005-2020

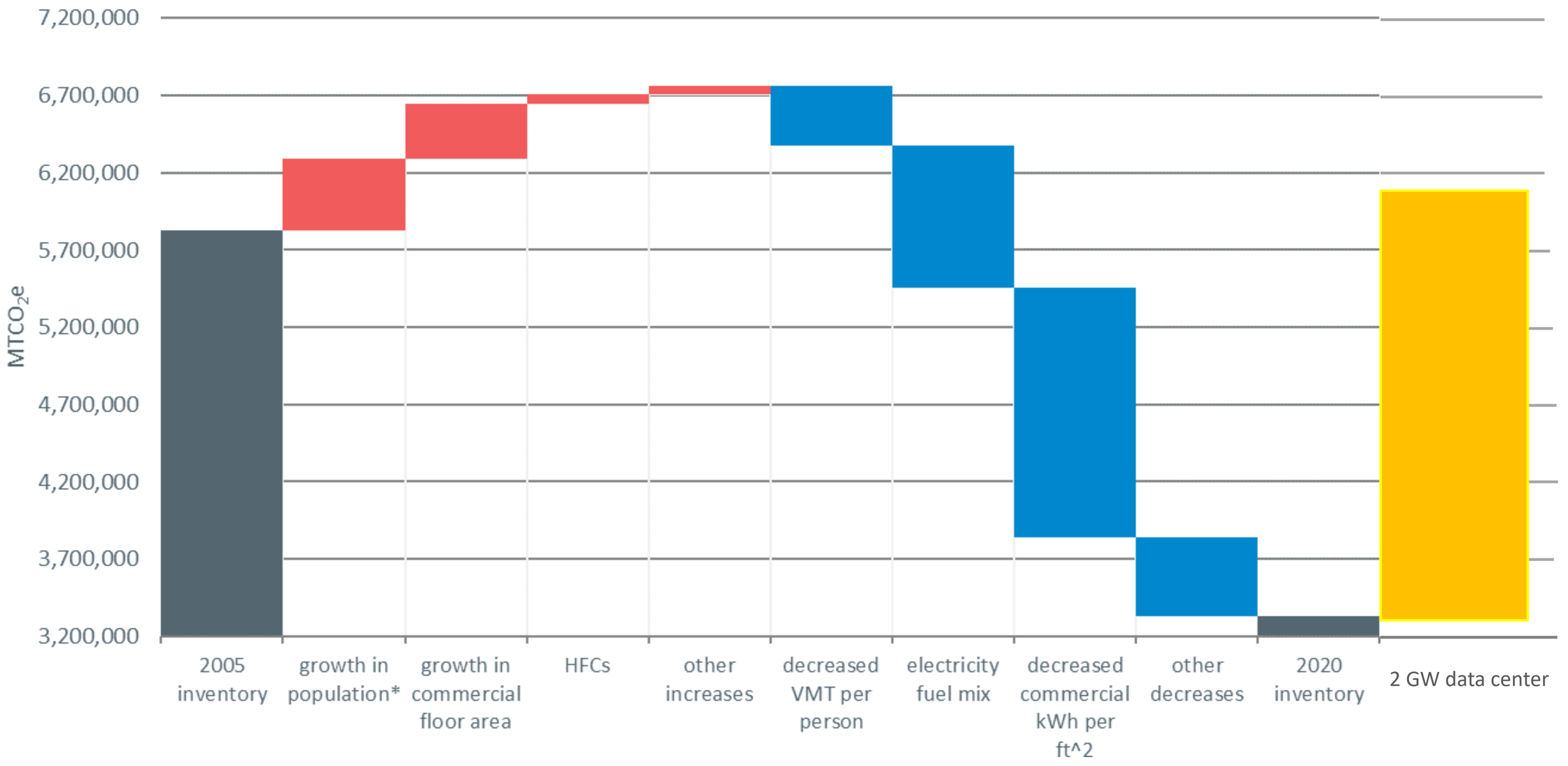
Greenhouse Gas Emissions: Considerations

- Frederick County needs to reduce an additional 0.4 million MTCO2e to meet 2030 goal, 3.3 million MTCO2e to meet 2050 goal.
- 1 gigawatt of power could add approximately 1.4 million MTCO2e (equivalent of 250,000-300,000 homes).
- Power demands will increase with additional sites.
- This estimate of increased emissions does not include impacts from diesel generators.

Impact of One Additional Gigawatt of Energy Use



Impact of Two Additional Gigawatts of Energy Use



Clean Energy Considerations

- **Use renewable energy onsite and/or offsite.**
  - Land availability for onsite renewable generation is limited.
  - Local or regional agreements.
  - State Renewable Portfolio Standards—50% by 2030
  - Frederick County will do a solar siting study in FY 24 to identify possible and priority solar locations in the County.

Clean Energy Considerations

- **Renewable Energy Credits (RECs):** Industry often buys Renewable Energy Credits to meet their own clean energy goals, anticipate sustainability reporting requirements.
- Consider requiring reporting of energy usage, emissions and proof of offsets.
- Consider requiring data on Renewable Energy Factor (REF): ratio of the renewable energy owned/controlled by a data center to the total data center energy use.
- Could look at energy use as threshold for offset, reporting requirement rather than make industry-specific. Example: Carbon Usage Effectiveness metric (CUE) calculated by total carbon emissions in a year divided by IT equipment energy use for a year.
- Aspects to consider: scale of where clean energy credits could come from, type of clean energy credit
- Certification/tracking system requirement. Green-e, GATS, other .
- Retirement requirement (otherwise can buy and sell).

Generator Emissions and Air Pollutants

- Diesel generators are used to ensure continuous operation. They need to be tested on a regular basis.

- These engines directly release greenhouse gases, NOx, particulates, carbon monoxide, hydrocarbons, etc.
  - Example: Aligned data center, 42 CAT C175-16 generators in approved site plan (168 at buildout). Per CAT, engines are U.S. EPA Certified for Stationary Emergency Use Only (Tier 2 Nonroad Equivalent Emission Standards). At 100% use each engine consumes 162.6 gal diesel/hr. Specs for this engine:

Emissions (Nominal)[3]		
NOx	4103.7 mg/Nm³	7.7 g/hp-hr
CO	153.1 mg/Nm³	0.3 g/hp-hr
HC	52.3 mg/Nm³	0.1 g/hp-hr
PM	10.4 mg/Nm³	0.0 g/hp-hr

  - Example: Loudoun Now estimates 4,151 diesel generators in Loudoun releasing 93 tons non-methane hydrocarbons and NOx, 51 tons CO/hour.

Generator Considerations

- **Air quality waivers have been proposed** in some locations (in California and in Loudoun County, Virginia) in order to allow data centers to “peak shave” by feeding back to the grid when the grid has a high likelihood of brownouts or blackouts. The public has been opposed due to impacts on homes, health.

- **Regulate emissions performance, not tech**. Example: Green Globes: Emissions.

- **Eliminate need for generators.** Examples:
  - QL plan subsidiary Q-Energy is interested to develop a critical power source to eliminate the need for generators. Develop a “battery storage farm” and sell power to data centers on the campus.
  - Washington Gas submitted a Hydro Hub Application/ RFP for development and utilization of lines that run through QL property, which would allow QL site be a hydro hub. Unknown time frame at this time but may be about 7-years before even a reality.
  - Terra Energy bought 740 ac in Dickerson, plans to create rooftop solar, battery storage.

- Hold series of events through Sustainability Commission and other groups to explore emerging technologies. Partner with NREL, MWCOG, Loudoun County, and others to find solutions. Loudoun has data center coalition hosted by Economic Development.

Electrical Capacity Considerations

Data centers are enormous electricity consumers, which can strain existing electrical infrastructure capacity if not prepared for appropriately.

- Will adding large electricity user(s) impact other Frederick County utility consumers?
- Will new capacity and/or infrastructure be needed? When? Who covers the cost?
- How will the needs of existing consumers be considered?
- Must be addressed by other entities: utility company, state regulators, and regional grid operators and regulators.

Electrical Capacity

- **CDI Legislation 1-19-8.403 Electric Substation Use regulates substation creation for data centers. A CDI Electric Substation application must include, for example:**
  - Information indicating conditions of use and existing infrastructure on adjoining properties within a 1,000-foot radius.
  - Description of the potential environmental and ecological (air, waters, wildlife, vegetation) effects of the proposed CDI Electric Substation “in the vicinity of the proposed development”.
  - Info on how to address visual impact on designated preservation areas such as rural legacy areas, ag preservation areas, critical farms, Monocacy scenic river, designated heritage areas, historic sites.
  - A description of methods to be used to mitigate waste disposal, air quality, and visual or noise impacts associated with the development of the operation.
  - Screening of mechanical equipment, power generators, water cooling and storage facilities, utility substations, and other utility infrastructure.
  - Front and side yards must include a four-season landscaped buffer with multilayered staggered rows of understory and overstory (at least 6 feet) trees and shrubs. Planning Commission may modify.

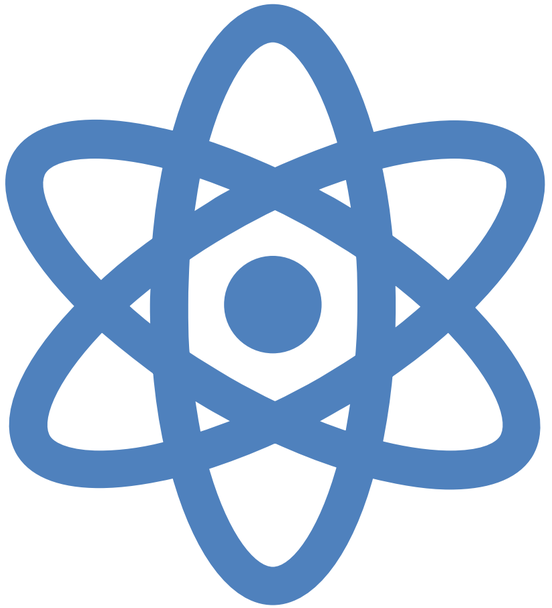
Electrical Capacity/ Energy Use Considerations

- **Review emerging standards** like Energy Star, Green Globes (verify- see Aligned application), LEED v4.1 BD&C: Data Centers, ASHRAE, ANSI and BICSI, ISO. Examples:
  - LEED 4.1 requirements: Regulate energy unit intensity (EUI) and not technology. Require energy performance target based on energy modeling analysis.
  - ISO: KPIs, Power Usage Effectiveness (PUE), ISO/IEC 30134-4 Information technology — Data centers — Key performance indicators — Part 4: IT Equipment Energy Efficiency for servers.

- **Maryland's Building Energy Performance Standards** regulate energy usage for all buildings greater than 35,000 sf, including data centers.
  - Site energy use intensity and net direct emissions standards for 2030-2034; 2035-2039; 2040 and beyond.

Electrical Capacity/Energy Use Considerations

- Investigate emerging technologies
  - Hydrogen
    - Proof of concept by Microsoft, and others for the data center industry. Companies working to bring tech to market.
    - Recent DOE grant application for Hydrogen Hub.
    - Hydrogen Hub with Hydrogen Cells .
      - Inflation Reduction Act hydrogen tax credits.
  - Lithium-ion Battery backup; battery trials showing 3 hours of use.
  - Methane Gas generators.
  - Combined Heat and Power (CHP) aka Cogeneration, ties in with Energy Reuse Factor. (Energy Reuse Factor is energy reuse divided by total data center energy use.)



Noise Regulation: Decibel limits and exemptions

- **Noise is commonly an issue for the public in areas with data centers.**
  - Data center noise is created by air handlers/chillers, generators, and other mechanical devices.
  - Noise must comply with CRITICAL DIGITAL INFRASTRUCTURE FACILITIES § 1-19-8.402(D)(1)

Sound Measured To	***Decibels Continuous Slow Meter Responses***
Industrial uses	70
Commercial uses	64
Residential uses in any zoning district	55
Institutional uses	55
All other uses	55

  - Guidelines for noise levels include maximum sound pressure levels as measured with a sound level meter. Vibrations are not allowed if felt without instruments.

Noise Regulation: Fines

- **Noise Ordinance Fines are covered in § 1-19-2.210. CIVIL ZONING INFRACTIONS.** This section covers any violation of any of the provisions of the zoning ordinance for Frederick County.

- **§ 1-19-2.210 (C)** states that a fine of $100 is imposed upon any person responsible for a civil zoning infraction for each violation. Each day such violation is permitted to exist shall be considered a separate infraction.

- “If after occupancy, continuous or intermittent violations of performance standards occur after notice and bona fide corrective actions are not taken, the Zoning Administrator may suspend or revoke the Zoning Certificate and Certificate of Occupancy and require operations and occupancy to immediately cease. These will be reinstated once issues are resolved to the Zoning Administrator’s satisfaction.”

Noise Considerations

CDI section 1-19-8.402(D)(d) states that generators must meet the sound requirements under (1)(b)“Emergency” in Frederick County’s Noise Ordinance.

- Aligned Data Center Planning Commission Site Plan Approval. Did not model “emergencies”, claiming exempt (code § 1-11-6. NUISANCE - NOISE LEVELS subsection (F)(9) of the Noise Ordinance that exempts “emergency operations”). Modeled the noise level of one unit during non-emergency for “industrial uses”. Max <70 dB with 1 generator, 73dB with two, unknown what the DB level will be at the edge of the neighboring property when all 42 generators are running.

Aligned Datacenter Application to Planning Commission:

Noise levels at the property line are expected to be elevated during emergency use conditions when multiple units are anticipated to operate. These conditions are not regulated by the County Code limits and are not expected to be extended in duration.

The staff report for Aligned was corrected this verbally at the FCPC meeting. The conditional approval included a condition for Aligned to amend the noise study.

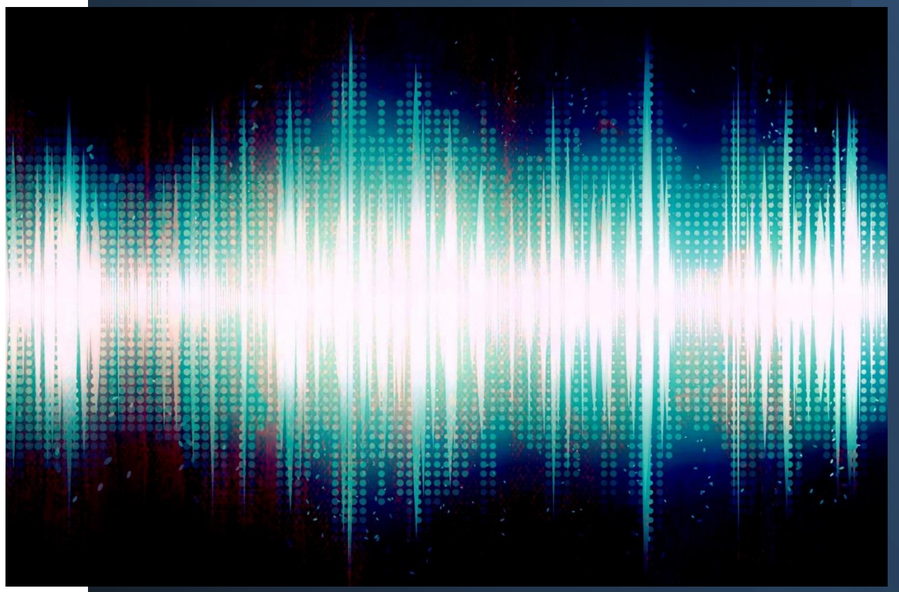
Noise Considerations

- Clarify that data centers cannot run diesel generators for continuous operation while waiting for substations to be built, to avoid long periods of continuous diesel noise and emissions. The lack of substation under the current noise ordinance is not an “emergency”.

- Continue to review noise studies/impact reports to ensure adequate parameters used, accurate distance measurements and calcs, topography. Model noise estimates based on 100% of power use with all diesel generators and do not exclude “emergency” operations. Include an evaluation of frequencies. Require attenuation where necessary.

- Regulate performance rather than technology. Encourage the use of improved technologies through review processes. Best Management Practices include wind bands and higher-power fan motors. Air exhaust vents can be wrapped with sound-absorbing blankets and other mitigation measures.

- Clarify CDI language to ensure data centers meet noise requirements during power outages. Update fines to act as deterrent.



Light Pollution

- Large facilities may contribute to outdoor lighting pollution towards neighbors, sky

- Lighting requirements are in Zoning Ordinance CRITICAL DIGITAL INFRASTRUCTURE FACILITIES § 1-19-8.402(B)(8) and reference §1-19-6.500 including allowable foot candles, pole heights, shielding for glare. CDI legislation §1-19-6.400(B) includes screening.

- **Fixture Seal of Approval** certifies lighting fixtures for dark skies. Issue for bird migration. Referenced at *www.darksky.org/our-work/lighting/lighting-for-industry/fsa*
  - MD Energy Administration promotes this standard
  - Certified fixtures are at *www.darksky.org/our-work/lighting/lighting-for-industry/fsa/fsa-products*

Cooling and Water Consumption

- Data centers require a significant amount of cooling, traditionally achieved by using both air and water.

- A limited amount of greywater is available for this use. Example:
  - A pipeline is already built to the former Alcoa site with 7,000 gal/day capacity from a line running down New Design Road.
    - This will be available for some QL customers.
    - It is anticipated that the need will exceed volume.

- Consumption of water could be an issue, especially during a drought.

Cooling and Water Consumption Considerations

- **Ensure water supplies are not stressed by data center requirements.**

- **Review standards** in Green Globes, Energy Star, LEED 4.1 BD&C: DC, ISO, IGCC CH 6

- **Regulate Water performance rather than technology.** Ultimate goal is zero water use.
  - ISO: Key Performance Indicators, Water Usage Effectiveness (WUE) metric
  - LEED: Perform a preliminary water budget analysis before the completion of schematic design that explores how to reduce potable water loads in the building, reduce the burden on municipal supply or wastewater treatment systems, and accomplish related sustainability goals. Assess and estimate the project's potential nonpotable water supply sources and water demand volumes
  - ASHRAE guidance for liquid cooling
  - Green Building Institute Green Globes: GBI calculator, water performance standards

Cooling and Water Consumption Considerations

- **Encourage adoption of newer technologies that use less water.**
  - Example: Schneider Electric/Iceotope coolant delivery. Floods a sealed server chassis with coolant. Reduces server fans, saves an estimated 15% on cooling *-Datacentre Magazine*
  - Air based cooling with “liquid cooled rear door heat exchangers that cool air right at the rack.” *-Datacentre Magazine*

- **Require secondary containment for coolant and ensure adequate industrial discharge permit coverage if necessary**
  - Example: Per FCSC, ensure that all onsite fuel and non-aqueous coolant storage containers and associated transfer piping have design features that prevent leakage into the soil in the event of possible earthquakes or impact from debris projectiles created by tornadoes or the high winds produced by hurricanes and other intense storms, because such hazardous events are likely to occur in Frederick County in the coming years.

Other Factors to Consider

- **Consumption of Agricultural and Forested Land**

- **Electromagnetic Interference** (EMI)
  - CDI legislation requires an assessment of the impact on nearby properties from electromagnetic fields to be generated by the CDI Electric Substation

  - Review best practices in the industry for protecting against EMI
    - Example: The Uptime Institute has Tier standards

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