Improving the Forecast of Data Center Greenhouse Gas Emissions: Implications for the Prince William Community Energy & Sustainability Master Plan

Presented to:

Prince William County Sustainability Commission

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Prepared by Commissioners

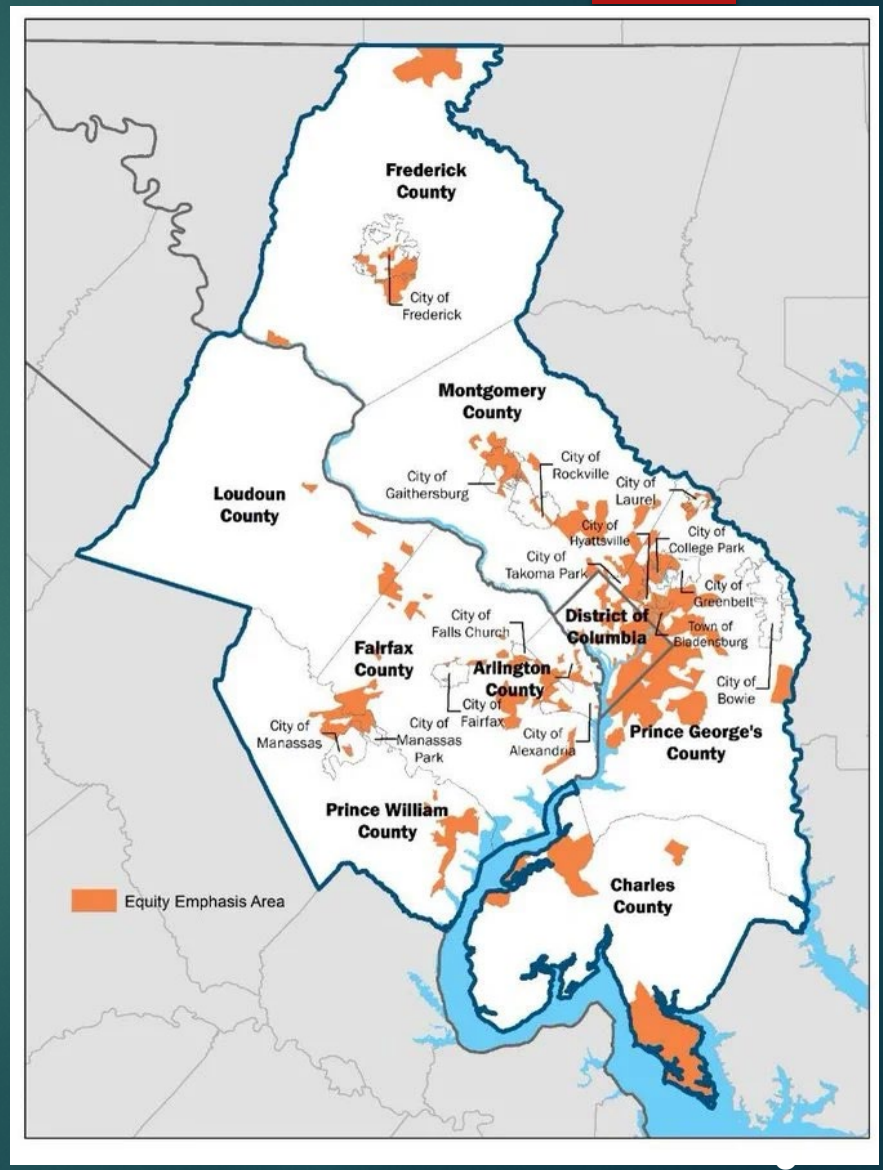
Randy Freed and Martin Jeter

Objectives & Outline

- Briefing Objectives
  - Provide SC's improved estimate of data center contribution to PWC greenhouse gas forecast
  - Describe implications – need for immediate departure from business-as-usual
  - Recommend measures to reduce impacts
- Background and Timeline – Regional and PWC goals
- Improved estimates for GHG Forecast
- Solutions
- Recommendations
- Appendix: Supporting slides

Background and Timeline - MWCOG

- 2008: MWCOG established regional goals of reducing GHG emissions, compared to 2005 levels, by 20% in 2020 and by 80% in 2050
- Nov. 2020: MWCOG adopted "2030 Climate and Energy Action Plan" with 3 goals for 2030 (Metropolitan_Washington_2030_Climate_and_Energy_Action_Plan_FINAL6 (5).pdf):
  - Cut GHG emissions to 50% of 2005 levels
  - Become a Climate Ready Region
  - Incorporate equity principles and expand education on climate change
- Goals adopted by PWC BOCS in Nov 2020



Background and Timeline - PWC

May 2021 – Oct. 2023: ESO, Core Team, AECOM conduct supporting analyses and formulate plan, using MWCOG methods (Sustainability Commission consults):

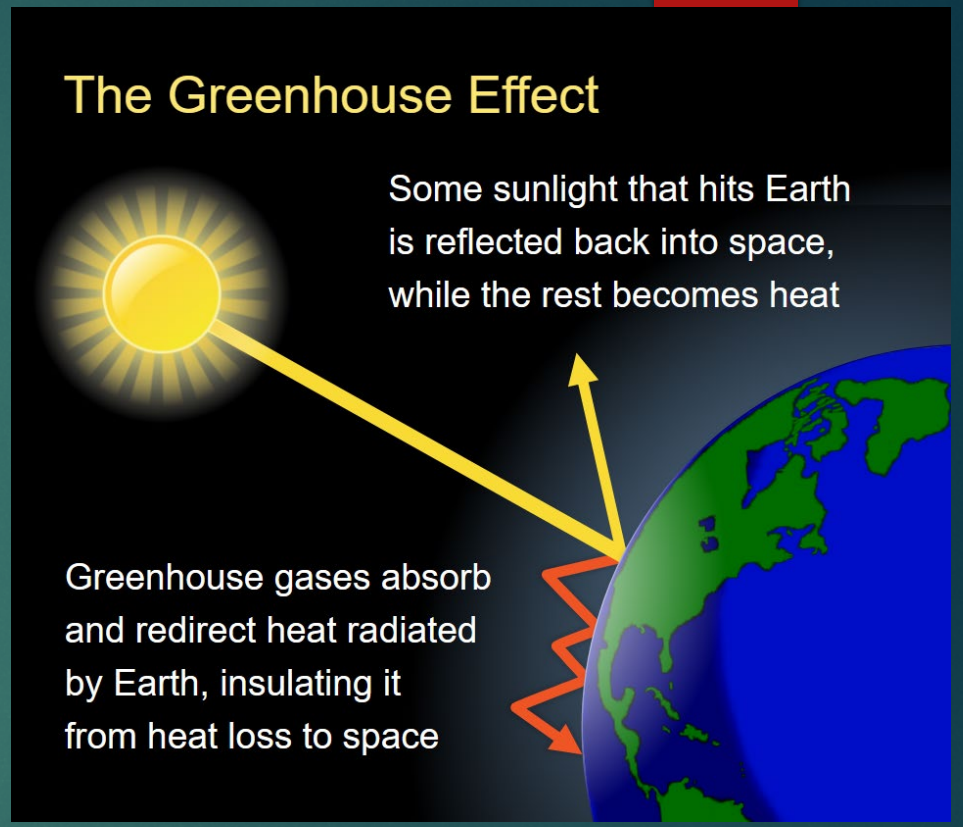
Oct. 24 2023: BOCS approves CESMP with 3 foundational program-wide initiatives (e.g., assessments for climate mitigation and resiliency impacts) and 25 programmatic actions (e.g., encourage transit-oriented development)

Ongoing: Setting priorities for CESMP implementation; current resources support less than 1/3 of actions and initiatives in the Plan

Planning Office, Office of Sustainability, and Emergency Management integrating CESMP into Comp Plan

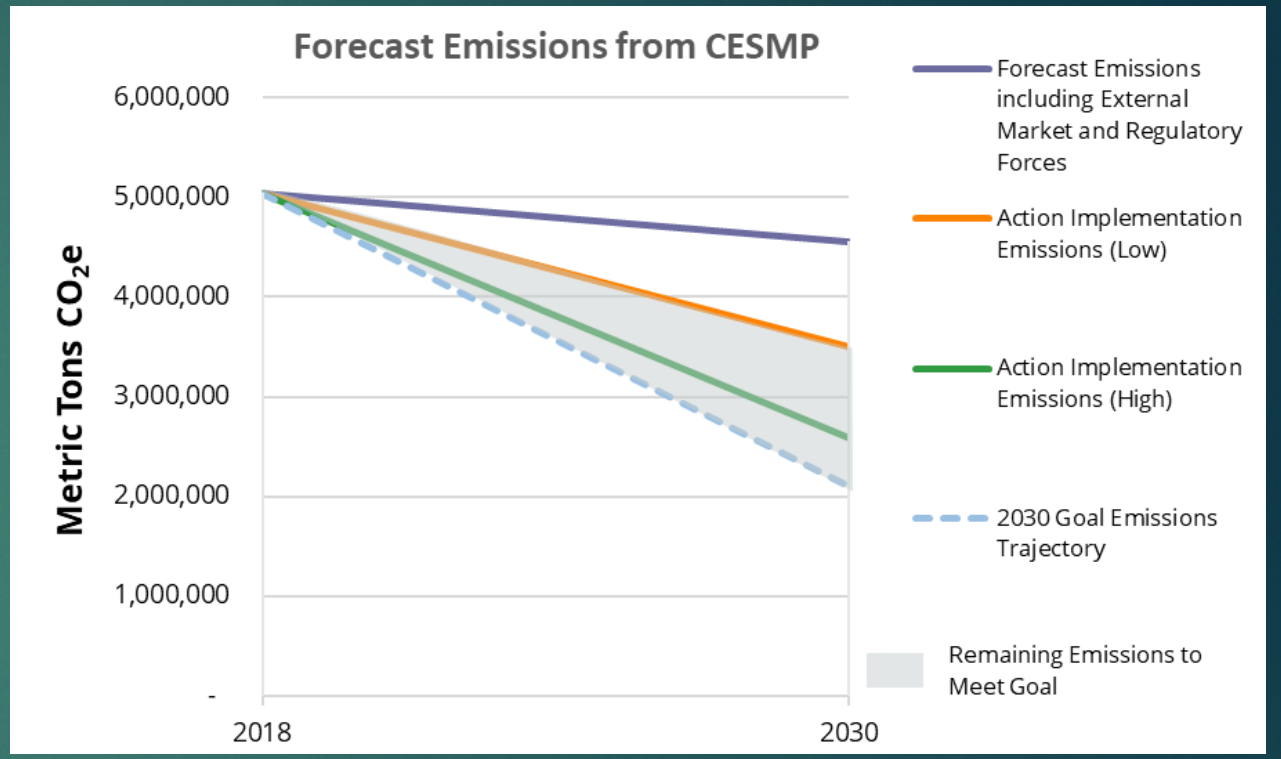
GHG Forecast in CESMP – MWCOG / AECOM

- GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) accumulate in the atmosphere and absorb heat
- MWCOG provides GHG emission inventories for all member jurisdictions for 2005 (base year), 2012, 2015, 2018, 2020. PWC used 2018 as reference point for forecast (2020 was covid year)
- MWCOG provides forecasting tool and basic data. PWC/AECOM did some fine tuning.



GHG Forecast in CESMP – MWCOG / AECOM

- **2030 goal is 2.1 million metric tons CO2e** (MMTCO2e), half of 2005 level; 2018 level was 5.0 MMTCO2e
- Using MWCOG methods, absent CESMP, 2030 emissions are projected to drop to **4.6 MMTCO2e. Data Center Emissions: 5%**
- Board-authorized CESMP actions would "bend the curve" to **2.6-3.5 MMTCO2e**, depending on implementation effectiveness (high or low)
- This leaves a **gap of 0.5 – 1.4 MMTCO2e in further emission reductions to reach the goal**



However, data center emissions had never before been specifically addressed by the MWCOG/AECOM methodology, and the "standard" method, as applied in PWC, produced an incomplete forecast.

2030 Forecast – CESMP Forecast Assumptions versus Improved Assumptions

Factor	Assumption in CESMP Forecast	Improved Assumption
Energy Intensity, annual kWh/ft^2	Data centers are part of the commercial building sector; their energy intensity is equal to other commercial buildings (retail, office, etc.)	Data centers are >50x more energy intensive than other commercial buildings, and are estimated separately
Floorspace, million ft^2 (MSF)	Total growth in floorspace for **all comm bldgs between 2018-2030 is 15.5 MSF:** 6.0 MSF from PWDG and 9.5 MSF from other unspecified comm bldgs (presumably including other data centers).	Growth in data center floorspace is far higher than value assumed for growth in **all** comm bldgs (total 2030 data center **buildout will be 21 - 73 MSF** depending on construction rate and electricity supply).
Emission (carbon) intensity of electric grid, kg CO_2e/kWh	Emission intensity remains constant at 2015 levels	Emission intensity declines due to effects of Inflation Reduction Act and continued market forces. Used Dominion IRP and Energy Info Admin forecast values for VA in 2030.
Clean energy purchases (% of electricity used)	All electricity is at grid average carbon intensity (i.e., no clean energy purchases)	Several major data center companies have made commitments on renewable energy use and/or carbon neutrality. For companies in PWC with these commitments, accounted for clean energy use.

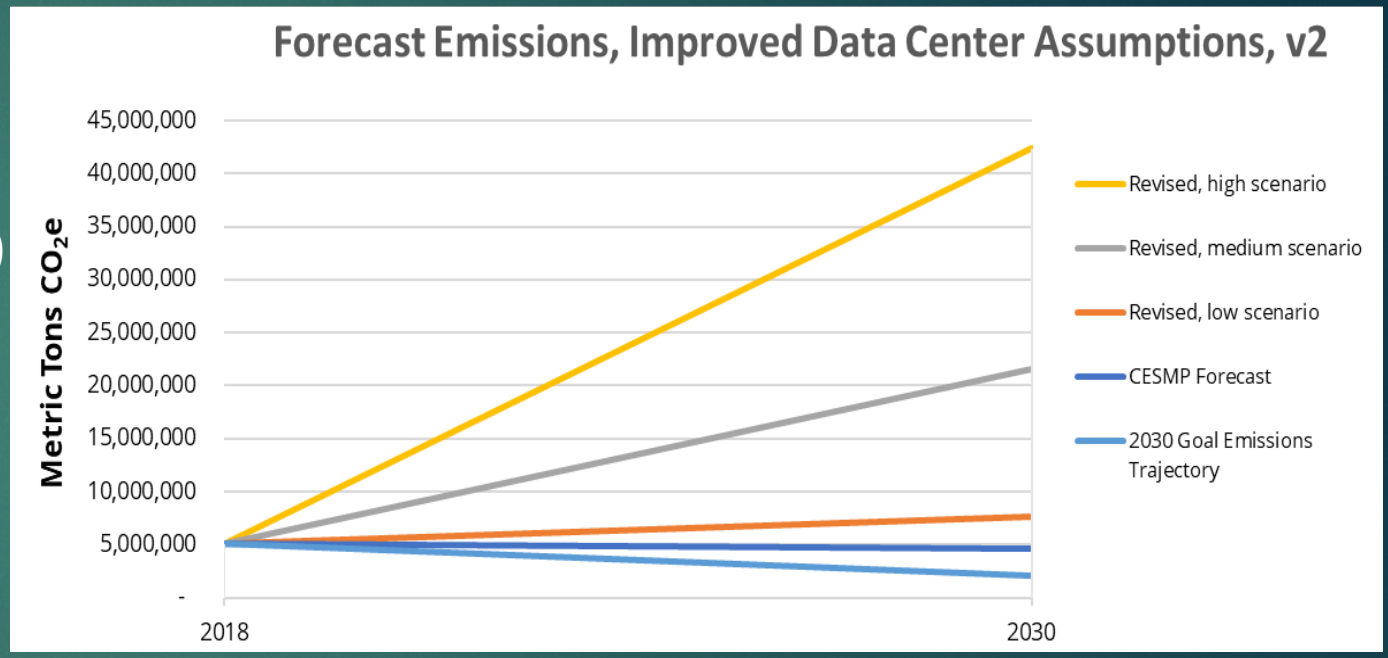
- First two improvements increase emission estimate; second two decrease estimate.
- Prior to analyzing with improved assumptions, overall direction of change was unknown.

2030 Improved Forecast

- Considerable uncertainty remains, even with improved assumptions, e.g.,
  - How much floorspace will be completed by 2030?
  - How will Artificial Intelligence affect energy intensity?
  - How much decarbonization will occur in VA's grid?
  - How much clean electricity will be purchased?
- Developed low-, medium-, and high-emission scenarios to combine factors and indicate the range of outcomes, absent further policy change

2030 Improved Forecast

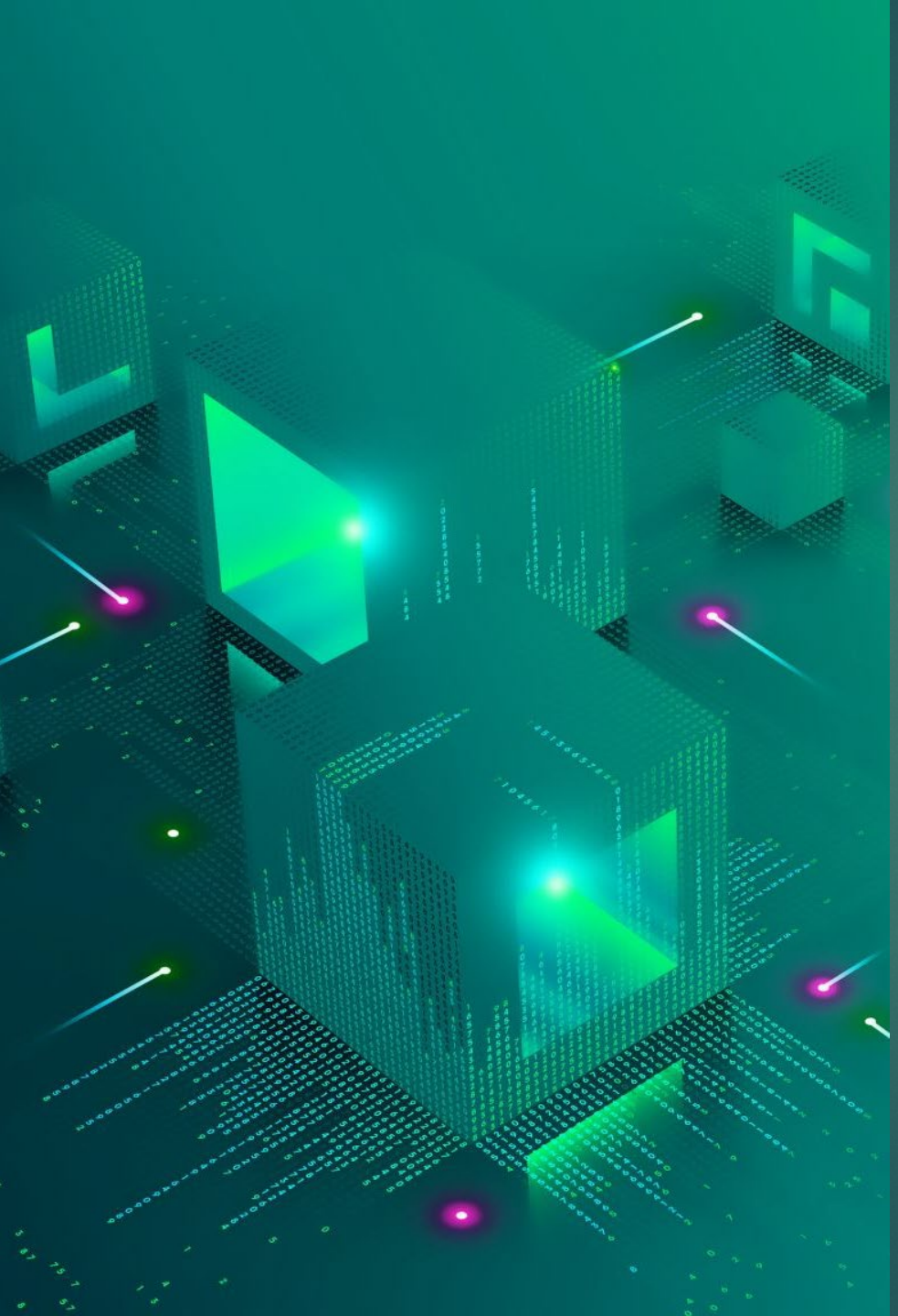
- For all 3 scenarios, instead of emissions reducing between 2018-2030, emissions increase dramatically
  - CESMP: 4.6 MMTCO2e **(5% DC)**
  - Revised low: 7.6 MMTCO2e **(56% DC)**
  - Revised medium: 22 MMTCO2e **(84% DC)**
  - Revised high: 42 MMTCO2e **(92% DC)**
- This greatly expands needed emission reductions (5.5-40 MMTCO2e for low and high scenarios, respectively)



Emissions growth due to data centers is a game-changer. PWC's unique economic development strategy has brought unique sustainability challenges not captured by the "standard" forecast tools.

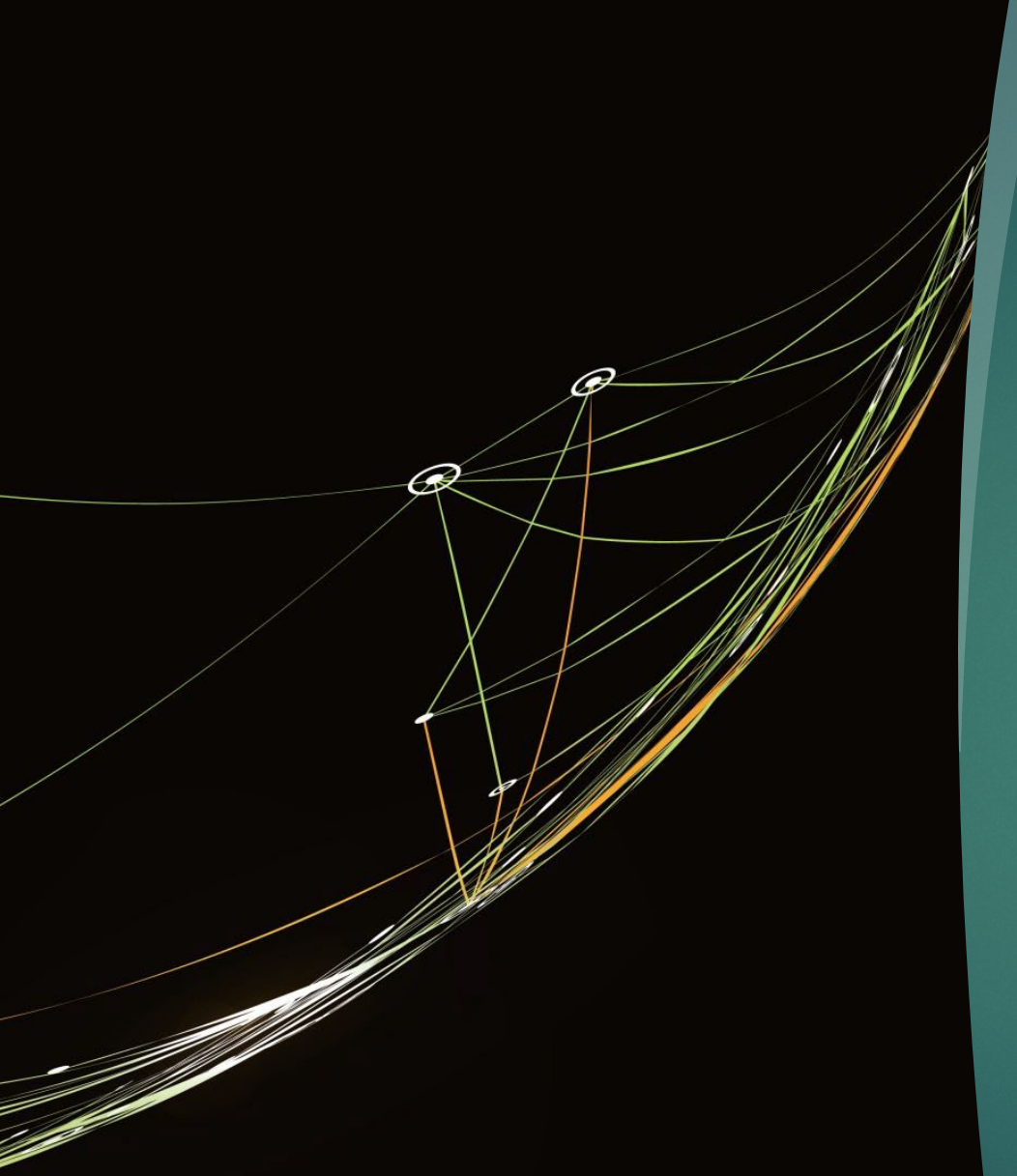
Potential Solutions

- Many large data center companies – including Google, AWS, Microsoft, and others already in PWC – have commitments to be carbon neutral, primarily by buying zero-carbon electricity
  - These commitments can take the form of Power Purchase Agreements (PPAs), Renewable Energy Certificates (RECs), or other arrangements where every MWh of electricity consumed by the data center is matched by a MWh of clean, zero-carbon electricity generated by a supplier
- Both Dominion and NOVEC have helped commercial customers source clean electricity. They already offer programs (Dominion Energy Green Power | Virginia | Dominion Energy; Renewable Energy Certificates (novec.com)) where residential customers can purchase clean electricity for a nominal surcharge (~$0.015/kWh). Dominion and NOVEC have capabilities to connect end users with clean electricity suppliers.



Potential Solutions

- HB116 (introduced by Del. Rip Sullivan), continued to 2025, would require data centers to "procure carbon-free renewable energy and associated renewable energy certificates from facilities equal to 90 percent of its electricity requirements or that its electricity will be otherwise derived from non-carbon-emitting, renewable sources" in order to continue receiving the state sales and use tax exemption for data center purchases.
  - Although the fate of a future state-wide solution is very uncertain, the County could possibly devise its own incentives along similar lines.



Potential Solutions

- "Community Choice Aggregation (also known as Municipal Aggregation) is an alternative energy procurement model that allows counties, cities, and municipalities to aggregate electrical energy load of residential, commercial, and industrial retail customers within their boundaries. By aggregating the electricity demand CCA can negotiate lower rates and choose a greater percentage of renewable energy." – What is CCA? - VIRGINIA CLEAN ENERGY ,
  - This action is in the CESMP as E.1: Acquire Clean Electricity Sources for the County. If adopted, CCA could potentially provide data centers as well as other commercial and residential users with clean electricity at competitive rates.
  - It's not clear whether CCA is legally authorized in areas served by electric coops (e.g., NOVEC), which includes half of PWC customers.

Potential Solutions

- If ***all*** PWC data centers purchased clean electricity to zero out their carbon footprints by 2030, GHG emissions would approximate the level projected in the CESMP forecast. **In this case – and only in this case – the County's climate mitigation goal would be in reach.**
  - If the County wants to meet its climate mitigation goals, it urgently needs to change from business as usual and explore innovative solutions to this problem. Prince William should be a regional leader in these efforts.

Recommended Actions

- Explore ways to **pause approvals on new data centers, including eliminating the opportunity zone and targeted industry status**, until the county can
  - adequately analyze and manage cumulative impacts of data center development (GHGs, water, noise)
  - devise a method to condition approval of any additional data centers on binding commitments by the applicants to use at least 90% zero-carbon electricity by 2030
- Immediately prioritize CESMP Action E.3: *Encourage Renewable Energy Use in Energy-Intensive Commercial Buildings* including developing a program to encourage, and if possible, require all existing and fully permitted data centers to commit to use at least 90% zero-carbon electricity by 2030
  - For example, additional data center tax increases could apply only to facilities that do not commit to zero-carbon electricity. This will take serious programmatic innovation and effort.

Recommended Actions

- Prioritize the CESMP foundational initiative on "*assessments for climate mitigation and resiliency impacts*," to be performed by the County to provide data on a project's impact on GHG emissions, renewable and fossil energy mix, and climate resiliency metrics. These assessments should apply not only to new data centers, but also to road projects, residential/ commercial development, and other projects that could materially affect accomplishment of the CM/CR goals to insure that the goals are not further at risk.
- Prioritize E.1: *Acquire Clean Electricity Sources for the County* to investigate a county-wide (or better yet, regional) approach to scale up clean electricity use through CCA.

Questions/ discussion

THANK YOU!

RFREED.PWCSUSCOMM@GMAIL.COM

Extra slides

Appendix: 2018 GHG Inventory from MWCOG

Note: excludes forest carbon storage

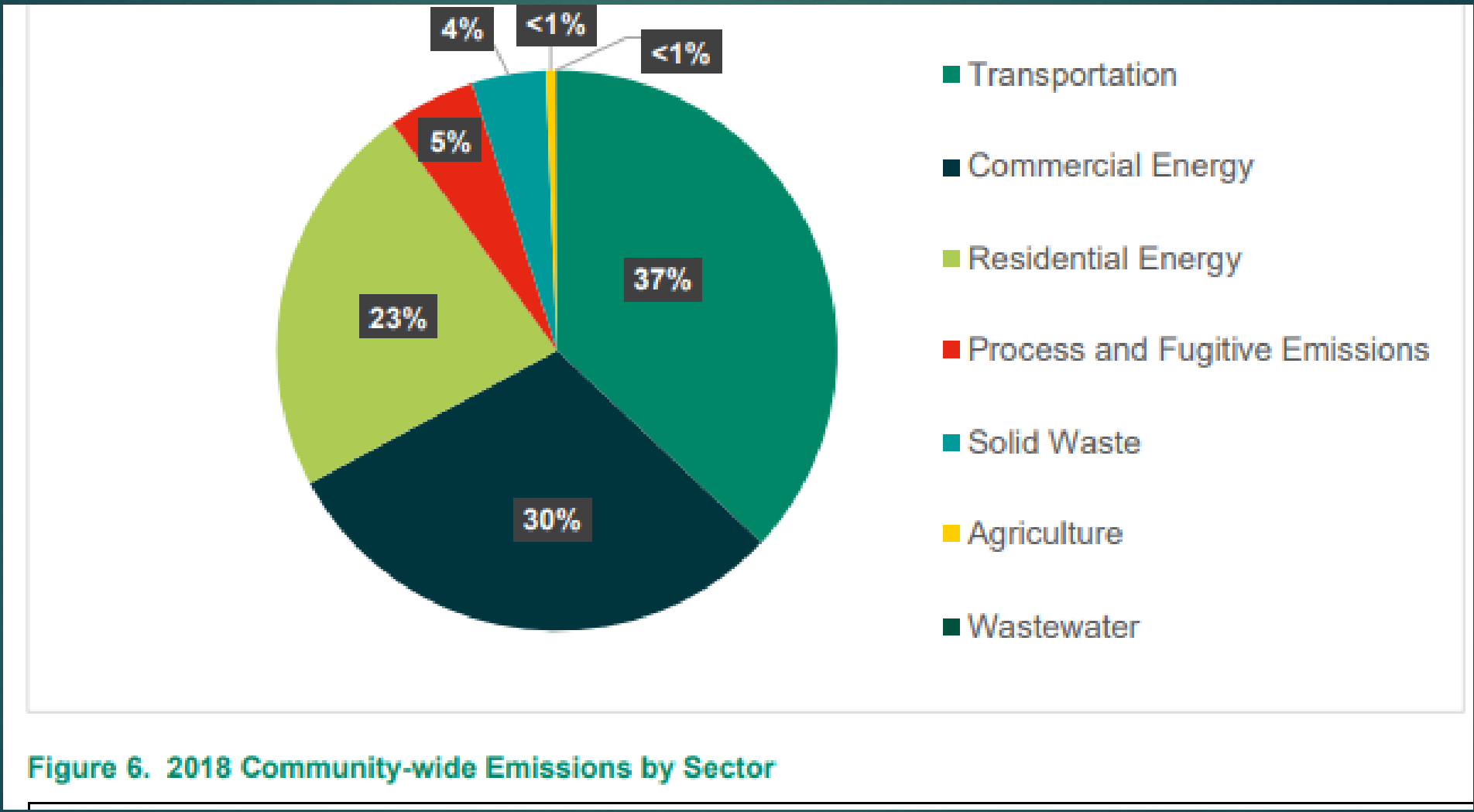
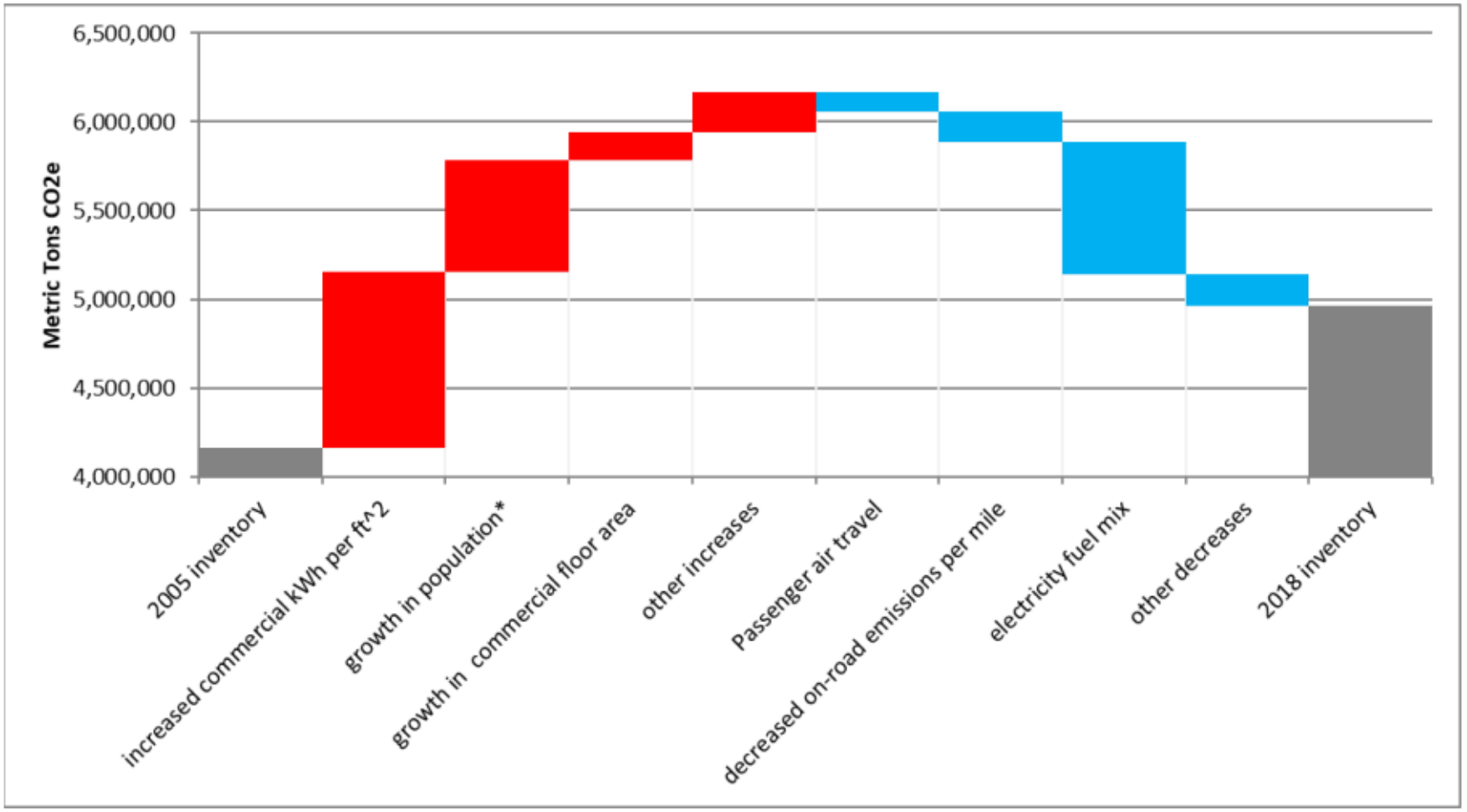


Figure 6. 2018 Community-wide Emissions by Sector

2. GHG Inventory from MWCOG

Exhibit 2. MWCOG High-level GHG Contributions Summary for PWC: Change Drivers from 2005 - 2018



Further changes, 2018-2020:

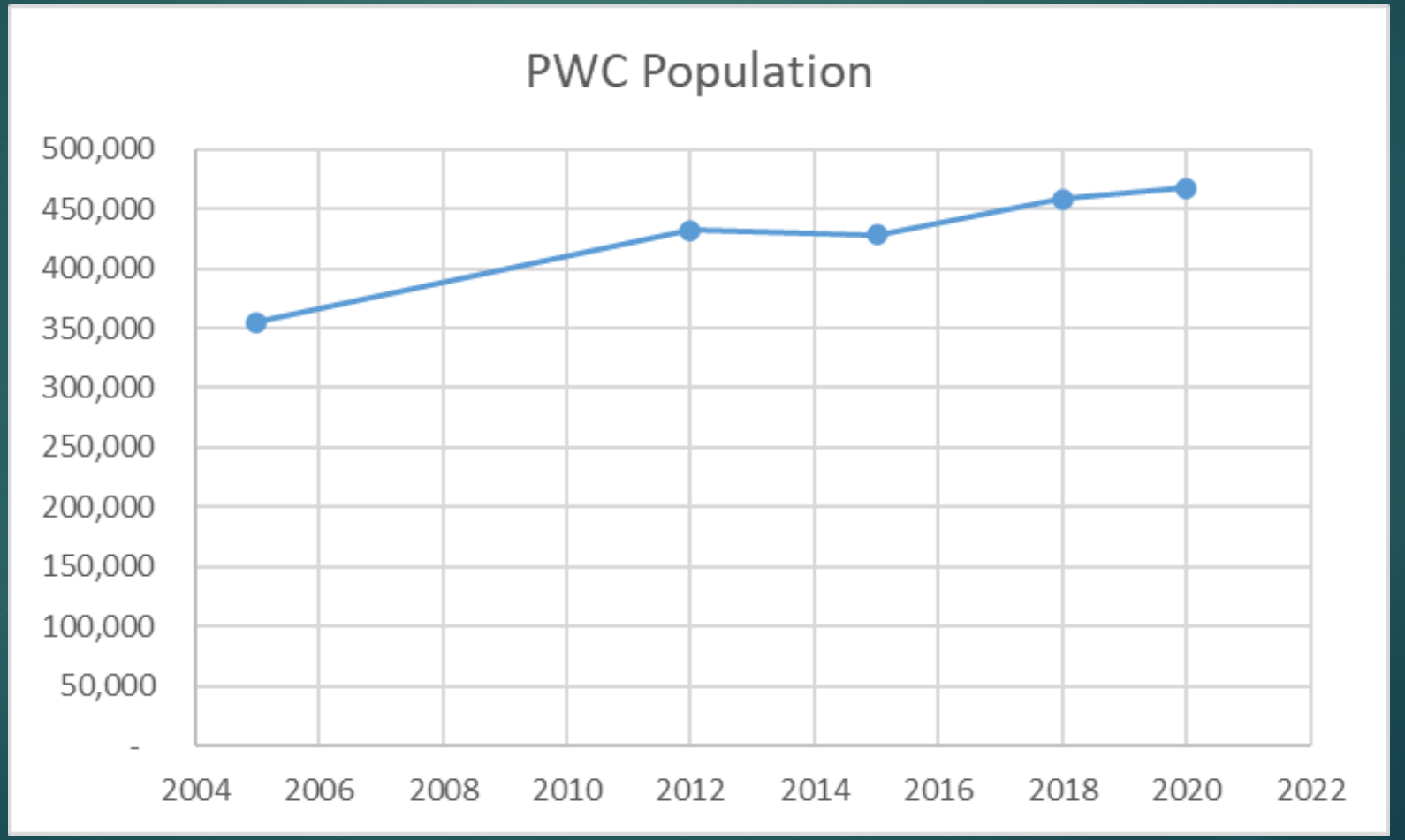
- Increased commercial building emissions (More data centers)
- Lower on-road vehicle emissions (COVID)

Appendix: Assumptions for Low-, Medium-, and High-Emission Scenarios

- Low-emission scenario: Only currently approved DCs get built by 2030 (medium MSF); Gil Jaramillo's estimate of energy intensity (delayed increase due to AI); high zero-carbon electricity purchases (data center industry-wide aspirational targets); EIA projection of carbon intensity of grid electricity
- Medium-emission scenario: Only currently approved DCs get built by 2030 (medium MSF); 305 kWh/ft2 energy intensity (delayed increase due to AI); medium zero-carbon electricity purchases (corporate commitments honored); EIA projection of carbon intensity of grid electricity
- High-emission scenario: All identified DCs get approved and start construction (high MSF); high energy intensity (due to increased AI); low zero-carbon electricity purchases (due to supply constraints/ lack of corporate ambition); high carbon intensity of grid electricity (due to additional gas plants, delayed retirement of coal plants)

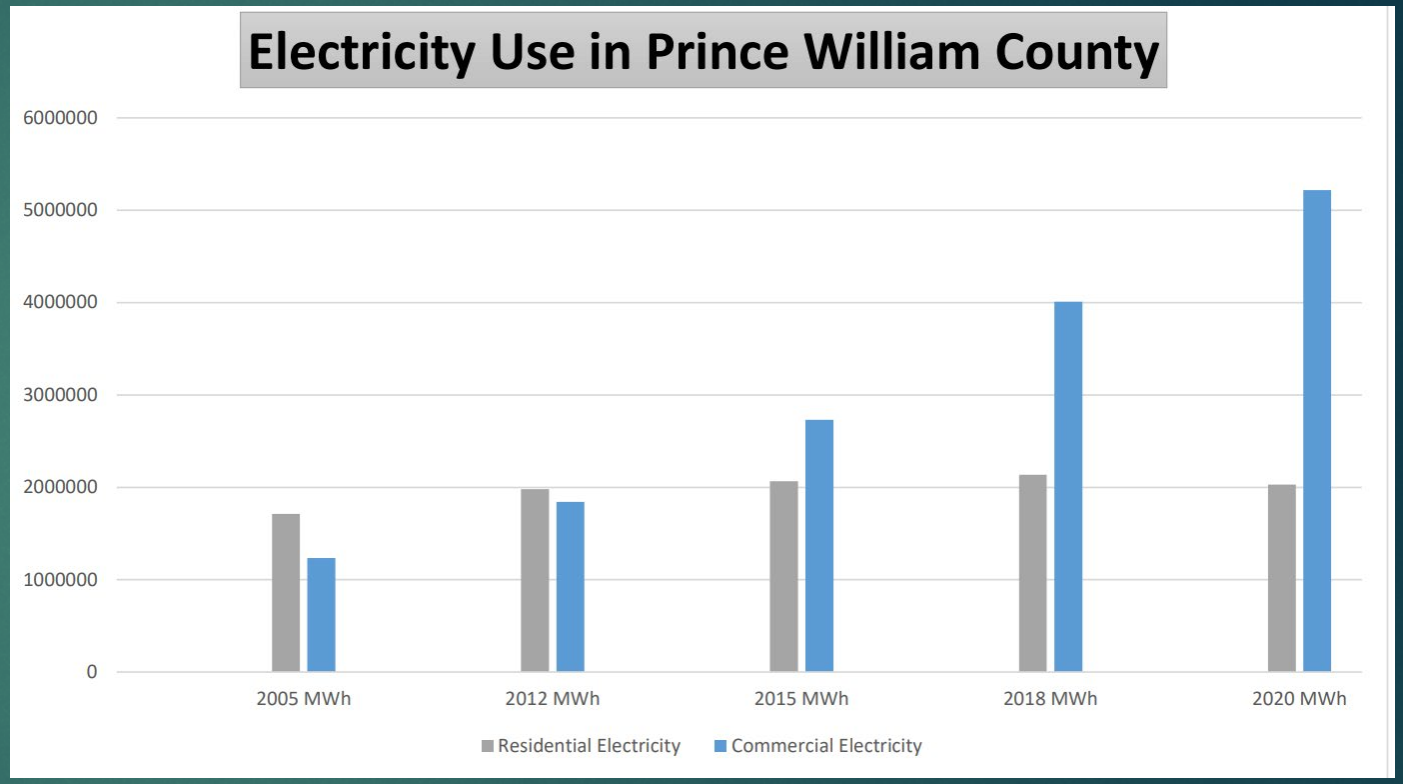
Appendix: GHG Inventory from MWCOG

- Population growth – 32% higher in 2020 than 2005, compared to 20% increase for the MWCOG region



Appendix: GHG Inventory from MWCOG

- Greatest increase in emissions: electricity use from commercial buildings. Emissions in 2020 were 844,000 MTCO2e higher than 2005 (+132% of 2005 levels)
- Increased commercial energy intensity and building floorspace -> more commercial electricity use
- Residential electricity emissions relatively flat despite population growth due to decrease in carbon intensity of electricity



Appendix: GHG Inventory from MWCOG

- Decreased carbon intensity of VA's grid – 2020 C intensity is 51% of 2005 C intensity (source: Energy Info Admin state electric power reports)