



# Emerging Issues: Long-Term Investments and Infrastructure

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November 22, 2024

# Presentation Outline

- 1 Virginia's Investments for Long-Term Success
- 2 Planning for Future Investments – Infrastructure Resilience
- 3 Planning for Future Investments – Energy Supply

# Virginia's Investments in Infrastructure, Education, and Workforce Have Secured the "Top State for Business" Title from CNBC for 2024

- Virginia ranked the best state for education.
  - State support for higher education and K-12 education has increased in recent years.
- Investments in Virginia's workforce have improved the state's business standing by ensuring a ready and available workforce for new jobs that enter the state.
  - Nearly 42.0 percent of Virginia's population has a bachelor's degree or higher, making it the most educated southern state.
- Virginia's recent investments in infrastructure have paid off.
  - CNBC labeled Virginia as one of America's "most virtually accessible" states.
  - Broadband connectivity and availability of sites for businesses put the Commonwealth near the top of the list.
  - Virginia's transportation funding model, adopted in 2020, adjusts revenue streams and allows for innovative distribution of revenue, including dedicated regional funding sources.
  - Recent budgets provided significant general fund support for capital outlay, transportation, and other long-term infrastructure projects.
- Virginia has held its AAA bond rating since 1938 allowing issuance of bonds at the lowest interest rates.

Sources: CNBC, "Virginia is America's Top State for Business in 2024," July 11, 2024; Virginia Economic Development Partnership, accessed November 8, 2024.

# Infrastructure, Workforce, and Education Offer Virginia the Best Opportunities for Long-Term Success in Business Rankings

Category	Relevant Factors to CNBC Ranking	Ranking
<b>Infrastructure</b>	Sites, energy reliability, renewable energy	3 <sup>rd</sup>
<b>Workforce</b>	Educated workers, new talent, migration	9 <sup>th</sup>
Economy	Job growth, state fiscal condition	19 <sup>th</sup>
Quality of Life	Crime, healthcare access, environment	19 <sup>th</sup>
Cost of Doing Business	Tax burden, utility and wage costs	24 <sup>th</sup>
Technology and Innovation	Patents, AI models, new AI jobs	15 <sup>th</sup>
Business Friendliness	Trade and labor regulations	5 <sup>th</sup>
<b>Education</b>	K-12/higher education quality, community college	1 <sup>st</sup>
Access to Capital	Venture capital investment, state-backed capital	8 <sup>th</sup>
Cost of Living	Housing affordability, home insurance prices	19 <sup>th</sup>
Note: Categories are listed from most-heavily weighted (Infrastructure – 17%) to least-heavily weighted (Cost of Living – 2%).		

Source: CNBC, “America’s Top States for Business 2024”, July 11, 2024.

# Virginia's Investments in Education Have Contributed to the State's Success

Investment (GF \$ in millions)	2022-2024 Biennium	2024-2026 Biennium
<b>Public Education Investments</b>		
Teacher Salary Increases	\$782.2	\$546.6
At-Risk Add-On	145.3	371.3
Reading Specialists	62.5	61.2
Rebenchmarking	9.1	969.0
Other Investments	<u>2,743.3</u>	<u>155.8</u>
<b>Total</b>	<b>\$3,742.4</b>	<b>\$2,103.9</b>
<b>Higher Education Investments</b>		
Affordable Access: Operational Support	\$361.0	\$205.4
Undergraduate Need-Based Aid	212.5	37.0
Other Investments (e.g. technical adjustments including salary increases, and other initiatives)	<u>469.1</u>	<u>633.0</u>
<b>Total</b>	<b>\$1,042.6</b>	<b>\$875.4</b>

- Joint Subcommittee to Study Elementary and Secondary Education Funding met in 2024 to begin to address long-term funding needs for public education.

Sources: Chapter 2, 2022 Acts of Assembly, Special Session I; Chapter 1, 2023 Acts of Assembly, Special Session I; Chapter 2, 2024 Acts of Assembly, Special Session I.

# Workforce Investments in Targeted Sectors Put Virginia Ahead of Most Other States in Rankings

Investment (GF \$ in millions)	2022-2024 Biennium	2024-2026 Biennium
Statewide Healthcare Workforce Programs	\$14.7	\$42.8
Innovative Internship Fund	13.0	2.5
Workforce Credential Grant Program	5.0	9.3
Community College Workforce Initiatives	8.4	0.0
Department of Workforce Development and Advancement	0.0	5.5
Other Investments	<u>23.2</u>	<u>0.0</u>
<b>Total</b>	<b>\$64.3</b>	<b>\$60.1</b>

- The Department of Workforce Development and Advancement, created during the 2023 Session, consolidated apprenticeship and workforce development programs from the Virginia Community College System, Department of Labor and Industry, and Virginia Employment Commission.
  - The Department also received an appropriation of \$256.6 million NGF over the 2024-2026 biennium and 459.0 positions.

Sources: Chapter 2, 2022 Acts of Assembly, Special Session I; Chapter 1, 2023 Acts of Assembly, Special Session I; Chapter 2, 2024 Acts of Assembly, Special Session I.

# Budget Also Prioritizes Investments in Long-Term Infrastructure

Investment (GF \$ in millions)	2022-2024 Biennium	2024-2026 Biennium
Capital Improvements and Renovation Projects (includes tax-supported debt, excludes planning & equipment)	\$1,808.9	\$1,244.4
Capital Maintenance Reserve	373.3	464.0
Wastewater (Water Quality Improvement Fund), Stormwater, and Combined Sewer Overflow*	158.0	450.0**
Community Flood Preparedness Fund and Resilient Virginia Revolving Loan Fund	100.0	100.0
I-64 and I-81 Improvements	260.0	245.0**
Norfolk Coastal Storm Management Project	0.0	25.0
Dam Safety Programs	55.5	5.0
Stormwater Local Assistance Fund	<u>55.0</u>	<u>0.0</u>
<b>Total</b>	<b>\$2,810.7</b>	<b>\$2,533.4</b>

\* In addition to GF, NGF support provided through American Rescue Plan Act funds. \*\*Balance reserve amounts require appropriation by the 2025 General Assembly.  
Sources: Chapter 2, 2022 Acts of Assembly, Special Session I; Chapter 786, 2023 Acts of Assembly; Chapter 1, 2023 Acts of Assembly, Special Session I; Chapters 1 and 2, 2024 Acts of Assembly, Special Session I.

# Meet the Panelists

**Mollie Mills**



Officer –  
State Fiscal  
Policy Project,  
Pew Charitable  
Trusts

**Bill Murray**



Senior Vice  
President –  
Corporate Affairs &  
Communications,  
Dominion Energy

**Katharine Bond**



Managing Partner &  
Founder –  
iliox Advisors



# Planning for Future Investments - Infrastructure Resilience

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# Planning for Future Risks and Building Resilience into Transportation and Water Infrastructure Asset Management

Senate Finance and Appropriations Committee Annual Meeting  
November 22<sup>nd</sup>, 2024

Mollie Mills, Officer  
State Fiscal Policy Project, The Pew Charitable Trusts

Pew

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## The Pew Charitable Trusts

- Nonpartisan, not-for-profit philanthropic organization with more than 40 active, evidence-based research projects on public policy issues.
- Projects include a variety of state and local economic policy and government performance initiatives ranging from public safety, state tax incentives, rainy day funds, state-sponsored private retirement security initiatives, and state pension plans for the public sector workforce.
- All follow a common approach: data-driven, inclusive, and transparent.

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## State Fiscal Policy Project: Long-Term Liabilities

- Since 2007, Pew has examined the bill coming due for states from public employee pension and retiree health benefits.
- While our work began with a fiscal lens, our research has covered plan design, retirement security, governance, investment practices, and tools to measure and manage risk.
- We've expanded our work to include a broader set of long-term liabilities that can have major impacts on state fiscal sustainability.
- Our recent research examines the bill coming due for deferred maintenance in investments needed to preserve and rehabilitate state infrastructure.

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## Overview

- Short- and Long-Term Extreme Weather Risks to US State Transportation and Water System Assets
- Short- and Long-Term Extreme Weather Risks to Virginia's Transportation and Water Infrastructure
- Examples of Planning from Other States

# Short- and Long-Term Weather Risks to State Transportation and Water System Assets

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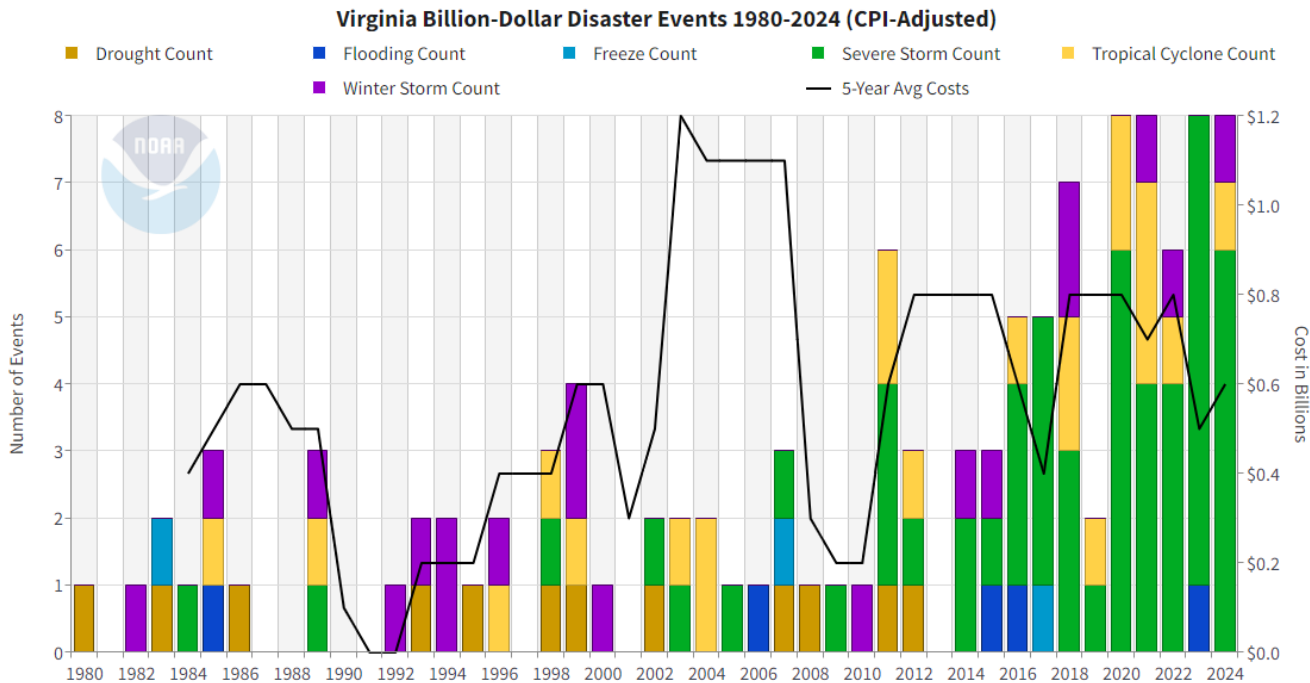
## Short- and Long-Term Weather Risks to Infrastructure

Aging infrastructure systems across the country are more vulnerable to risks.

- In 2021, 43% of U.S. roads were in poor condition, contributing to a \$435 billion maintenance and repair backlog ([ASCE, 2021](#)). Additionally, short- and long-term weather-related damages to paved roads could add up to \$20 billion annually by the end of the century.
- Recent EPA surveys of state and local governments concluded that they will need to spend roughly \$1.2 trillion over the next 20 years to maintain and improve the nation's drinking and wastewater infrastructure, with another \$448 to \$944 billion needed through 2050 to adapt these systems to a changing environment.
- States will need to address the combined effects of deferred maintenance and environmental changes, as more frequent and intense extreme weather will increasingly disrupt and damage their transportation infrastructure.

# Rising Frequency and Costs of Extreme Weather Events in Virginia

Share of billion-dollar weather event damage, by disaster type and costs, 1980-2024\*



\*This graph does not include damages done by Hurricane Helene in October 2024.

Source: National Integrated Drought Information System, *Billion-Dollar Weather and Climate Disasters*, as of September 2024.



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# Impacts on State Capital Spending

## Measuring Economic Consequences

- **Physical risks:** Damage to people, assets, or income from severe weather and disasters.
- **Transition risks:** Costs or declines in revenue from climate policies or new technologies.

## Implications for States' Budgets

- **Acute physical risks:** Higher costs for emergency repairs and service disruptions from severe weather events and natural disasters.
- **Chronic physical risks:** More frequent maintenance, repair, and system redesigns needed to handle ongoing climate stressors.
- **Transition risks:** Added costs or revenue losses due to climate policies or new technologies, e.g., taxes on GHG emissions or reduced gas tax revenues due to electric vehicles.

# Impacts on State Capital Spending: Examples

## Physical risks

- Hurricane Ian severely damaged the Lee County, Florida water system, creating water pressure and supply issues for nearly 760,000 residents and costing the county an estimated **\$56 million** for repairs, nearly 20% of the hurricane's total cost in the county.
- In North Carolina, Hurricane Helene damaged an estimated 5,000 miles of state-maintained roads and 674 bridges. The total transportation cost is estimated to be nearly **\$10 billion**, with **\$6 billion** attributed to the NCDOT highway and bridge system.
- The 2021 Marshall Fire in Colorado affected six drinking water systems, disrupting the power supply and destroying and depressurizing some physical infrastructure. The three largest affected water systems incurred an estimated **\$6 million** in expenses, not including revenue loss.

## Impacts on State Capital Spending: Examples

### Transition risks

- The proliferation of electric vehicles—which could account for up to 50% of total U.S. car sales by 2030—will require state governments to replace motor vehicle fuel tax collections, which currently make up nearly 40% of states' transportation revenue.
- Shifts toward electric vehicles will incur added costs for infrastructure adaptation and upgrades, such as expanding the charging network.
- Cities and water systems that fail to maintain and upgrade their infrastructure face the threat of lower credit ratings, which affects their ability to borrow and increases utility rates for customers.

# Short- and Long-Term Weather Risks to Virginia's Transportation and Water Infrastructure

## Assessing Risks: Virginia

- The Commonwealth's Hazard Mitigation Plan places floods, hurricanes, and winter weather in the highest threat level.
- VDOT is focusing on **sea-level rise, inland riverine flooding, storm surge, and geohazards** because of their impacts to transportation infrastructure.
- Sea levels are rising at above average rates in Virginia due, in part, to land subsidence from natural and man-made factors. Sea levels in Norfolk, VA could rise 4.6 feet from 2020 levels by 2080.

*2023 Commonwealth of Virginia Hazard Mitigation Plan Overall Hazard Ranking*

Threat Level	Hazard
High	Flood, Hurricane, Winter Weather
Medium – High	Extreme Heat, Non-Tornadic Wind, Tornado
Medium	Drought, Extreme Cold
Medium – Low	Earthquake, Pandemic, Wildfire
Low	Erosion, Impoundment Failure, Karst (Sinkholes), Landslide
Negligible	Land Subsidence, Space Weather

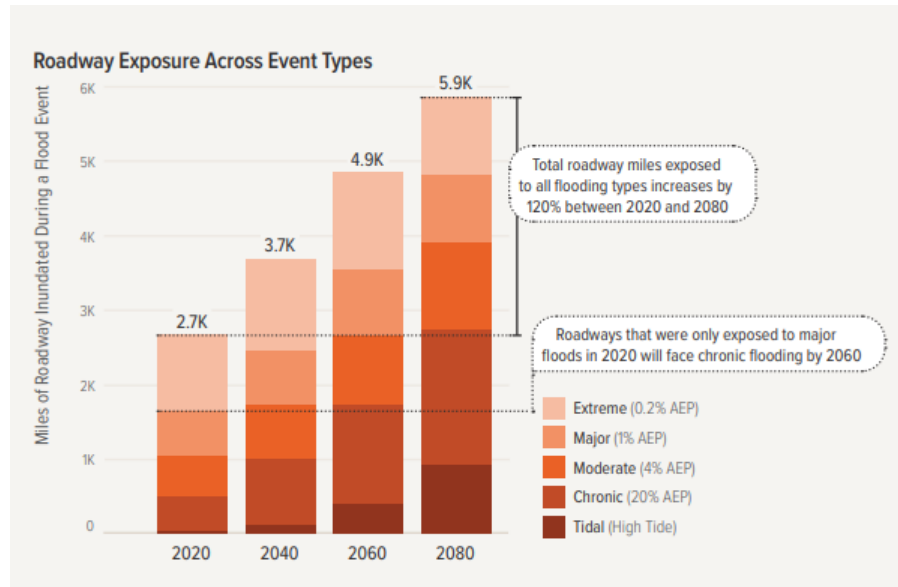
# Environmental Risks for Transportation and Water Systems

Environmental Conditions	Weather Hazard	Impact on Roads and Bridges	Impacts on Water Utilities and Resources
Rising temperatures	Heat waves and extreme temperatures	<ul style="list-style-type: none"> <li>• Rutting, cracking, premature pavement softening or expanding, potholes, road crumbling</li> <li>• Stress on bridge joints</li> <li>• Limited construction activities/capacity because of worker safety concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Increased evaporation, depletion of water flows and aquifer reserves</li> <li>• Delays and disruptions in water availability</li> </ul>
Changing precipitation patterns	Heavy precipitation and flooding	<ul style="list-style-type: none"> <li>• Rutting of paved roads and erosion of unpaved roads</li> <li>• Traffic disruptions</li> <li>• Washouts of roads and bridges</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to water supply chain and treatment facilities</li> <li>• Damage to sewer systems and wastewater treatment facilities</li> </ul>
	Droughts	<ul style="list-style-type: none"> <li>• Surface cracking and deterioration</li> <li>• Subsidence and sinkholes</li> <li>• Erosion and structural instability</li> </ul>	<ul style="list-style-type: none"> <li>• Impacts on utility operations</li> <li>• Poor water quality</li> <li>• Decreasing water supply</li> </ul>
Sea-level rise	Coastal flooding and higher tides	<ul style="list-style-type: none"> <li>• Shortening of life cycle of roads and bridges</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sewer systems and wastewater treatment facilities</li> <li>• Reduced drinking water supply and salinization of freshwater systems</li> </ul>
More frequent and intense storms	Higher tides, storm surges, and flooding	<ul style="list-style-type: none"> <li>• Damage to roadways and bridges</li> <li>• Shortening of life cycle and fidelity of roads and bridges</li> <li>• Bridge washouts</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sewer systems and wastewater treatment facilities</li> <li>• Reduced drinking water supply and salinization of freshwater systems</li> </ul>

Sources: James E. Neumann et al., Climate Change Risks to U.S. Infrastructure: Impacts on Roads, Bridges, Coastal Development, and Urban Drainage, Jan. 23, 2014; Allison R. Crimmins et al., Fifth National Climate Assessment, 2023; Steve Muench et al., Pavement Resilience: State of the Practice, 2023; Transportation Research Board, The Potential Impacts of Climate Change on U.S. Transportation, 2008

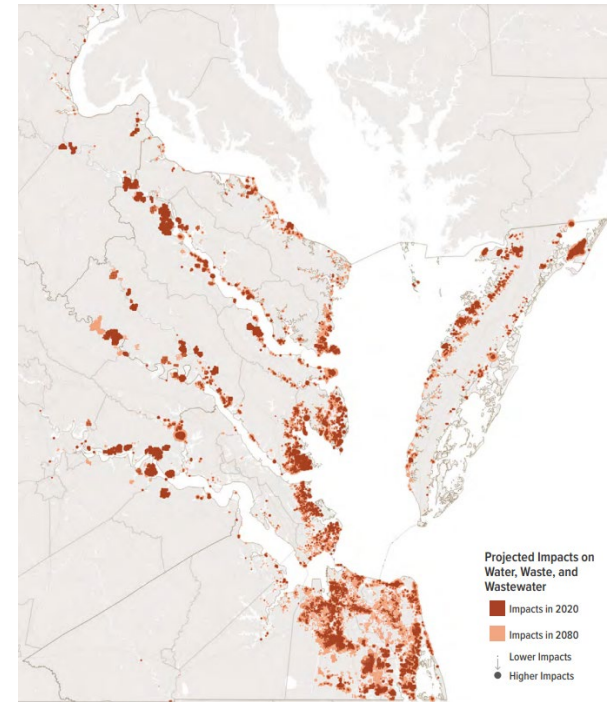
# Impacts to Virginia's Transportation Infrastructure

- In a major coastal flood today, around 1,650 miles of roadways would be flooded; by 2080, an additional 3,200 miles could be affected.
- By 2080, nearly 1,000 miles of roadway may be covered with water and unusable from high tides or sea-level rise.
- By 2080, the number of airports, freight, port and shipping facilities, and railways affected by coastal flooding will increase from 1,600 to almost 2,500.
- Flooding of transportation infrastructure may cause damage and service disruptions that affect business, among other concerns.



# Impacts to Virginia's Water Infrastructure

- The number of wastewater assets affected by major coastal flooding is expected to grow from 3,600 in 2020 to 8,400 in 2080 and the number of drinking water wells affected is expected to grow from 4,000 to over 13,000.
- As sea levels rise, saltwater can contaminate freshwater aquifers, resulting in unsustainable water supplies, damaged pipes, and higher treatment costs. This may be especially prominent on the Eastern Shore, where all drinking water comes from the Yorktown-Eastover aquifer.
- Urban flooding occurs when stormwater infrastructure is overwhelmed during extreme weather events or increased precipitation. Fairfax County flags this as an increasing risk in their Resilience Plan, citing insufficient and aging stormwater infrastructure and changing climate conditions.





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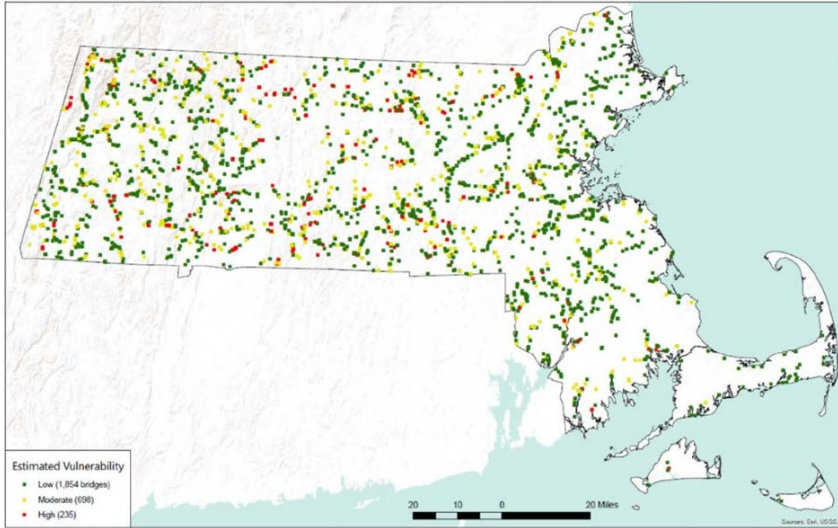
## Impacts to Virginia Infrastructure: Hurricane Helene

- In Southwest Virginia, damage to roads and bridges will impact the area's manufacturing, transportation, and utilities industries, which make up nearly half of region's workforce and account for 10% of manufacturing employers in Virginia.
- The Federal Highway Administration announced \$10 million in emergency funding to VDOT for repairs to roads and bridges that were damaged in Hurricane Helene, especially the washed-out section of Route 58 in Southwest Virginia, but the total cost of the damages is still unknown.
- Some residents in Southwest Virginia lost access to clean drinking water due to flooding. Many communities were under boil advisories.

# Examples of Planning from Other States

# Assessing Risks and Developing a Payment Strategy: Massachusetts

Exhibit 5.1 Vulnerable Bridges over Massachusetts Rivers and Streams, Physical Design and Flow Characteristics

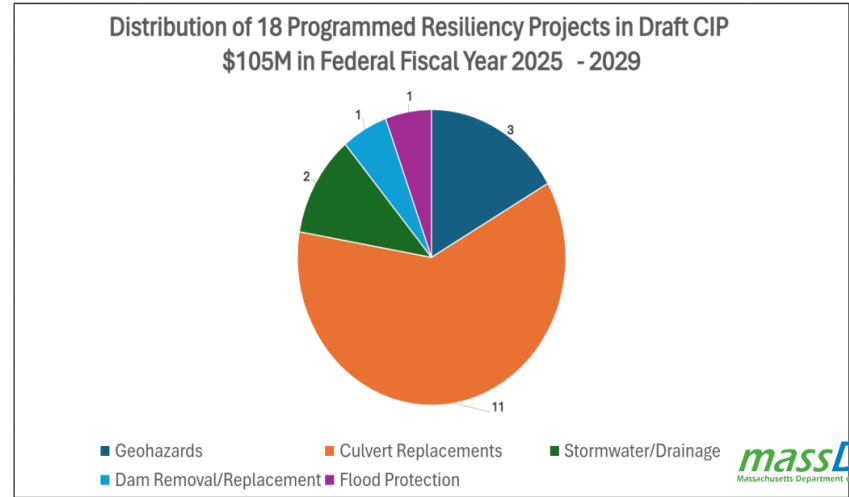


This information will be used to drive inspection and replacement efforts going forward.

## Highway Resiliency Capital Investment Program

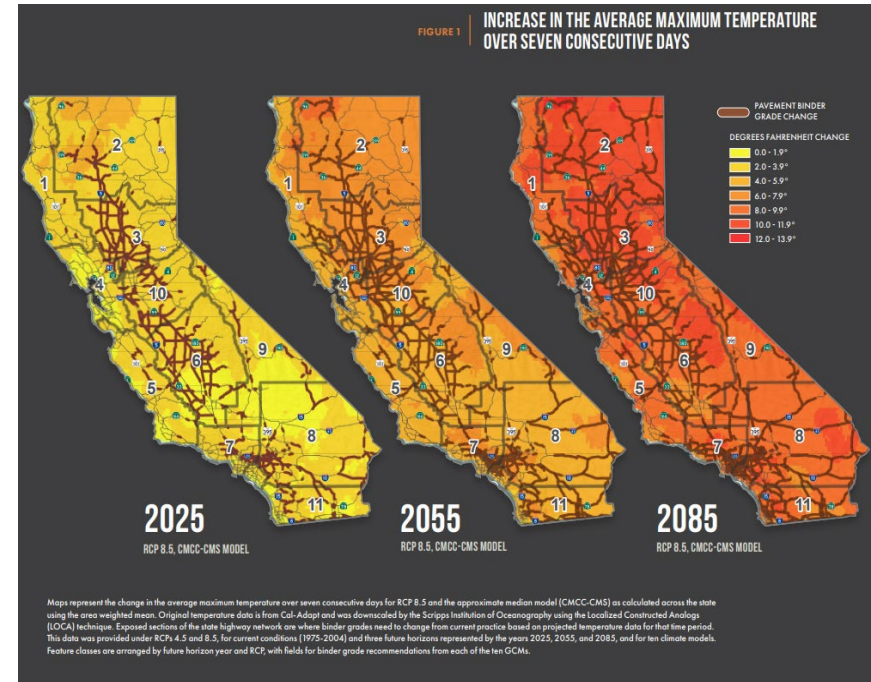
Federal aid funded with PROTECT formula

8



# Assessing Risks and Developing a Payment Strategy: California

- In 2018, Caltrans began conducting vulnerability assessments across its 12 transportation districts to identify key climate risks in each area.
- By 2021, results were used to establish district-specific adaptation priorities.
- In response, The California Transportation Commission created the *Local Transportation Climate Adaptation Program (LTCAP)* to provide grants to address these local adaptation and resilience needs.
- As of 2023, LTCAP has awarded **\$309.2 million** to 15 resilience-focused projects across the state.



**For more information:**

<https://www.pewtrusts.org/en/projects/state-fiscal-policy>

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**Pew**

# Planning for Future Investments - Energy Supply

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**Katharine Bond**  
Managing Partner &  
Founder –  
iliox Advisors

# Achieving Reliable Electricity

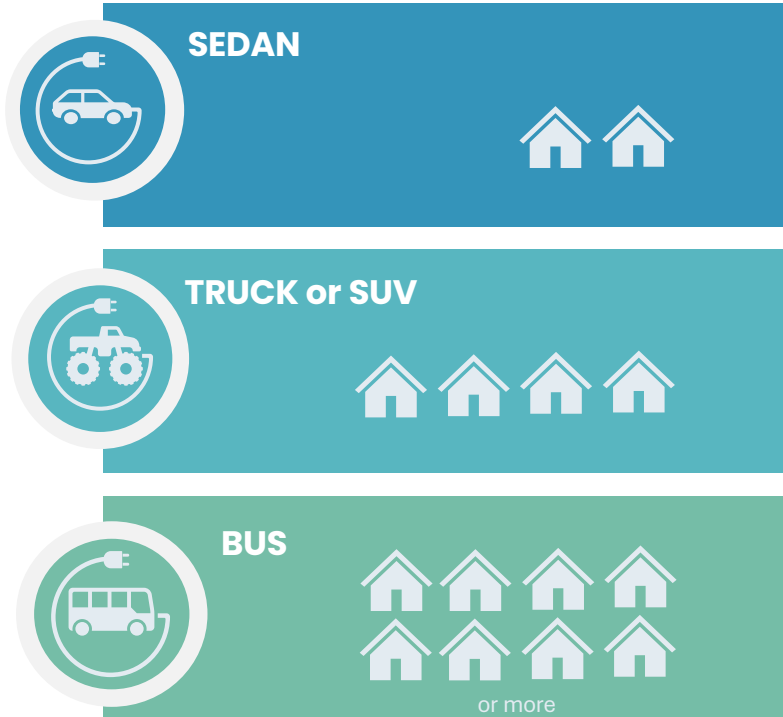
**Supply = Demand**

Equilibrium



# Transportation Electrification

Approx. # homes electricity equivalent to fully charge



## Level 3

Fully charges in 30-45 minutes

### 1 vehicle

Instantaneous electricity demand is similar to a small commercial building or school

800+ Publicly-available in Virginia

Source: U.S. Department of Energy – Alternative Fuels Center

# Our Growing Reliance On Technology ...



## VIRTUAL MEETINGS

1+ billion virtual meetings annually

>95% of households use streaming services

1.1 billion gamers



## CONNECTED DEVICES

Average devices per home:

2023 → 21

2019 → 11



## PICTURES & VIDEO

Average per person:

20 photos per day

1.5 billion weekly



## ARTIFICIAL INTELLIGENCE (AI)

Smart phone assists

- Spam filters
- Predictive text
- Facial recognition
- Social media content
- E-commerce
- GPS
- Fraud detection
- Health and fitness devices

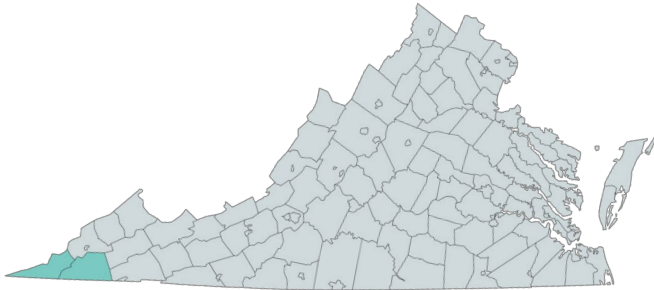
# ... Increases Data Center Electricity Needs

Putting into perspective the energy needed by one data center

## Earlier Data Center

Roughly equivalent to less than 20,000 homes

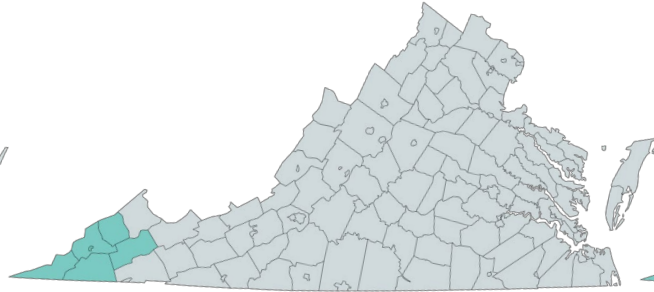
(e.g. all homes in Lee and Scott Counties)



## Data Center 2.0

Roughly equivalent to 50,000 homes

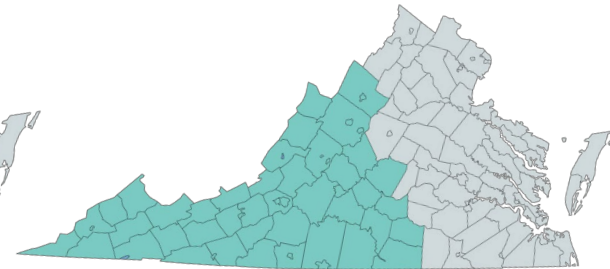
(e.g. all homes in City or Norton plus Lee, Scott, Wise, Dickenson, and Russell Counties)



## Hyperscale Data Centers

Some are roughly equivalent to 1 million homes

(e.g. all homes in areas shaded)



# Common Generation Resources

1 megawatt (MW) operating at full capacity generates 1 megawatt-hour (MWh) of electricity.

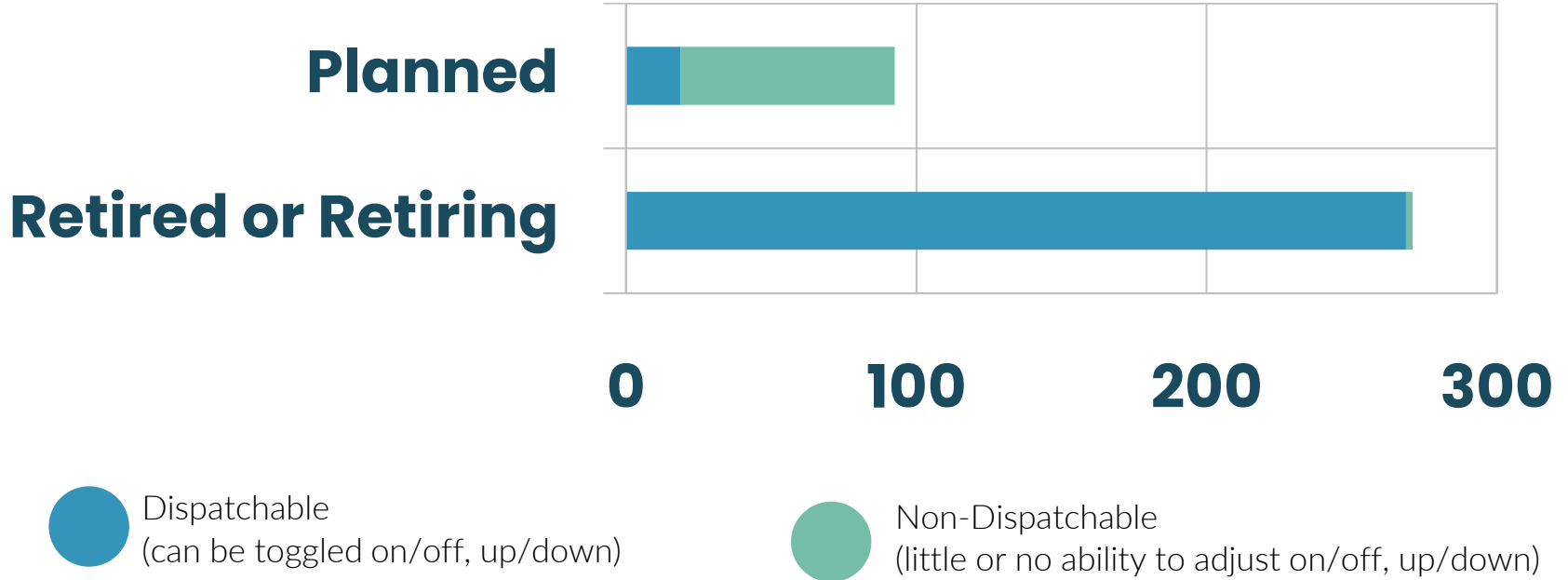
	Carbon Emissions	Dispatchable <small>(can be toggled on/off, up/down)</small>	Average Electricity Generated per 1 Megawatt of Capacity Installed*	
			Winter Month	Mild Month
Coal	<b>2,300</b> lbs./MWh	<b>Yes</b>	<b>321</b> MWh	<b>220</b> MWh
Natural Gas	<b>970</b> lbs./MWh	<b>Yes</b>	<b>413</b> MWh	<b>345</b> MWh
Nuclear	<b>0</b> lbs./MWh	<b>Yes</b>	<b>725</b> MWh	<b>599</b> MWh
Solar	<b>0</b> lbs./MWh	<b>No</b> <small>(unless coupled with storage)</small>	<b>102</b> MWh	<b>193</b> MWh
Wind	<b>0</b> lbs./MWh	<b>No</b> <small>(unless coupled with storage)</small>	<b>261</b> MWh	<b>297</b> MWh

Source: U.S. Energy Information Administration, U.S. Environmental Protection Agency; EIA combines on-shore and off-shore wind into one metric.

\* Estimated based on capacity factor nationwide as determined by U.S. Energy Information Association

# Generation Retirements

Not being replaced 1:1





## **Bill Murray**

Senior  
Vice President –  
Corporate Affairs &  
Communications,  
Dominion Energy

Committed to serving the people of the Commonwealth by safely providing **reliable, affordable, and increasingly clean energy.**



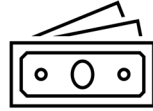
2.7M

Electric customers  
(homes and  
businesses)



19,000+

Employees & contractors



14%

Below the national  
average residential rate



67,000

Miles of power lines



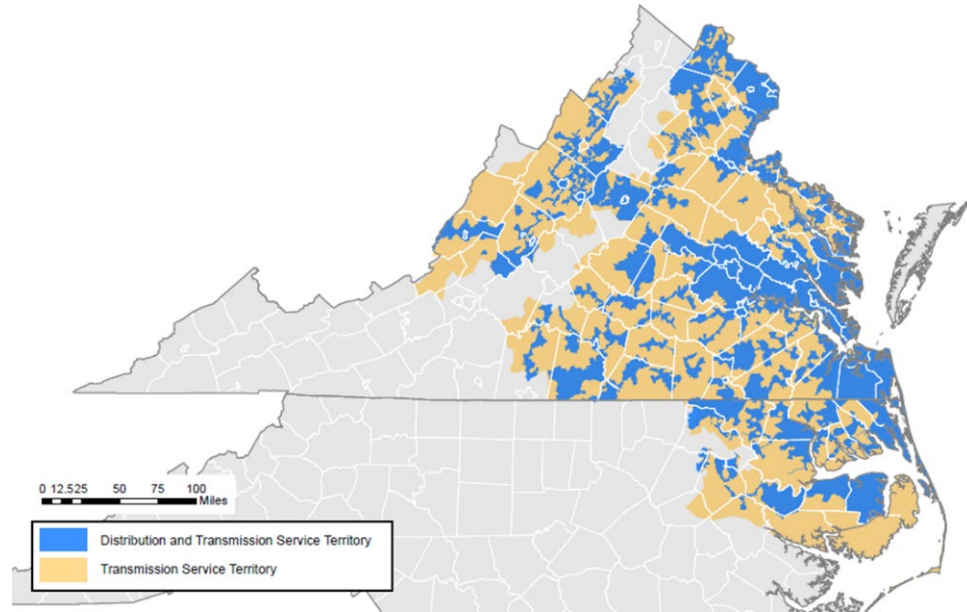
40

Years of EnergyShare  
assistance



20,400+

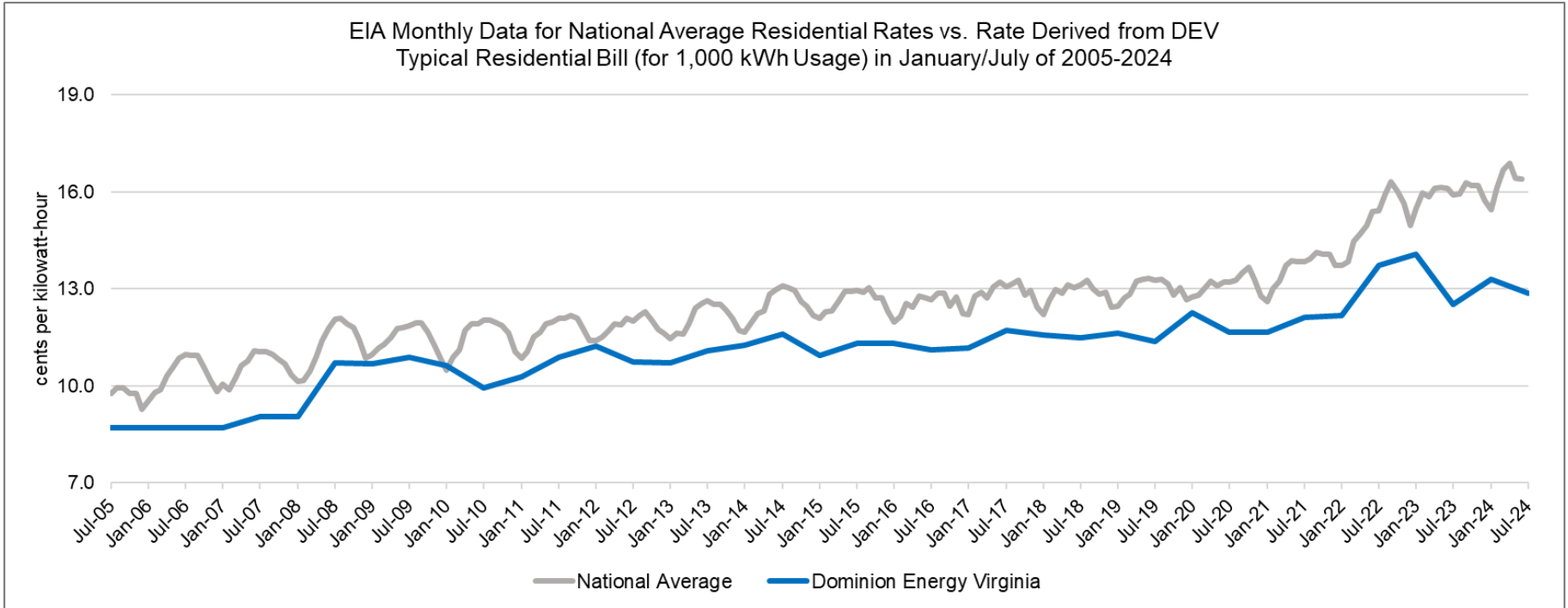
Megawatts of generation



# Rate Comparison: Historical View



EIA Monthly Data for National Average Residential Rates vs. Rate Derived from DEV  
Typical Residential Bill (for 1,000 kWh Usage) in January/July of 2005-2024





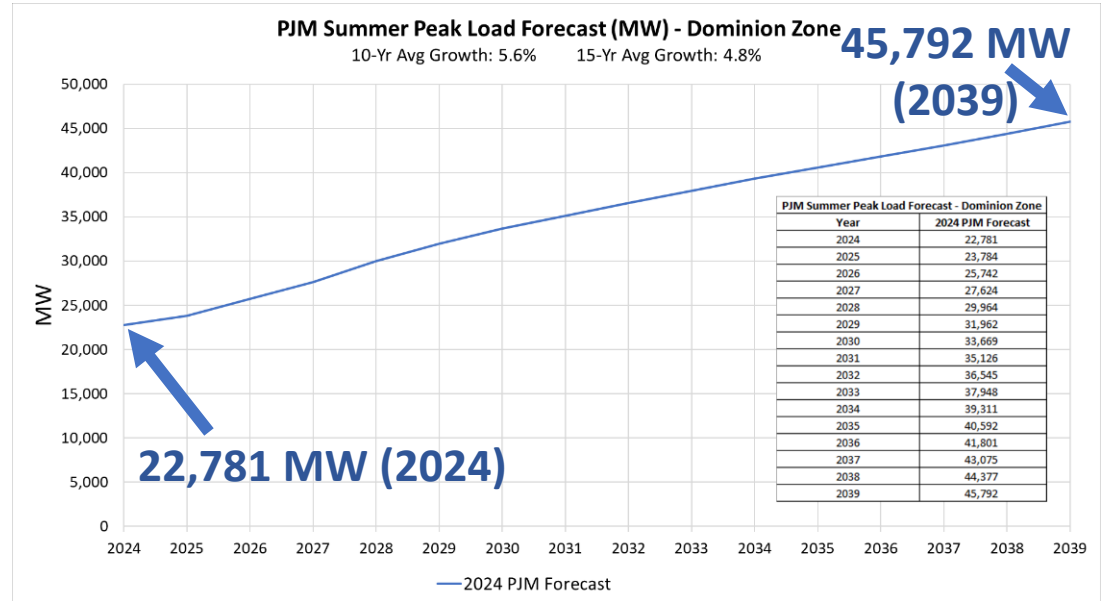
# 2024 Integrated Resource Plan (IRP)

## An IRP is:

- An outline of possible strategies for meeting customers' future needs
- A “snapshot in time” based on present-day information and assumptions
- Required to use PJM’s forecast for customer demand
- Subject to 100+ other requirements in statute and prior SCC orders

## An IRP is NOT:

- A definitive near-term build plan
- A request for SCC approval of specific projects/programs, or for cost recovery



The Dominion Zone (“DOM Zone”) within PJM has the **highest load growth forecast in the nation**

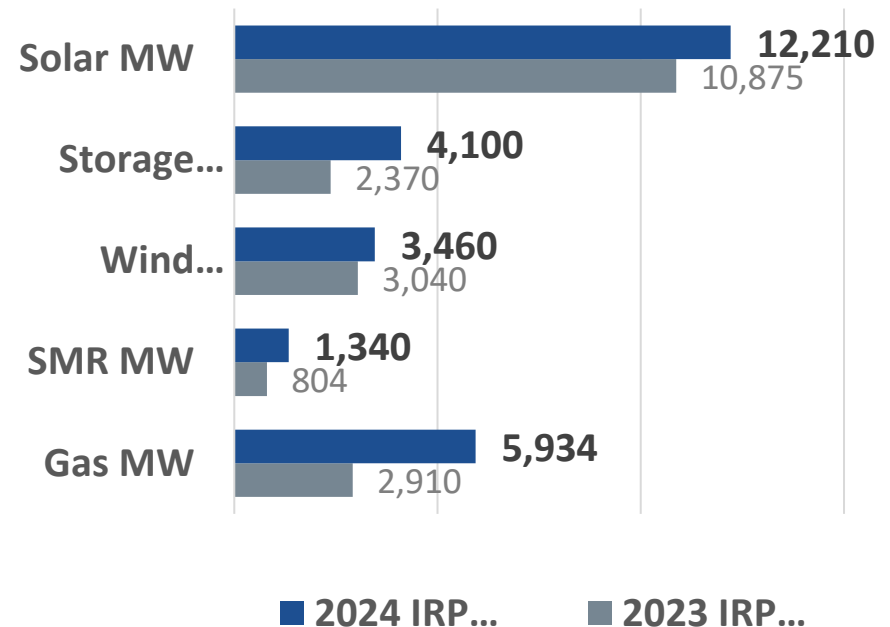
# IRP Summary – 2023 vs. 2024



## Assumptions

Key Metrics	2023 IRP	2024 IRP
IRP Plan Timeframe	15 year + 25 year	15 year only
PJM Dom Zone Load Growth	4.5%	4.8%
Dom LSE Load Growth	3.0%	2.8%
Dom Zone Capacity Import Limit	2,700 MW	3,300 MW
Environmental Rules	RGGI	New EPA Rules
Retirements	None in 15 Yr; Forced in 25 Yr	None in 15 Yr Portfolio
Solar Build Limit	900 MW/Yr	1,020 MW/Yr
Storage Build Limit	300 MW/Yr	350 MW/Yr

## Generation Resources Comparison



# 2024 Integrated Resource Plan (IRP)



- Illustrates the need for **diversified sources of energy**—all have strengths and weaknesses
- Must maintain **reliable back-up sources** to provide service under challenging conditions
- Discusses both power generation and delivery solutions, including **grid-enhancing technologies**

Resource Additions through 2039	2024 Primary Portfolios				Stakeholder Input Case
	VCEA with EPA	VCEA without EPA	REC/RPS Only with EPA	REC/RPS Only without EPA	
Solar (MW)	12,210	12,210	11,932	11,932	23,430
Wind (MW)	3,460	3,460	3,460	3,460	6,060
Storage (MW)	4,100	4,100	4,577	4,577	7,550
Nuclear (MW)	1,340	1,340	1,340	1,340	2,948
Natural Gas (MW)	5,934	5,934	5,934	5,934	0
Total (MW)	27,044	27,044	27,243	27,243	39,998
Zero-Carbon & Storage (%)	78%	78%	78%	78%	100%

\*The Stakeholder Input Case is not considered one of the primary portfolios in the 2024 IRP, and due to reliability/feasibility concerns is not a viable path forward in the company's view.

# Key Takeaways and 2025 Outlook

- Continued support for budget priorities in education, workforce, and infrastructure is a recognized best practice and will likely continue to bolster Virginia's economy.
- Planning and support may be necessary to mitigate extreme weather risks and protect the Commonwealth's infrastructure investments, including support and tools for building technical capacity at the local, regional, and state levels.
- Energy supply will play a role in economic development in the Commonwealth, and balancing supply and demand will be a challenge nationwide.
  - Joint Legislative Audit and Review Commission report on data centers will address energy use and incentives.