# WHERE DO WE WANT TO BE?

## Climate Projections and Scenarios

Climate Planning Mitigation Work Session

November 20, 2019

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# Agenda

- BAU & Target Setting in the CAP Process
  - History of MWCOG Work

- BAU
  - Overview of the approach taken
  - Results

- Scenarios Actions
  - Renewable Energy Strategies
  - Deep Energy Retrofits
  - EV Deployment
  - Land Use and VMT
  - Other Multi-Sector Working Group

- Discussion

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# Business-as-Usual & 2030 Scenarios

- Goals:
  - Re-evaluate current trajectory

  - Take Stock of Existing Commitments and Actions

  - Determine what it would take to meet the interim goal of 40% below 2005 by 2030

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# Business-as-Usual

- What Happens if we do nothing

- Sometimes referred to as a "Baseline Scenario"

- Early Practice: Emissions at the same rate as population & employment increases.

- This effort is based on demographics, building information, and anticipated transportation improvements

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# The Climate Planning Process



2008 National Capital Climate Change Report
- 2005 Baseline Inventory
- Business As Usual to 2050
- Targets
  - 10% by 2012
  - 20% by 2020
  - 80% by 2050

2010 "What Would It Take" Report
- Analysis of Specific Transportation Actions

2015-16 Multi-Sector Working Group
- 2005 Baseline Inventory
- Updated Business As Usual to 2050
- Deep Analysis of Reduction Potential from Many Actions

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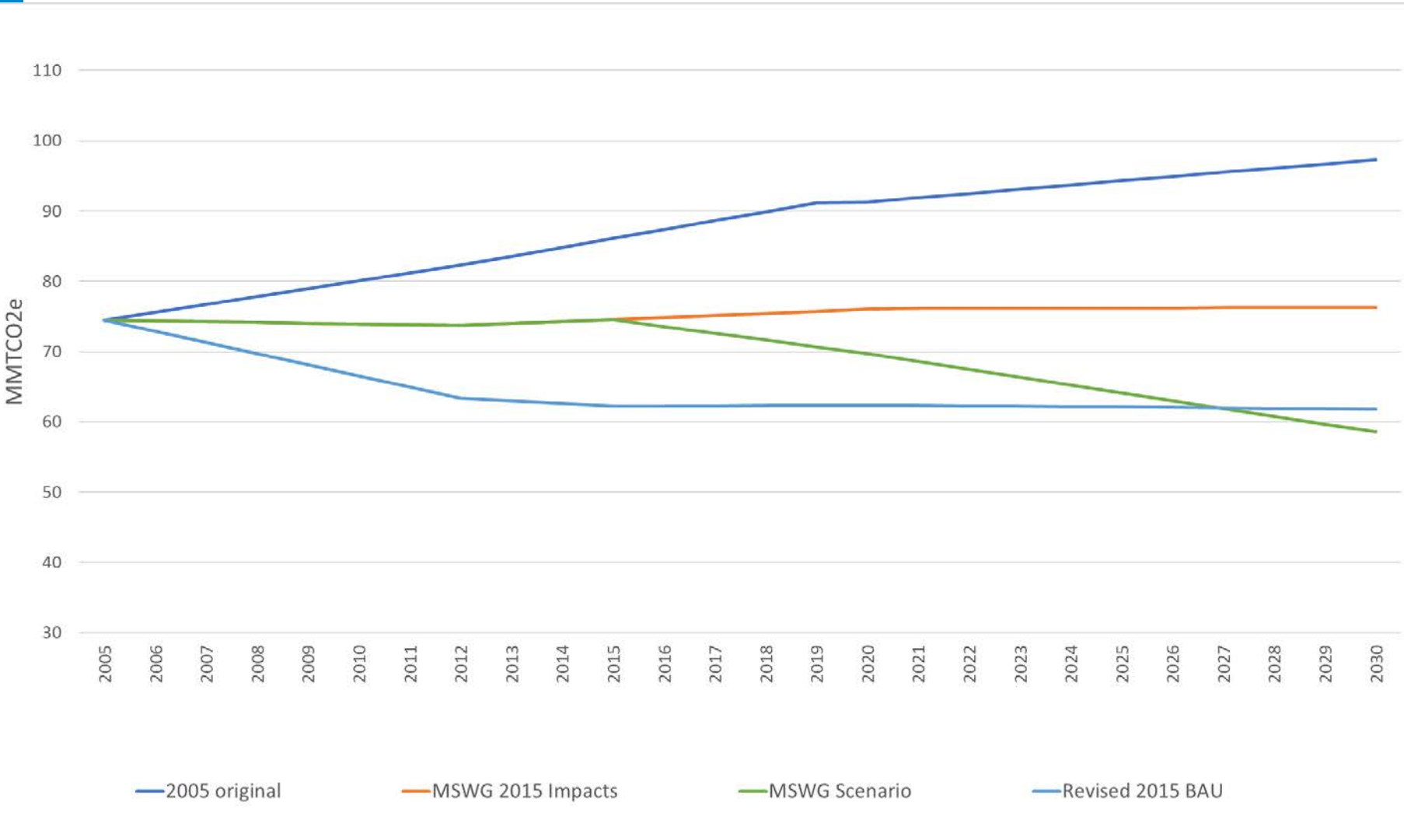**Council of Governments**

# Multi-Sector Work Group

- Identifying viable, implementable local, regional, and state actions in each of the four sectors (Energy, Transportation, Land Use, and the Built Environment).

- Quantifying benefits, costs, and implementation timeframes.

- Jointly developing an action plan for the region.

- Exploring specific greenhouse gas emission reduction goals, measures and/or targets, along with reductions in criteria pollutants as a co-benefit, for the four sectors.



Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region

Final Technical Report

ICF INTERNATIONAL

January 31, 2016

Metropolitan Washington Council of Governments

Submitted by:
ICF International

With support from
Renaissance Planning and Mondre Energy

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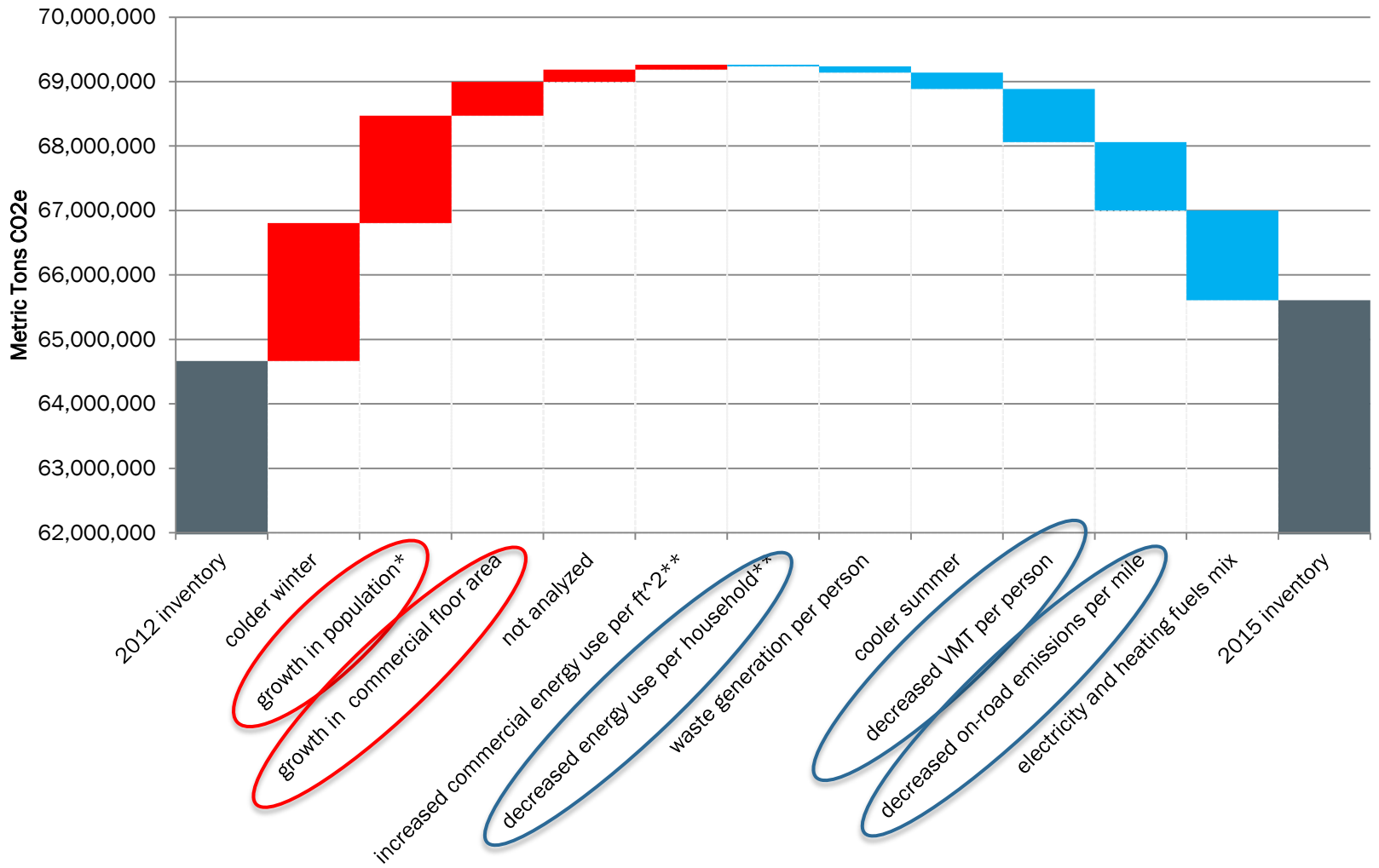**Council of Governments**

# Past Scenarios

# Business-as-Usual

- According to the Round 9.1 Cooperative Forecasts, between now and 2030, the region will add more than:

  - 858,000 people,
  - 610,000 jobs,
  - 362,000 households

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# Recent Trends

# 2015 BAU Inputs

- Residential Energy
  - Round 9.1 Household Growth by COG Member Jurisdiction
  - Applied to typical housing mix in each community (Single Family Attached, ... Detached, Apts 2-4 Units, Apts 5+ Units)
  - Typical Energy Use Intensity by Housing Type

- Commercial/Industrial Energy
  - Round 9.1 Employment Growth by Jurisdiction
  - Historic Job Growth & Commercial Construction -> SQFT New Construction / Job
  - New Building mix by Core, Inner, Outer areas from MWCOG Commercial Construction Report
  - Typical Energy Use Intensity by Building Type (Office, Retail, Flex/Other)

# 2015 BAU Inputs

- On-Road Transportation
  - Adopted Transportation Planning Board projections from Vision 2045

  - Transportation Demand Model 2.3.75
    - Uses Visualize 2045 Transportation Networks & 9.1 Cooperative Forecasts as inputs

  - EPA MOVES2014b
    - Incorporates incremental improvements in average fuel economy

  - Small amount of EVs introduced
    - NREL Electrification Futures Study Reference Case

# 2015 BAU Inputs

- Off-Road
  - Under the assumption that most of this category is construction related, not yard work, held constant

- Aviation
  - Passenger growth based on MWCOG Regional Air Passenger Origin/Destination Forecast Update.

- Rail
  - Percent Increase derived from Transportation Planning Board projections of future ridership

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# 2015 BAU Inputs

- Agriculture
  - All sources (soils, livestock, manure) decreased at annual rate of recent loss in farmland (2007-2012) from MWCOG "What our Region Grows 2017".

- Fugitive Natural Gas
  - Driven by increases in natural gas consumption

- Waste, Wastewater, HFCs,
  - Proportional increase with population

# 2015-2030 BAU Results
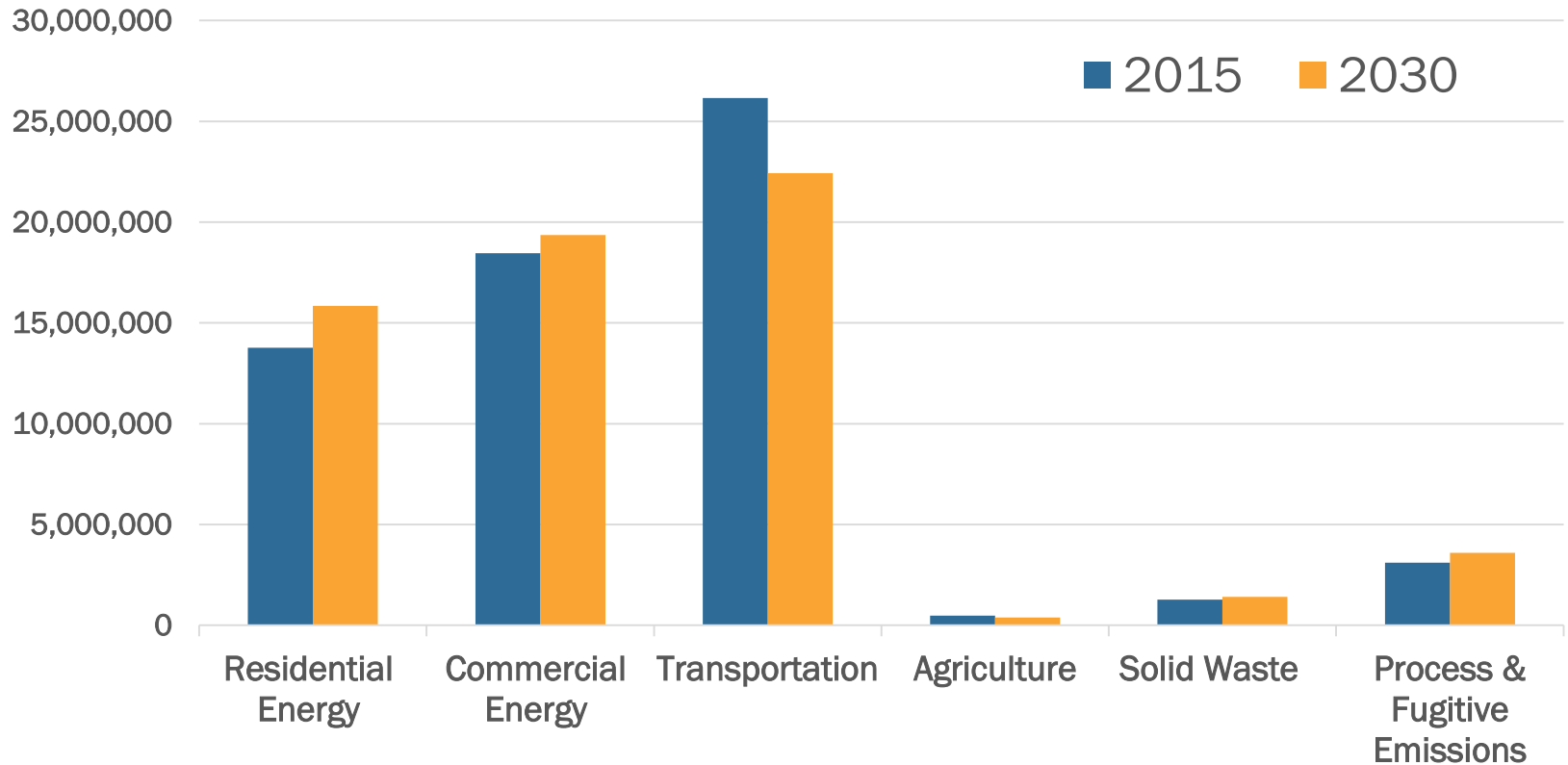
# Region-Wide BAU 2030 Results

## Questions on the BAU?

| | MTCO2e | % Change from '15 |
|---|---|---|
| Residential Electricity | 8,326,386 | 11.70% |
| Residential Natural Gas | 6,184,273 | 23.47% |
| Commercial Electricity | 14,984,982 | 5.49% |
| Commercial Natural Gas | 4,012,020 | 5.89% |
| On Road Mobile Emissions | 17,079,707 | -21.72% |
| Passenger Air Travel | 2,537,408 | 33.56% |
| Rail Transportation | 42,995 | 25.44% |
| Septic System Emissions | 37,732 | 0.25% |
| Sewer System Emissions | 13,027 | 0.02% |
| N2O Effluent Discharge Emissions | 5,892 | 0.02% |
| Enteric Fermentation | 167,463 | -19.06% |
| Manure Management | 48,856 | -19.06% |
| Ag Soils | 168,039 | -19.06% |
| Landfill Waste Generation | 736,294 | 6.00% |
| Combustion of Solid Waste | 671,541 | 15.93% |
| HFCs | 3,292,899 | 15.93% |
| Natural Gas Fugitive Emissions | 300,103 | 15.73% |
| Total | 61,782,047 | -0.81% |

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# Getting to 40% - Existing Targets
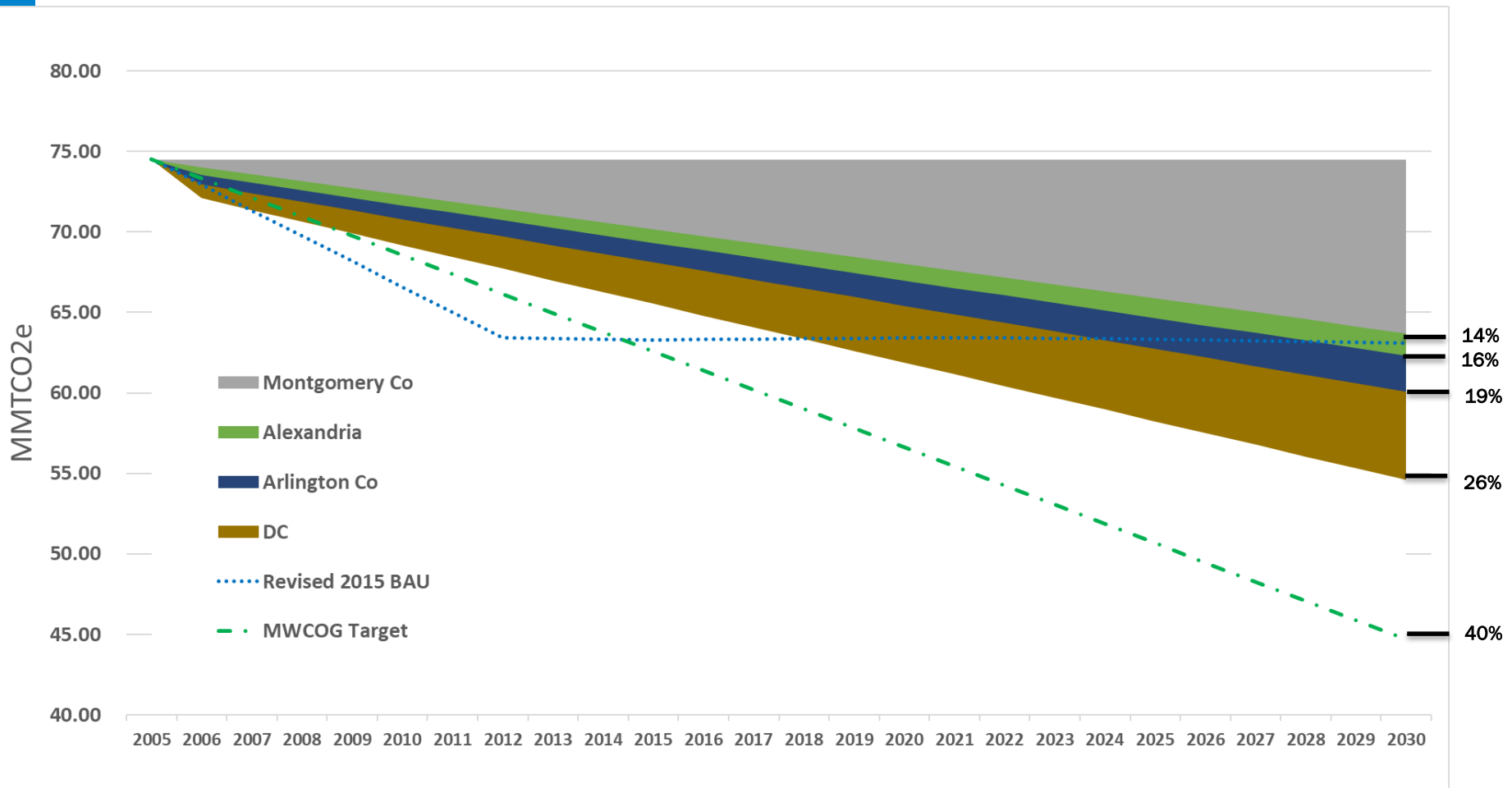
# Getting to 40% – 'Technical Potential
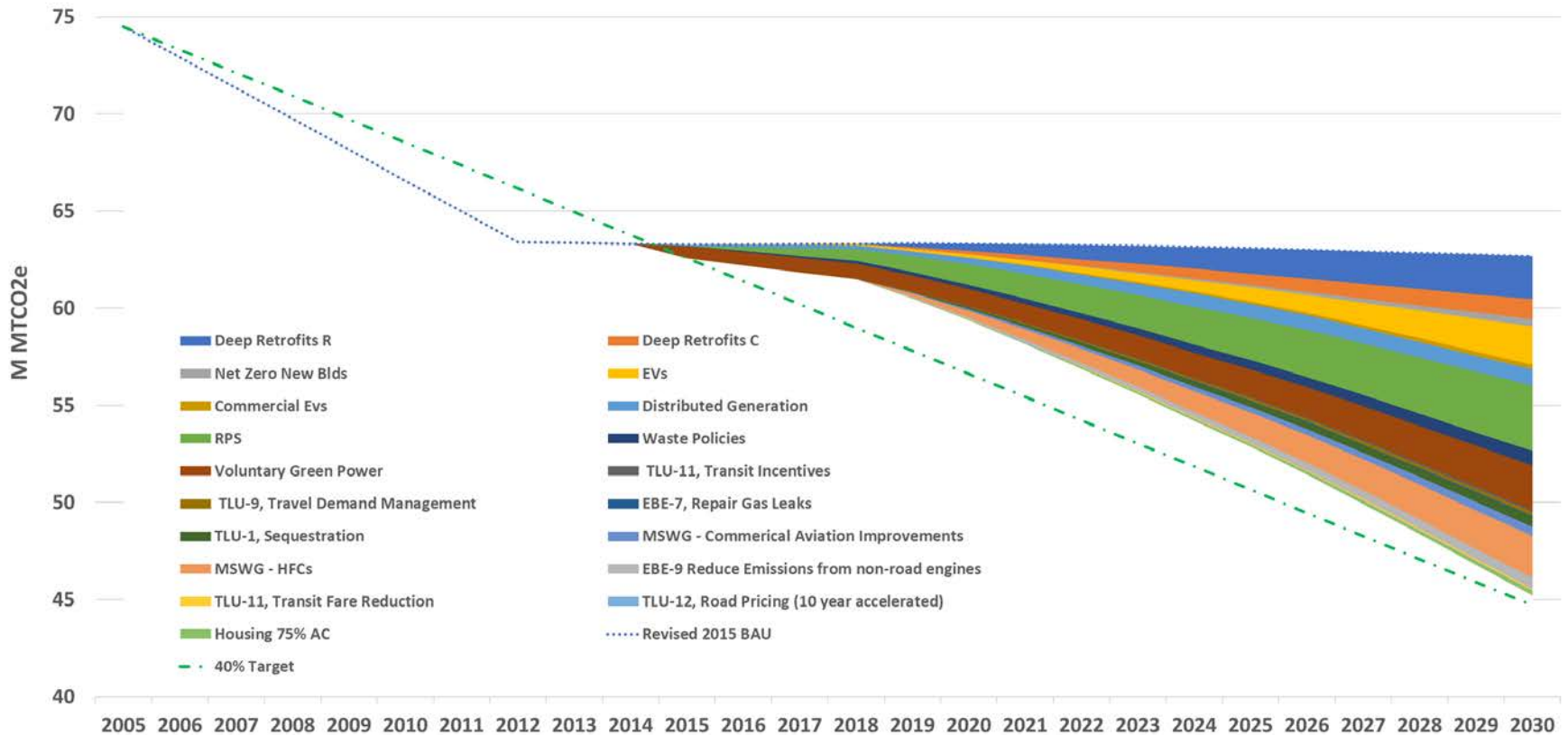
# Renewable Energy – 3 Mechanisms

- Distributed Generation
  - On-site Solar
  - Extrapolating from Recent Regional Growth

- RPS Policies
  - DC 100% x 2032
  - MD 50% x 2030
  - VA 30% x 2040

- Green Power Purchases
  - Commitments by businesses, institutions, individuals to purchase renewable energy
  - Extrapolating from Recent Regional Growth

# Distributed Generation – On Site Solar
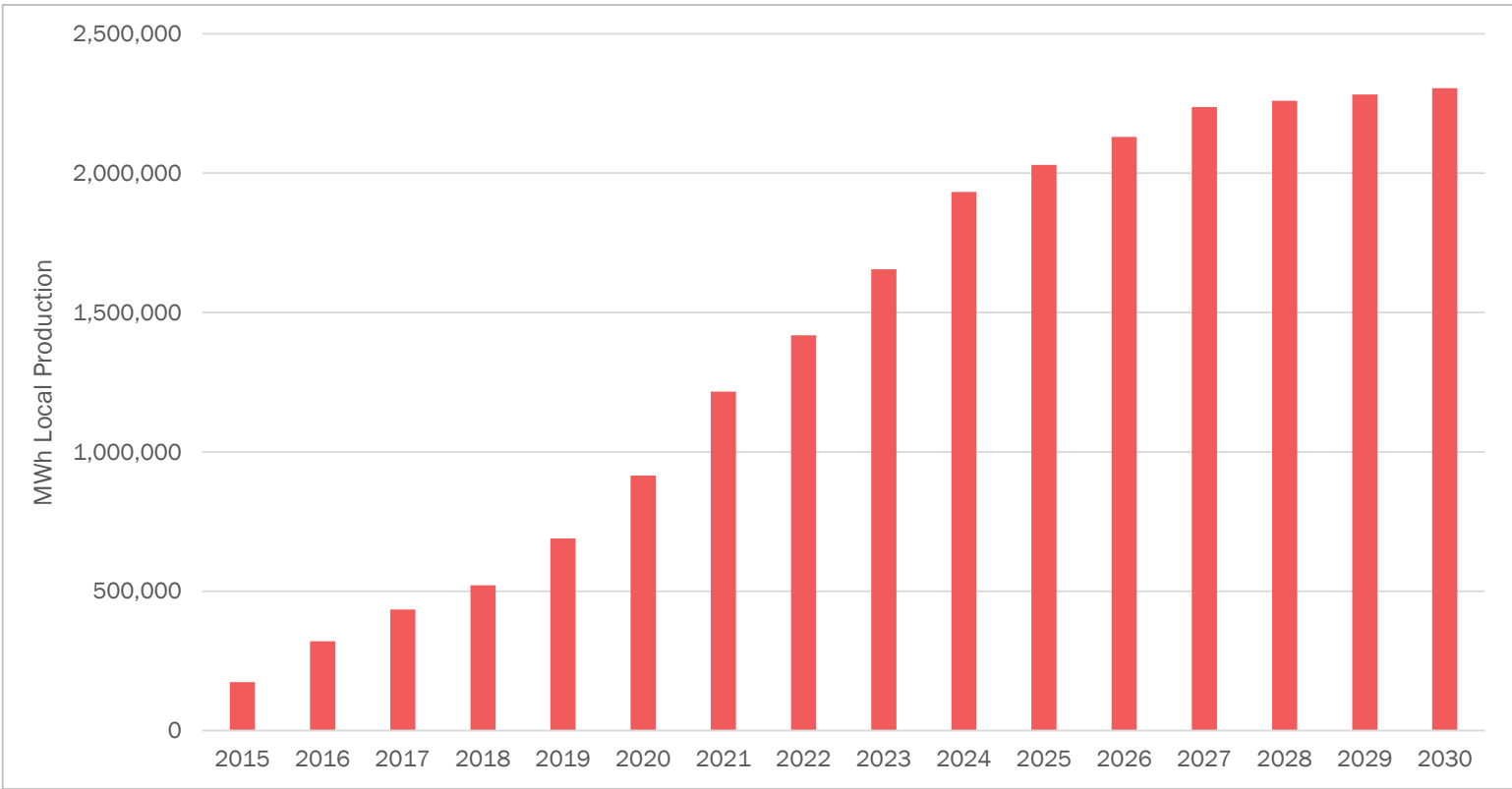
# Distributed Generation – On Site Solar

- By 2030 – 1,681,255 kW of distributed solar capacity

- At current system size that means 216,170 new additional systems

- Equivalent to 24% of all COG-Region single-family homes with solar

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# Emissions Accounting - Geographic

- Focuses on the sources and activities that physically occur within a defined jurisdiction boundary

- Vertical integration (summing up all local action globally)
  - What emissions are covered by engaged communities
  - How local actions might impact global trajectories

- Use of 'location-based' grid energy factors (eGRID)



https://www.globalcovenantofmayors.org/impact2018/
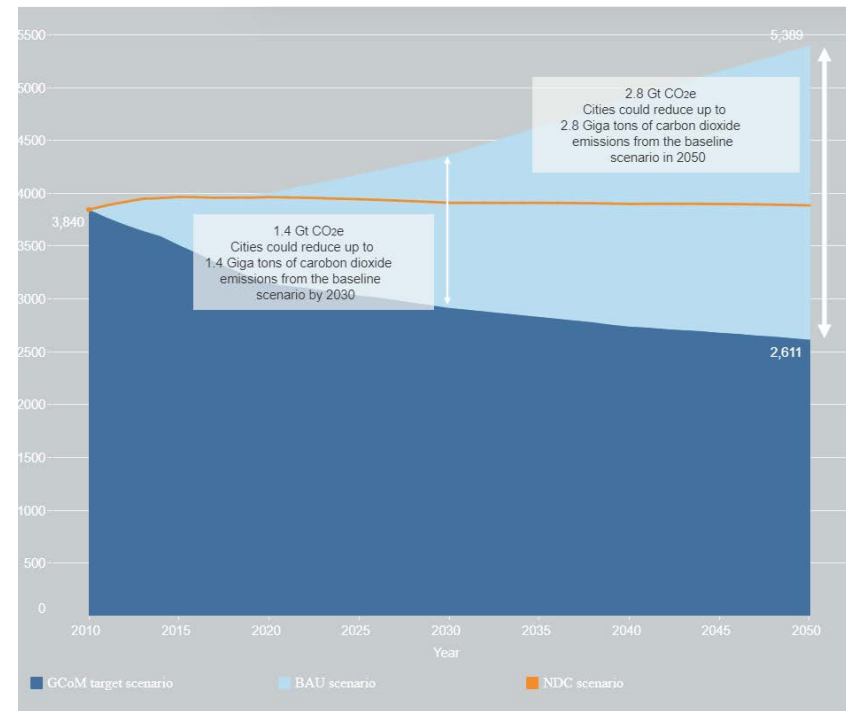
# Emissions Accounting – Market Based

- Jurisdictions, firms, and individuals can drive reductions elsewhere!

- There are legal underpinning supports the use of market-based instruments to make claims of environmental performance (100% RE, Carbon Neutral, etc.).
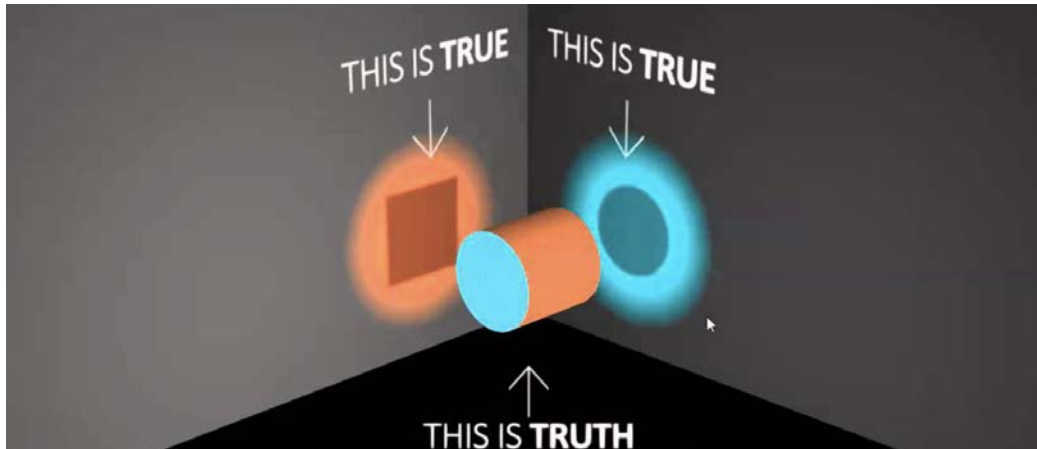
# Renewable Portfolio Standards

- Geographic Perspective & Physical Impact

  – Future inventories will be assessed on the actual future grid

  – Impact: It depends on other states and actions

  – Projections on future grid mix from EIA & LBNL are essentially constant for grid mix needed to meet RPS demands (Ohio demand drops off)

  – Current RPS policies 'hold the line'

- 2020 Updates to EIA and LBNL studies may show more impact

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# Renewable Portfolio Standards

- Market-Based Perspective – What can be claimed?

- How Much Clean Grid Energy would be consumed in 2030?

| | % Renewable Energy | Clean Energy Demand from COG Jurisdictions (Million MWh) | MTCO2e Reduced |
|---|---|---|---|
| DC | 87% | 2.7 | 833,000 |
| MD | 50% | 5.3 | 1,750,000 |
| VA | 18.9% | 2.1 | 792,000 |

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# Green Power Purchases

- Continued 10% Annual Growth
- Equivalent to ~16% of Total Commercial Electricity Use

| 2030 MWh of GPP | 2030 MTCO2e Reduced |
|---|---|
| 6,478,000 | 2,310,000 |
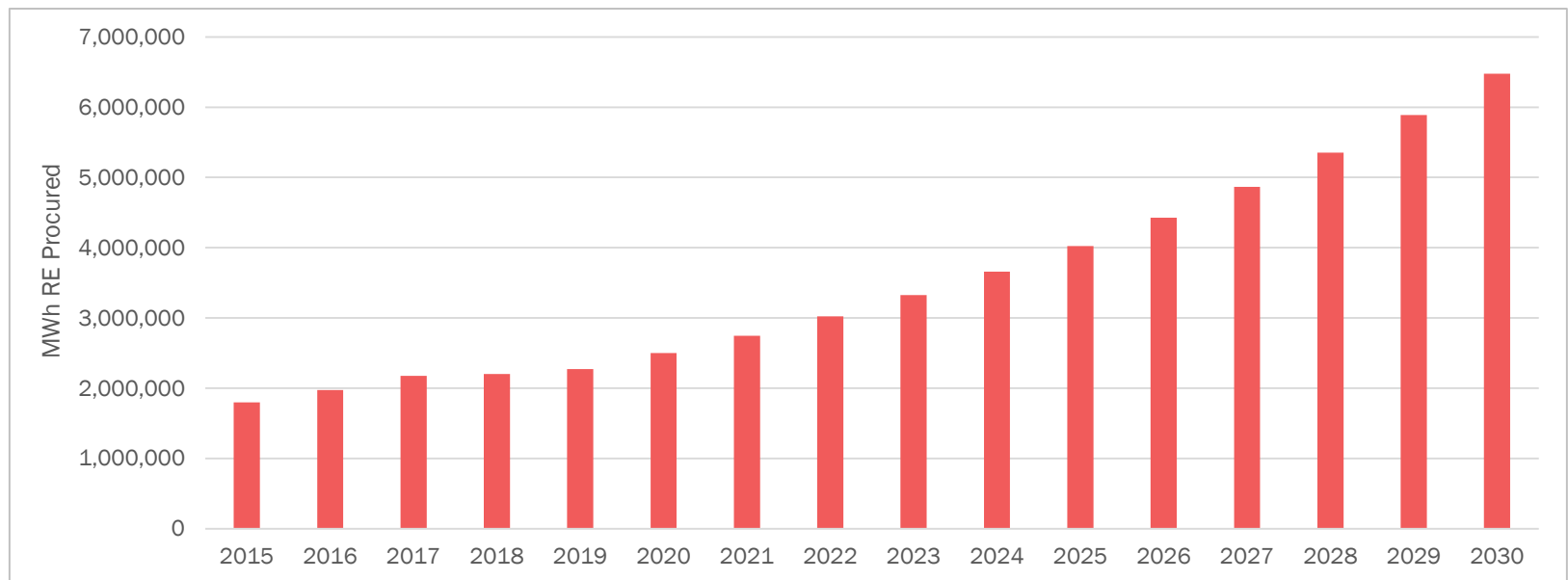
# What Does It Take? – Deep Retrofits

- Existing buildings are the biggest segment of the regional footprint.

- There are many small actions that can be applied to existing buildings:
  - Appliance Rebates, Energy 'Tune-ups', Energy Disclosure.
  - Bottom Up detailed modeling out of scope here.

- Big wins with Deep Retrofits that overhaul everything

| ENERGY USE | ENERGY REDUCTION (KBTU/SF/YR) | CAPITAL COST ($/SF) |
|---|---|---|
| PLUG LOAD | 6–15 | 0 |
| LIGHTING | 6–8 | 3–5 |
| VENTILATION | 4–5 | 2–5 |
| COOLING | 10–25 | 10–75 |
| HEATING | 3–10 | 10–75 |
| TOTAL | 30–50 | 25–150+ |

Source: Kok, Nils, Norm Miller, and Peter Morris, 2011: "The Economics of Renovation." Available at www.nilskok.com.

Guide to Building the Case for Deep Energy Retrofits. RMI. 2012
Available at RetroFitDepot.org

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# What Does It Take? – Deep Retrofits

- Starting Point:  Existing Energy Use

| Housing Type | Base kBtu/SQFT | kBtu/SQFT Saved |
|---|---|---|
| Single Family + Small Multifamily* | 53.7 | 32 |
| Multifamily | 81.6 | 50 |

- Building Area to work with

| Housing Type | Total COG-Region Square Feet |
|---|---|
| 1-unit, detached | 2,135,906,400 |
| 1-unit, attached | 699,356,800 |
| 2 units | 17,637,760 |
| 3 or 4 units | 44,293,760 |
| 5 to 9 units | 88,664,000 |
| 10 to 19 units | 188,567,100 |
| 20 or more units | 299,118,120 |

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# Deep Retrofits – Residential Scale

| | 0.5% per Year | | 1% Per Year | | 2% Per Year | |
|---|---|---|---|---|---|---|
| Housing Type | Number of Units | MWh Savings | Number of Units | MWh Savings | Number of Units | MWh Savings |
| 1-unit, detached | 4,450 | 540,840 | 8,900 | 1,081,680 | 17,799 | 2,163,360 |
| 1-unit, attached | 2,185 | 177,086 | 4,371 | 354,172 | 8,742 | 708,345 |
| 2 units | 98 | 4,466 | 197 | 8,932 | 394 | 17,864 |
| 3 or 4 units | 261 | 11,215 | 521 | 22,431 | 1,042 | 44,863 |
| 5 to 9 units | 522 | 35,734 | 1,043 | 71,468 | 2,086 | 142,937 |
| 10 to 19 units | 1,109 | 75,998 | 2,218 | 151,996 | 4,437 | 303,993 |
| 20 or more units | 1,760 | 120,553 | 3,519 | 241,107 | 7,038 | 482,215 |

Context: Harvard Joint Center on Housing estimates 449,000 Metro-Area Renovations in 2017. 17% involve building system upgrades (76,000)

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# Deep Retrofits – Commercial Scale

| Building Type | 0.5% per Year | | | 1% Per Year | | | 2% Per Year | | |
|---|---|---|---|---|---|---|---|---|---|
| | Buildings | SQFT | MWh Savings | Buildings | SQFT | MWh Savings | Buildings | SQFT | MWh Savings |
| Office | 79 | 2,536,630 | 307,383 | 158 | 5,073,260 | 614,767 | 316 | 10,146,519 | 1,229,535 |
| Retail | 13 | 404,781 | 48,964 | 25 | 809,563 | 97,929 | 50 | 1,619,125 | 195,859 |
| Other | 83 | 2,671,557 | 272,249 | 166 | 5,343,114 | 544,499 | 333 | 10,686,228 | 1,088,998 |

2018 Metro-Area New Commercial Construction: 10.4 Million SQFT

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# What Does It Take? – Deep Retrofits

- Is this realistic within your community?

- What are the Barriers?

- What are the Opportunities?

- How do we scale it Up?

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# Electric Vehicle Deployment

- **Results based on a Consumer Choice Model at the national scale:**
  - Vehicle Prices, charging infrastructure, and Range
  - Consumer Incomes, Preferences etc.
  - Maybe conservative for the region?



NREL

**Electrification Futures Study:**
Scenarios of Electric Technology Adoption and Power Consumption for the United States

Trieu Mai, Paige Jadun, Jeffrey Logan, Colin McMillan, Matteo Muratori, Daniel Steinberg, Laura Vimmerstedt, Ryan Jones, Benjamin Haley, and Brent Nelson
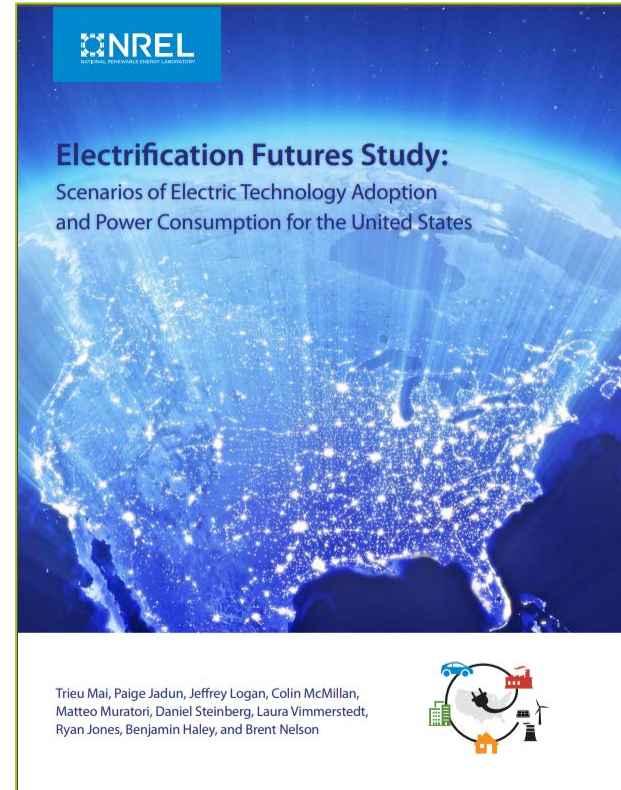
# Passenger Vehicles

| Vehicle Type | Scenario | % of Sales | % of Vehicle Type VMT | % of All VMT |
|---|---|---|---|---|
| Passenger Cars | Reference Case | 6.5 | 11 | 5 |
| | Medium Adoption | 24 | 31 | <u>15</u> |
| | High Adoption | 32 | 34 | 16 |
| Light Trucks | Reference Case | - | 1 | 0.6 |
| | Medium Adoption | - | 14 | <u>6</u> |
| | High Adoption | - | 16 | 7 |

# Electrifying Fleets

## By 2050

| Subsector | EFS Scenario | Share of VMT Electrified in Primary Operating Range | | | | | Total Share of VMT Electrified |
|-----------|--------------|-----------------------|----------------|-----------------|-----------------|-------------------|-----------------|
| | | Less than 50 miles | 51–100 miles | 101–200 miles | 201–500 miles | Over 500 miles | |
| MDVs | Medium | 40% | 20% | 10% | 0% | 0% | 29% |
| | High | 80% | 50% | 20% | 10% | 0% | 61% |
| HDVs | Medium | 30% | 15% | 5% | 0% | 0% | 10% |
| | High | 80% | 50% | 40% | 30% | 15% | 41% |

- Light Commercial Vehicles ~11% of 2030 On-Road BAU

- 1/3 of the way by 2030 ->
  - 236,000 MTCO2e (Medium Adoption)
  - 496,000 MTCO2e (High Adoption)

# Multi-Sector Work Group - TLU - 2

- Effect of Land Use Planning on Transportation Demand

- BAU has Vision 2045 Development Pattern "Baked–In"
  - ~30% of new housing in Activity Centers
  - Resulted in a -3% VMT/Capita

- Future of Housing Report – Target 75% of New Housing in Activity Centers or High Capacity Transit

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# Multi-Sector Work Group - TLU - 2

| Percent in AC/HCT | Households | VMT Reduced | MTCO2e Reduced |
|---|---|---|---|
| 40% | 24,160 | 191,423,513 | 67,603 |
| 50% | 48,320 | 382,847,026 | 135,206 |
| **60%** | **72,480** | **669,982,295** | **202,809** |
| 70% | 96,640 | 765,694,051 | 270,413 |
| 75% | 108,720 | 861,405,808 | 304,214 |

# Multi-Sector Work Group Actions

- External – No Local Action Needed
  - Commercial Air Traffic Carbon Reductions
  - National Phase out of HFCs

- Local Actions
  - Reduce Natural Gas System Leakage
  - Transportation Demand Management
  - Transit Fare Reductions
  - Sequestration within Trees and Working Lands
  - Roadway Pricing (Phase I DC Cordon Pricing)

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# What Isn't Counted

- Building Decarbonization/Electrification

- Regular Efficiency & Appliance Rebate Programs

- Micro-Mobility

- Density-Related Building Energy Impacts

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# Keep Counting What You're Doing!

- This analysis wouldn't have been possible without great MWCOG data
  - Solar Deployments
  - EV Registrations
  - Building Statistics

- The next iteration could be better with all your successes counted towards where the region is headed.

# Open Discussion

- 40% Reduction will be challenging to hit without coordinated action from all jurisdictions

- How do the items from the "Where Are We Going?" session add into this discussion?

- Next Steps: Help Refine the Projections

# Thanks!

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