Overview of Draft Emission Scenarios (v2)

for

Fairfax County Community-Wide Energy and Climate Action Plan (CECAP) Focus Groups and Task Force

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Prepared by the Metropolitan Washington Council of Governments (COG), Department of Environmental Programs

COG is participating on a consulting team with ICF and DMV Strategies to assist in the Fairfax CECAP planning process. COG handles development of local and regional greenhouse gas (GHG) inventories for the region. Using the completed 2018 Progress Year Inventory for Fairfax, COG developed a set of future emission modeling scenarios to facilitate initial Task Force discussions of establishing GHG reduction goals for the county. Scenario reductions were compared to a 2005 Base Year Inventory. 2005 was selected as a base year for these scenarios to be in alignment with national and international climate goal setting trends. These scenarios are intended to be starting point for the goal setting discussion, the team will be doing much more detailed modeling and analysis throughout the plan development process.

Scenarios

Business As Usual (BAU)

COG developed a BAU scenario to project emissions to 2030 and 2050. Growth rates were applied to various source sectors as described in the Greenhouse Gas Methodology Report.

Reduction Scenarios

In addition to the BAU, COG developed five main emission modeling scenarios for both 2030 and 2050 milestone years:

- *Scenario A- A low-moderate reduction scenario for both energy and transportation*
- *Scenario B- A more aggressive reduction scenario for both energy and transportation*
- *Scenario C- A Net Zero Grid and Low Carbon Transportation Scenario*
- *Scenario D- A Net Zero Grid, High Penetration of Low Carbon Gas, and Low Carbon Transportation Scenario*
- *Scenario E- An 80x50 Scenario including Net Zero Grid, High Penetration of Low Carbon Gas, Low Carbon Transportation and Elimination of HFCs Scenario*

COG surveyed past local studies of GHG reduction potential for various strategies and actions to inform the emission reduction estimates for each sector or subsector. Using information from these studies total reduction potential in 2030/2050 is estimated by applying the reduction estimates to the appropriate portion of the emission source sector for Fairfax. The sectors were broadly divided into Residential Energy, Commercial Energy, Transport, Wastewater Treatment, Agriculture, Waste, and Process & Fugitive Emissions. Reduction estimates related to energy efficiency, and grid and renewable improvements were applied only to the electricity segment of the Residential Energy and Commercial Energy categories (roughly 58% of Residential Energy's GHG emissions, and roughly 82% or Commercial

Energy's GHG emissions). Similarly, reduction estimates applied to transport were focused on On Road Mobile Emissions (92% of Transport GHG emissions), and of those reductions most were further focused on light duty vehicle improvements (64% of On Road Transportation GHG emissions). See the table below to see sector breakouts:

Emissions Type (Main ClearPath Tab)	**Emissions Activity or Source** (ClearPath Calculator)	**Inventory Records** (Entered in ClearPath)	**Emissions ($MTCO_2e$)**	
			2018	**% of GHG emissions contributed within sector**
BUILT ENVIRONMENT				
Residential Energy	Emissions from Grid Electricity	Residential Electricity	1,703,601	58%
	Emissions from Stationary Fuel	Residential Natural Gas	1,163,735	40%
		Residential Fuel Oil	33,458	1%
		Residential LPG	24,851	1%
Commercial Energy	Emissions from Grid Electricity	Commercial Electricity	2,695,007	82%
	Emissions from Stationary Fuel Combustion	Commercial Natural Gas	564,784	17%
		Commercial Fuel Oil	11,166	0%
		Commercial LPG	5,308	0%
TRANSPORTATION AND MOBILE EMISSIONS				
Transportation and Mobile Emissions	On Road Transportation	On Road Mobile Emissions	4,741,809	92%
	Rail Transportation	Rail Transportation	12,098	0%
	Emissions from Off Road Vehicles	Off Road Mobile Emissions	398,776	8%
WASTEWATER TREATMENT				
Water and Wastewater	Fugitive Emissions from Septic Systems	Septic System Emissions	321	7%
	Nitrification/Denitrification Process N2O Emissions from Wastewater Treatment	Sewer System Emissions	2,977	67%
	Process N2O from Effluent Discharge to Rivers and Estuaries	N2O Effluent Discharge Emissions	1,118	25%
AGRICULTURE				
Agriculture	Emissions from Agricultural Activities	Enteric Fermentation	1,849	22%
		Manure Management	403	5%
		Ag Soils	6,111	74%
SOLID WASTE TREATMENT				
Solid Waste	Waste Generation	Landfill Waste Generation	0	0%
	Combustion of Solid Waste Generated by the Community	Combustion of Solid Waste	213,737	100%
OTHER				
Process and Fugitive Emissions	Hydrofluorocarbon & Refrigerant Emissions	HFCs	582,206	92%
	Fugitive Emissions from Natural Gas Distribution	Natural Gas Fugitive Emissions	50,356	8%
TOTAL GREENHOUSE GAS EMISSIONS			**12,213,672**	**100%**

Assumptions for Each Scenario

Scenario A- Low-Moderate – Models potential emissions reductions of modest energy efficiency improvements combined with moderate grid/renewables improvements.

- By 2030 – Models emissions reductions from modest energy efficiency-grid/renewables improvements (30% by 2030); 20% modest low carbon transportation improvements in light duty sector; Modest low carbon transportation combined with the energy components above.
- By 2050 - 52% models emissions reductions from improvement in energy efficiency-grid/renewables; Growth in low carbon transportation improvements (41% for light duty); Growth in low carbon transportation combined with the improved energy components above.

Scenario B- More Aggressive - More aggressive energy efficiency improvements combined with moderate grid/renewables improvements.

- By 2030 – Models emissions reductions from more aggressive grid/renewables improvements (41% by 2030); Higher penetration of low carbon transportation improvements in light duty sector (30%); Higher low carbon transportation combined with the improved energy components above.
- By 2050 – Models emissions reductions from more aggressive grid/renewables improvements (52% by 2050); More rapid expansion of low carbon transportation for light duty sector (47%); More rapid expansion of low carbon transportation for light duty sector combined with aggressive renewables.

Scenario C- Net Zero Grid, Low/High Penetration of Low Carbon Gas and Low Carbon Transportation Scenario

- By 2050 - Net Zero Grid (100% by 2050); Low and high penetration of low carbon gas providing a net reduction in carbon emissions(15 to 35% by 2050); Near complete expansion of low carbon transportation for light duty sector (85%); Near complete expansion of low carbon transportation for light duty sector combined with net zero grid and low carbon gas high.

Scenario D- Net Zero Grid and Low Carbon Transport - Achieve a zero-carbon emission grid by 2050 combined with substantial penetration of zero emissions vehicles in the light duty fleet.

- By 2050 - Net Zero Grid (100% by 2050), matching Virginia's Clean Economy Act's mandate; Near complete expansion of low carbon transportation for light duty sector (85%); Near complete expansion of low carbon transportation for light duty sector combined with net zero grid.

Results

Scenario	County-Wide Emission Reduction by 2030 from 2018 Progress Year	County-Wide Emission Reduction by 2050 from 2018 Progress Year	County-Wide Emission Reduction by 2030 from 2005 Base Year	County-Wide Emission Reduction by 2050 from 2005 Base Year
Scenario A- A low-moderate reduction scenario for both energy and transportation	15%	24%	24%	32%
Scenario B- A more aggressive reduction scenario for both energy and transportation	21%	28%	30%	36%
Scenario C- A Net Zero Grid and Low Carbon Transportation Scenario	NA	55%	NA	60%
Scenario D- A Net Zero Grid, High Penetration of Low Carbon Gas, and Low Carbon Transportation Scenario	NA	60%	NA	64%

Notes: The COG regional goal is to reach 80% reduction by 2050 from a 2005 Base Year.
Reductions %s could be 4-6% less due to anticipated growth across all sectors.

What Will It Take to Go Beyond These Scenarios?

One additional scenario was run to assess what it would take to achieve an 80% reduction by 2050, in line with COG's regional 2050 goal.

Scenario E- Achieving an 80% reduction was met under the following scenario:

- Net zero grid.
- 50% of all gas therm usage for all residential and commercial sector uses is zero carbon/renewable gas.
- 75% of all on- and off-road vehicles and fuels are zero or low carbon.
- All HFCs are phased out and replaced with no global warming potential alternatives.

Options to investigate additional potential scenarios for achieving additional reductions beyond the 80% scenario could include:

- Faster penetration of renewable natural gas
- Faster reductions in emissions from vehicles and fuels for medium and heavy duty fleets, and off-road vehicles.
- Role of purchasing carbon offsets and RECs
- Electrification of heating and hot water systems

- Full electrification of light duty fleets
- Waste and sanitation system changes
- Government operations represents approximately 4-5% of the community wide inventory and presents an unique opportunity to lead by example.

Attachment: Overview of Past Studies of Emission Reduction Potential

COG used the following reference materials to develop foundational assumptions on what emissions reductions might be possible in Fairfax County:

MWCOG's Climate Action Plan and associated files can be found at: https://www.mwcog.org/documents/2017/03/23/regional-climate-and-energy-action-plan-climate--energy-climate-change-energy/

What Would it Take Scenario Study from MWCOG and associated files can be found at: https://www.mwcog.org/transportation/planning-areas/land-use-coordination/scenario-planning/WWIT/

Arlington's Community Energy Plan and associated files can be found at: https://environment.arlingtonva.us/energy/community-energy-plan-cep/

GHG Emissions Reduction Estimates			
	References		
Sector	**MSWG**	**WWIT**	**Arlington**
Energy	9% reduction in GHG emissions by 2020 from 2005 levels; 37% reductions by 2040; 43% reduction by 2050[a]		9% reduction in GHG emissions by 2020 from 2016, 41% reduction by 2030, 49% reduction by 2040, and 52% reduction by 2050.
Grid	EBE-5 Scenario: 1% annual reduction in fossil energy use from 2015, 35% cumulative by 2050 EBE-6 Scenario: 30% GHG emissions reduction from energy generation by 2030 from 2015		30% reduction in emissions from the grid mix from 2020 to 2030; 80% by 2050[g]
Renewables	From 2012: 20% increase in renewables by 2022 for MD; 20% increase by 2020 for DC		

GHG Emissions Reduction Estimates			
Building Energy Efficiency	EBE-1 Scenario: 2% annual reduction in energy consumption from 2015, 30% cumulative reduction by 2030		
Natural Gas	EBE-7 Scenario: 20% reduction in methane leaks from NG pipelines by 2030 from 2015		
Transportation	5.5% reduction in GHG emissions by 2020, 36% reduction by 2050 - under current policies. With increased efforts, a possible 10% reduction by 2020 from 2005 levels; 40% reductions by 2040; 47% reduction by 2050[f].	17.9% reduction by 2030 from 2010 levels[b]. Additional 3.9% reduction can be achieved through regional strategies[d].	Transportation Strategy would produce a 1.7% GHG emissions reduction by 2020 from 2016, 10% reduction by 2030, 22.5% reduction by 2040, and 34% reduction by 2050.
VMT	Potential reduction from 2.2% to 4.2% by 2020, 11.6% to 15.4% by 2040, and 14.1% to 27.6% by 2050.	Potential 6% reduction in VMT if gasoline price increases significantly.	
Alternative Fuel/ Electric Vehicles		From less than 4% in 2010 to 25% in 2030[c]. Would result in an additional 2.1% reduction in GHG emissions for the same period.	

GHG Emissions Reduction Estimates			
Non Road Engines	EBE-9 Scenario: 2% annual, 30% cumulative reduction in GHG emissions from non-road sources by 2030 from 2015		
NOTES:			
[a] Reduction estimates include 2016's current energy and built environment measures with reductions from additional regional and national policies. More aggressive measures could result in reductions from 13% by 2020, 62% by 2040, and 85% by 2050 (these estimates include aviation and HFC reductions).			
[b] Reduction estimates incorporate CAFE standards and committed Transportation Emissions Reductions Measures (TERMs). CAFE standards make up 17.3% of this figure. Based on achieving 35 mpg by 2020 as specified in the 2007 Energy Independence and Security Act (EISA). Increasing CAFE standards increases GHG reductions substantially - Federal role is crucial. TERMs are measures implemented throughout the region for the purposes of reducing criteria pollutants, which are now being studied for their CO2 reduction potential. Visualize 2045 states that emissions will decrease by 19% between 2018 and 2040, with a slight uptick between 2040 and 2045, as cleaner vehicles saturate the fleet.			
[c] The U.S. DOE national-level results from its 2009 Annual Energy Outlook show a significant increase in alternative fuel/hybrid vehicle technology from less than 4% in 2010 to 25% in 2030 when applied to the Washington region.			
[d] Depends on adoption of short-term strategies including increasing transit use, increasing bike/ped use, pricing (parking cash-out subsidies, parking impact fees, and payas-you-drive insurance), improving operation efficiency, and reducing travel. This is 3.9% reduction below BAU levels calculated in the WWIT report.			
[e] With an increase in gas prices, the result is 4.4% reduction below BAU levels from 2010-2030.			
[f] Reduction estimates include 2016's current transportation and land use measures with the addition of estimates from advanced technology and additional national actions. With even more aggressive actions, on road transportation emissions could decrease by 10% by 2020, 30% by 2030, 51% by 2040, and 69% by 2050.			
[g] This assumes RGGI contribution decreases grid intensity.			