

Virginia IPM Scenario Customer Bill Analysis

November 9, 2017

- **Overview**
- **Analysis Method**
- **Assumptions and Sources**
- **Results**

- AG's analysis measures potential changes in residential, commercial, and industrial customer electricity bills using the Virginia Reference and Policy Scenario results from ICF
- The following slides present projections
- This analysis provides information for Virginia's deliberation of a carbon emission reduction program. The scenarios reviewed are based on the ICF modeling results and do not reflect a preference for or selection of any specific policy

Method

- **Analysis:**

- Calculates the *change in* the average monthly electricity bill on a customer class average basis between the Virginia Reference Cases and Policy Scenarios
- Includes adjustment to the average monthly bill by customer class assuming that revenues from allowance consignment auctions are returned to ratepayers based on each customer class's contribution to total annual consumption

- **Does not account for:**

- Savings due to potential demand reduction investments

Method – Average Monthly Bill Impact Calculation

\$/kWh

x Monthly kWh

=

\$/Month

Firm Power Rate

- Reflects firm power prices
- Modeled by ICF for reference and policy scenario through 2031
- Same for all customer classes

Average Monthly Use

- Approximated based on historical consumption, using public data reported by distribution companies to EIA
- Five-year average to smooth out annual weather-driven variations; grown over time at historical growth rates
- Average calculated for each customer class

Average Monthly Bill

- Product of combined customer-class average firm power and delivery rates, and average customer class monthly consumption
- Adjusted assuming 95% of allowance revenues are applied as a credit to ratepayers on a pro-rata basis across customer classes

Average Monthly Bill *Impact*

- *Difference* in average monthly bill, between Reference case and Policy Case

Delivery (T/D) Rate

- Reflects cost of delivery of electricity to end-use customer, including transmission, distribution, customer charges, etc.
- Approximated using public data reported by distribution companies to EIA and PJM wholesale prices in Virginia
- Calculated for each customer class

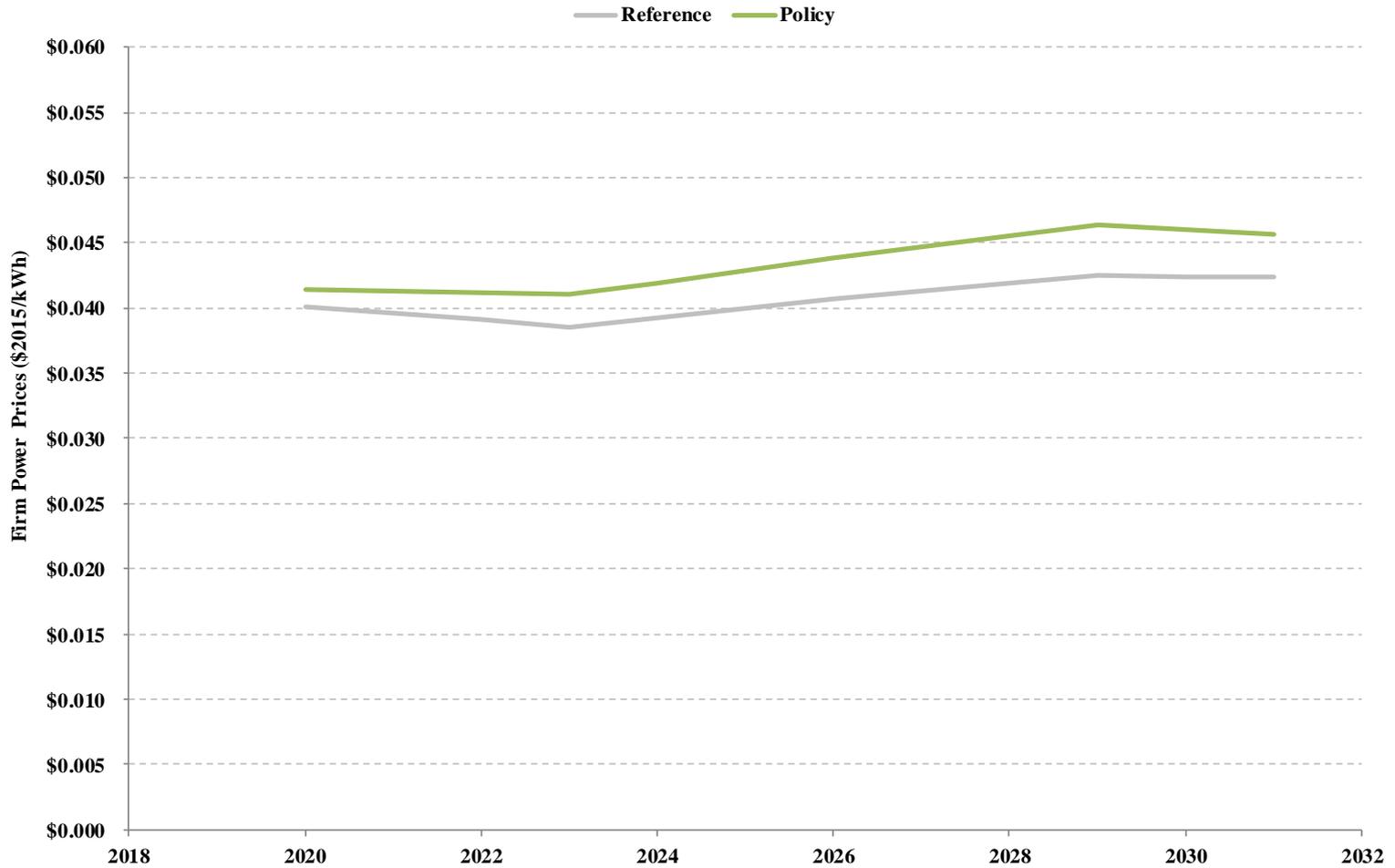
Assumptions – Electricity Rates & Average Monthly Usage

- **Electricity Rate Assumptions (\$/kWh)**
 - **Firm Power Rates:** IPM model output
 - **Delivery (T/D) Rate:** Average bundled energy rates from U.S. Energy Information Association (EIA) minus load-weighted annual average day-ahead locational marginal prices from PJM
 - Growth in delivery rates approximated based on average growth rate over the past five years
- **Average Monthly Usage Assumptions by Rate Class**
 - **Historical Usage Data:** 5-year average data from EIA
- **Discount Rate Assumption:** 2.1%

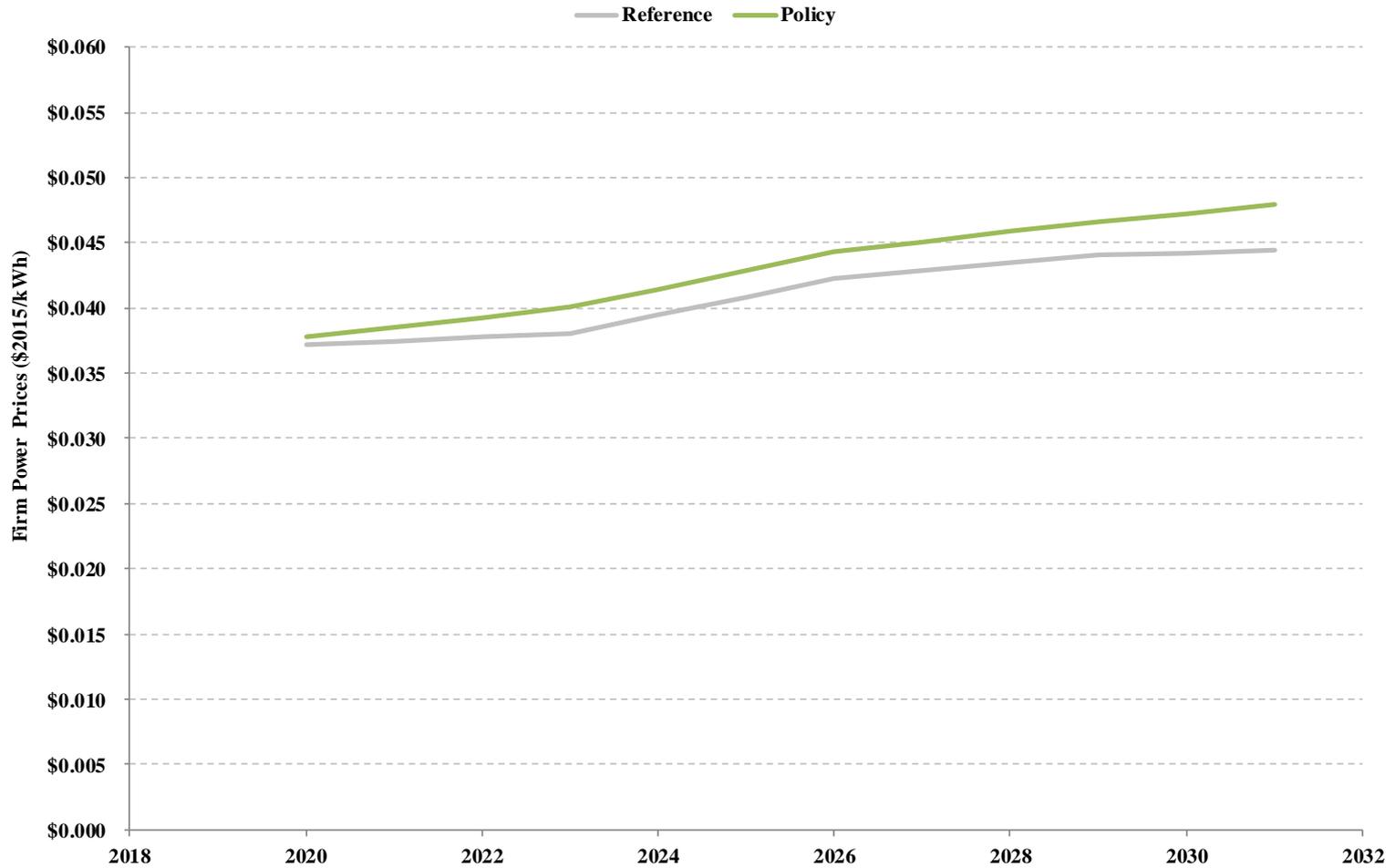
State Assumptions – Allowance Revenues

- In our bill impact analysis, *for purposes of illustration*, we assume that 95% of revenues that accrue to utilities from the sale of carbon allowances or credits are returned to ratepayers
 - 5% of allowance revenues are set aside for electricity demand reduction strategies
 - We assign revenues to customer classes based on share of load
 - For the purpose of this analysis we treat revenues from allowances to independent power producers in the same way as those allocated to utilities (i.e., revenues returned to ratepayers); however, the benefits from allocations to IPPs may not accrue to ratepayers

IPM Modeled Firm Power Prices RGGI Assumptions



IPM Modeled Firm Power Prices RGGI + VA Assumptions



Results

The following slides show results for the reference case and policy scenario with RGGI assumptions from 2020-2031, consistent with the IPM modeling timeline.

Residential Average Bills Policy Scenario & Reference Case with RGGI Assumptions (2020-2031)

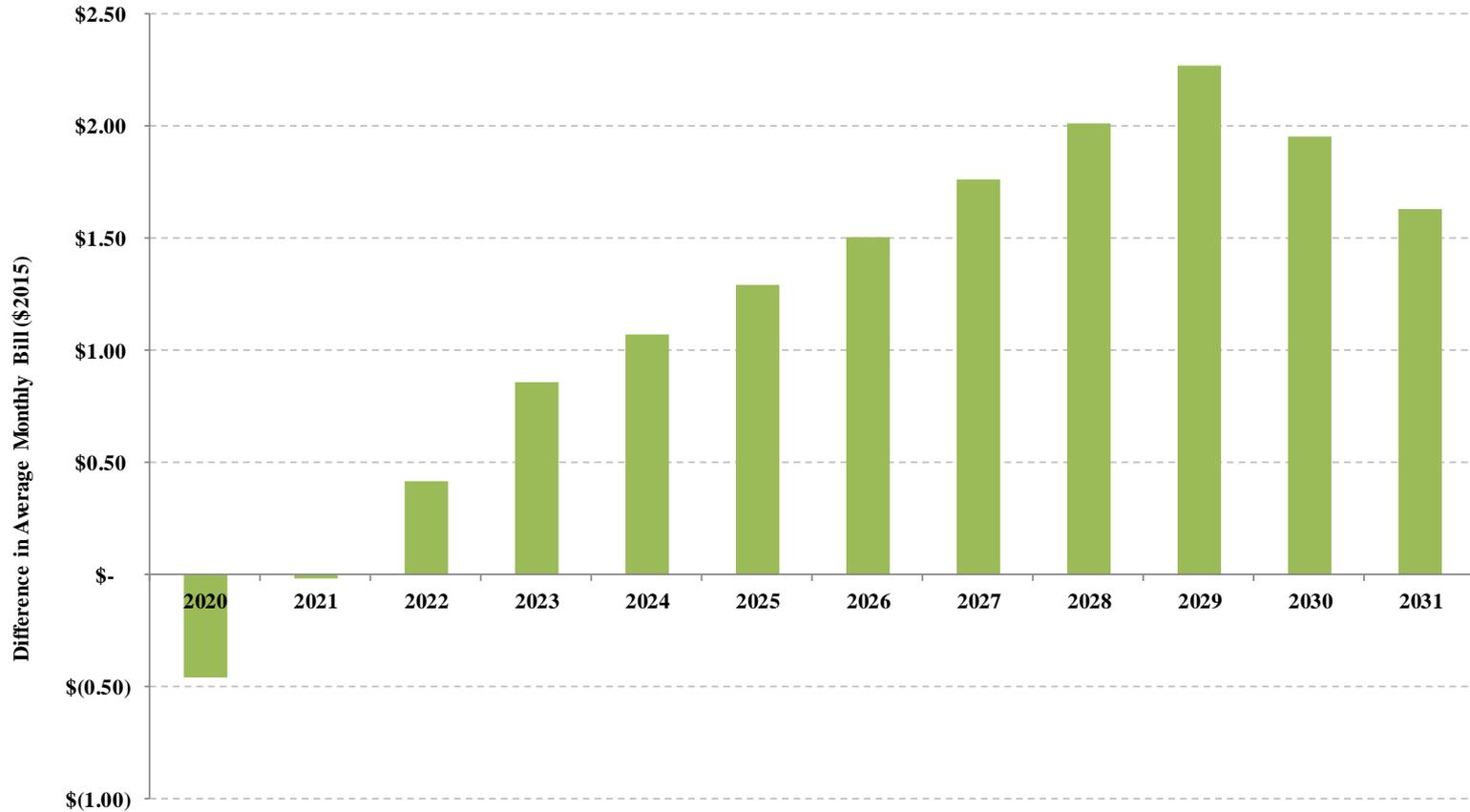
**Average Electric Monthly Bills (\$2015)
Residential Customers
RGGI Assumptions**



Residential Average Bill Impacts

Policy Scenario & Reference Case with RGGI Assumptions (2020-2031)

**Average Monthly Bill Impacts
Residential
RGGI Assumptions**



Virginia Average Bill Impacts

Policy Scenario with RGGI Assumptions Residential Results (2020-2031)

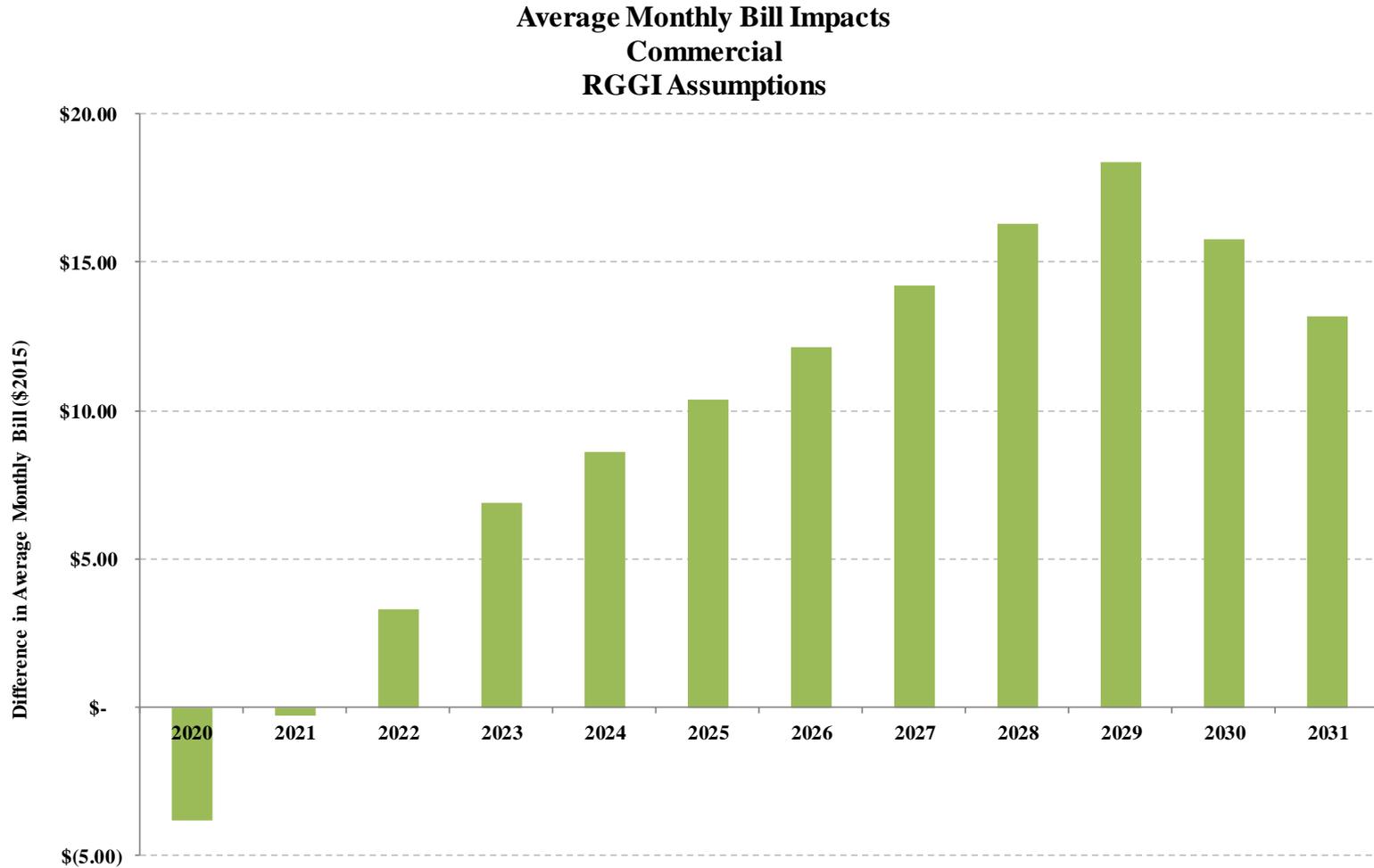
Average Bill Impacts VA Residential Customers RGGI Assumptions						
Year	Average Monthly		Difference between Reference Cases and Scenario Case (\$2015)			
	Reference Bill (\$2015)	Average Monthly Policy Scenario Bill (\$2015)	Average Monthly Difference		Percent	
			(\$2015)		Difference	
2020	\$ 152.97	\$ 152.51	\$	(0.46)		-0.3%
2021	\$ 156.78	\$ 156.76	\$	(0.02)		0.0%
2022	\$ 160.77	\$ 161.19	\$	0.42		0.3%
2023	\$ 164.94	\$ 165.80	\$	0.86		0.5%
2024	\$ 170.72	\$ 171.79	\$	1.07		0.6%
2025	\$ 176.70	\$ 177.99	\$	1.29		0.7%
2026	\$ 182.89	\$ 184.40	\$	1.51		0.8%
2027	\$ 189.20	\$ 190.96	\$	1.76		0.9%
2028	\$ 195.73	\$ 197.75	\$	2.02		1.0%
2029	\$ 202.51	\$ 204.78	\$	2.27		1.1%
2030	\$ 208.69	\$ 210.65	\$	1.95		0.9%
2031	\$ 215.14	\$ 216.77	\$	1.63		0.8%
Average (2020-2031)	\$ 181.42	\$ 182.61	\$	1.19		0.7%

Commercial Average Bills Policy Scenario & Reference Case with RGI Assumptions (2020-2031)

**Average Electric Monthly Bills (\$2015)
Commercial Customers
RGI Assumptions**



Commercial Average Bill Impacts Policy Scenario & Reference Case with RGI Assumptions (2020-2031)



Virginia Average Bill Impacts

Policy Scenario with RGGI Assumptions Commercial Results (2020-2031)

**Average Bill Impacts
VA Commercial Customers
RGGI Assumptions**

Year			Difference between Reference Cases and Scenario Case (\$2015)				
			Average Monthly		Average Monthly Policy		Average Monthly Difference
2020	\$	882.35	\$	878.53	\$	(3.82)	-0.4%
2021	\$	898.42	\$	898.17	\$	(0.25)	0.0%
2022	\$	915.35	\$	918.66	\$	3.31	0.4%
2023	\$	933.17	\$	940.05	\$	6.88	0.7%
2024	\$	963.34	\$	971.97	\$	8.63	0.9%
2025	\$	994.47	\$	1,004.86	\$	10.38	1.0%
2026	\$	1,026.61	\$	1,038.75	\$	12.14	1.2%
2027	\$	1,058.91	\$	1,073.12	\$	14.21	1.3%
2028	\$	1,092.29	\$	1,108.58	\$	16.29	1.5%
2029	\$	1,126.81	\$	1,145.18	\$	18.37	1.6%
2030	\$	1,155.72	\$	1,171.49	\$	15.77	1.4%
2031	\$	1,185.85	\$	1,199.03	\$	13.18	1.1%
Average (2020-2031)	\$	1,019.44	\$	1,029.03	\$	9.59	0.9%

Industrial Average Bills

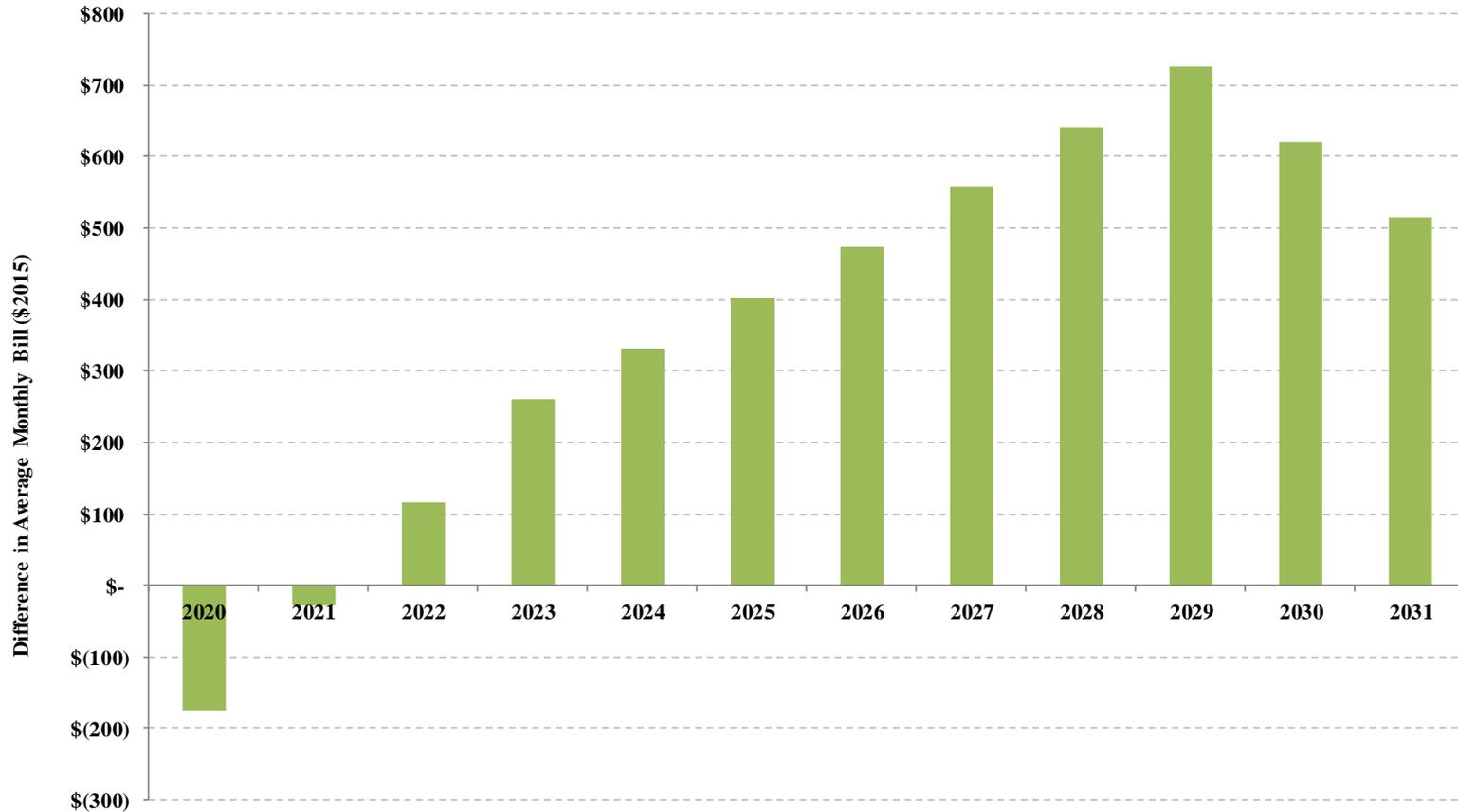
Policy Scenario & Reference Case with RGGI Assumptions (2020-2031)

Average Electric Monthly Bills (\$2015)
Industrial Customers
RGGI Assumptions



Industrial Average Bill Impacts Policy Scenario & Reference Case with RGGI Assumptions (2020-2031)

Average Monthly Bill Impacts Industrial RGGI Assumptions



Virginia Average Bill Impacts

Policy Scenario with RGGI Assumptions Industrial Results (2020-2031)

Average Bill Impacts
VA Industrial Customers
RGGI Assumptions

Year			Difference between Reference Cases and Scenario Case (\$2015)			
			Average Monthly Difference	Percent		
	Average Monthly	Average Monthly Policy				
2020	\$ 29,913.65	\$ 29,739.43	\$ (174.22)		-0.6%	
2021	\$ 30,321.72	\$ 30,292.44	\$ (29.28)		-0.1%	
2022	\$ 30,754.52	\$ 30,870.18	\$ 115.66		0.4%	
2023	\$ 31,213.08	\$ 31,473.67	\$ 260.59		0.8%	
2024	\$ 32,162.62	\$ 32,494.14	\$ 331.52		1.0%	
2025	\$ 33,140.09	\$ 33,542.53	\$ 402.44		1.2%	
2026	\$ 34,146.62	\$ 34,619.98	\$ 473.36		1.4%	
2027	\$ 35,146.99	\$ 35,704.78	\$ 557.79		1.6%	
2028	\$ 36,178.88	\$ 36,821.09	\$ 642.22		1.8%	
2029	\$ 37,243.57	\$ 37,970.22	\$ 726.64		2.0%	
2030	\$ 38,065.83	\$ 38,686.61	\$ 620.77		1.6%	
2031	\$ 38,923.66	\$ 39,438.56	\$ 514.90		1.3%	
Average (2020-2031)	\$ 33,934.27	\$ 34,304.47	\$ 370.20		1.1%	

Virginia Average Bill Impacts IPM Scenario Summary Results

VA Monthly Bill Impact for Years 2017-2031			
RGGI Assumptions			
Customer Class	Reference Case	Policy Scenario	
		Monthly Difference	Percent
	Bill (\$2015)	(\$2015)	Difference
Residential	\$ 181.42	\$ 1.19	0.7%
Commercial	\$ 1,019.44	\$ 9.59	0.9%
Industrial	\$ 33,934.27	\$ 370.20	1.1%

Results

The following slides show results for the reference case and policy scenario with Virginia assumptions from 2020-2031, consistent with the IPM modeling timeline.

Residential Average Bills Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

**Average Electric Monthly Bills (\$2015)
Residential Customers
RGGI+ VA Assumptions**



Residential Average Bill Impacts

Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

**Average Monthly Bill Impacts
Residential
RGGI+ VA Assumptions**



Virginia Average Bill Impacts

Policy Scenario with Virginia Assumptions Residential Results (2020-2031)

**Average Bill Impacts
VA Residential Customers
RGGI + VA Assumptions**

Year	Average Monthly		Difference between Reference Cases and Scenario Case (\$2015)			
	Reference Bill (\$2015)	Scenario Bill (\$2015)	Average Monthly Difference (\$2015)		Percent Difference	
2020	\$ 149.59	\$ 148.53	\$	(1.06)	-0.7%	
2021	\$ 154.33	\$ 153.78	\$	(0.55)	-0.4%	
2022	\$ 159.26	\$ 159.22	\$	(0.04)	0.0%	
2023	\$ 164.37	\$ 164.84	\$	0.47	0.3%	
2024	\$ 170.94	\$ 171.39	\$	0.45	0.3%	
2025	\$ 177.71	\$ 178.14	\$	0.44	0.2%	
2026	\$ 184.69	\$ 185.11	\$	0.42	0.2%	
2027	\$ 190.96	\$ 191.60	\$	0.64	0.3%	
2028	\$ 197.46	\$ 198.33	\$	0.87	0.4%	
2029	\$ 204.21	\$ 205.30	\$	1.09	0.5%	
2030	\$ 210.75	\$ 212.34	\$	1.59	0.8%	
2031	\$ 217.55	\$ 219.64	\$	2.09	1.0%	
Average (2020-2031)	\$ 181.82	\$ 182.35	\$	0.53	0.3%	

Commercial Average Bills Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

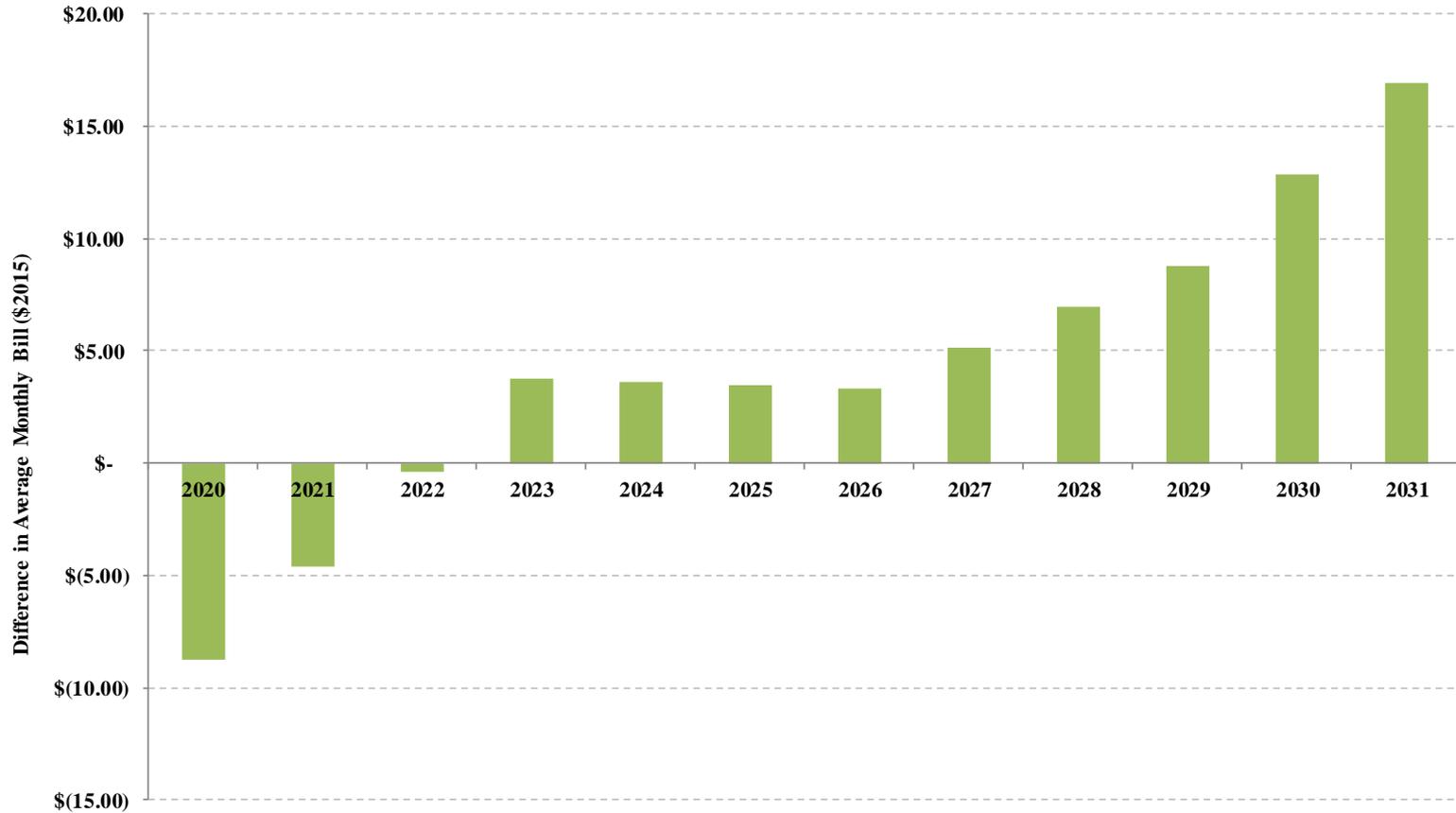
**Average Electric Monthly Bills (\$2015)
Commercial Customers
RGGI+ VA Assumptions**



Commercial Average Bill Impacts

Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

Average Monthly Bill Impacts Commercial RGGI+ VA Assumptions



Virginia Average Bill Impacts

Policy Scenario with Virginia Assumptions Commercial Results (2020-2031)

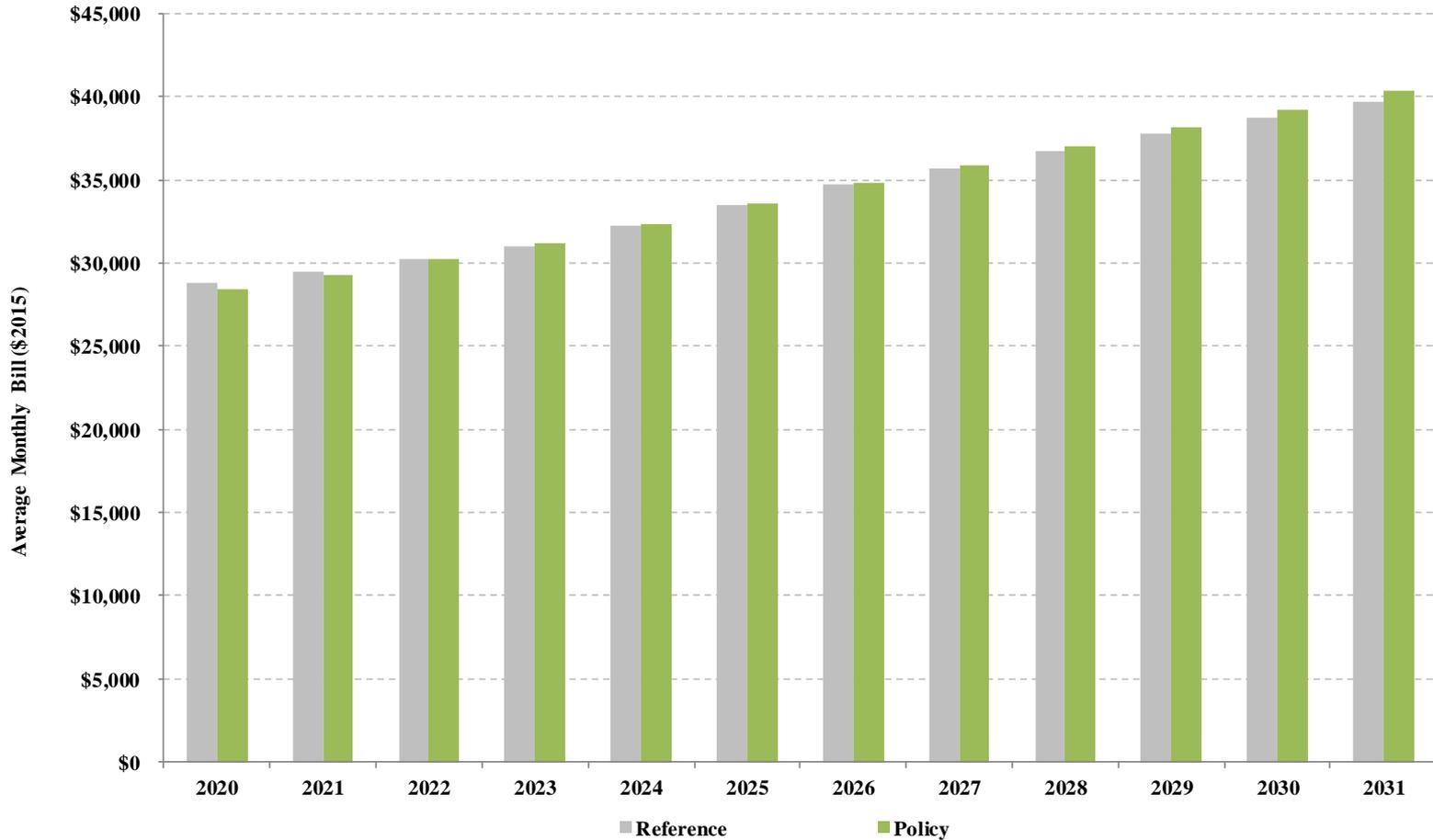
**Average Bill Impacts
VA Commercial Customers
RGGI + VA Assumptions**

Year			Difference between Reference Cases and Scenario Case (\$2015)					
			Average Monthly		Average Monthly Policy		Average Monthly Difference	
2020	\$	854.86	\$	846.13	\$	(8.73)		-1.0%
2021	\$	878.54	\$	873.97	\$	(4.57)		-0.5%
2022	\$	903.08	\$	902.66	\$	(0.42)		0.0%
2023	\$	928.51	\$	932.24	\$	3.73		0.4%
2024	\$	965.10	\$	968.69	\$	3.59		0.4%
2025	\$	1,002.66	\$	1,006.10	\$	3.44		0.3%
2026	\$	1,041.22	\$	1,044.52	\$	3.30		0.3%
2027	\$	1,073.25	\$	1,078.38	\$	5.13		0.5%
2028	\$	1,106.38	\$	1,113.33	\$	6.95		0.6%
2029	\$	1,140.64	\$	1,149.41	\$	8.78		0.8%
2030	\$	1,172.42	\$	1,185.25	\$	12.83		1.1%
2031	\$	1,205.43	\$	1,222.32	\$	16.89		1.4%
Average (2020-2031)	\$	1,022.67	\$	1,026.92	\$	4.24		0.4%

Industrial Average Bills

Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

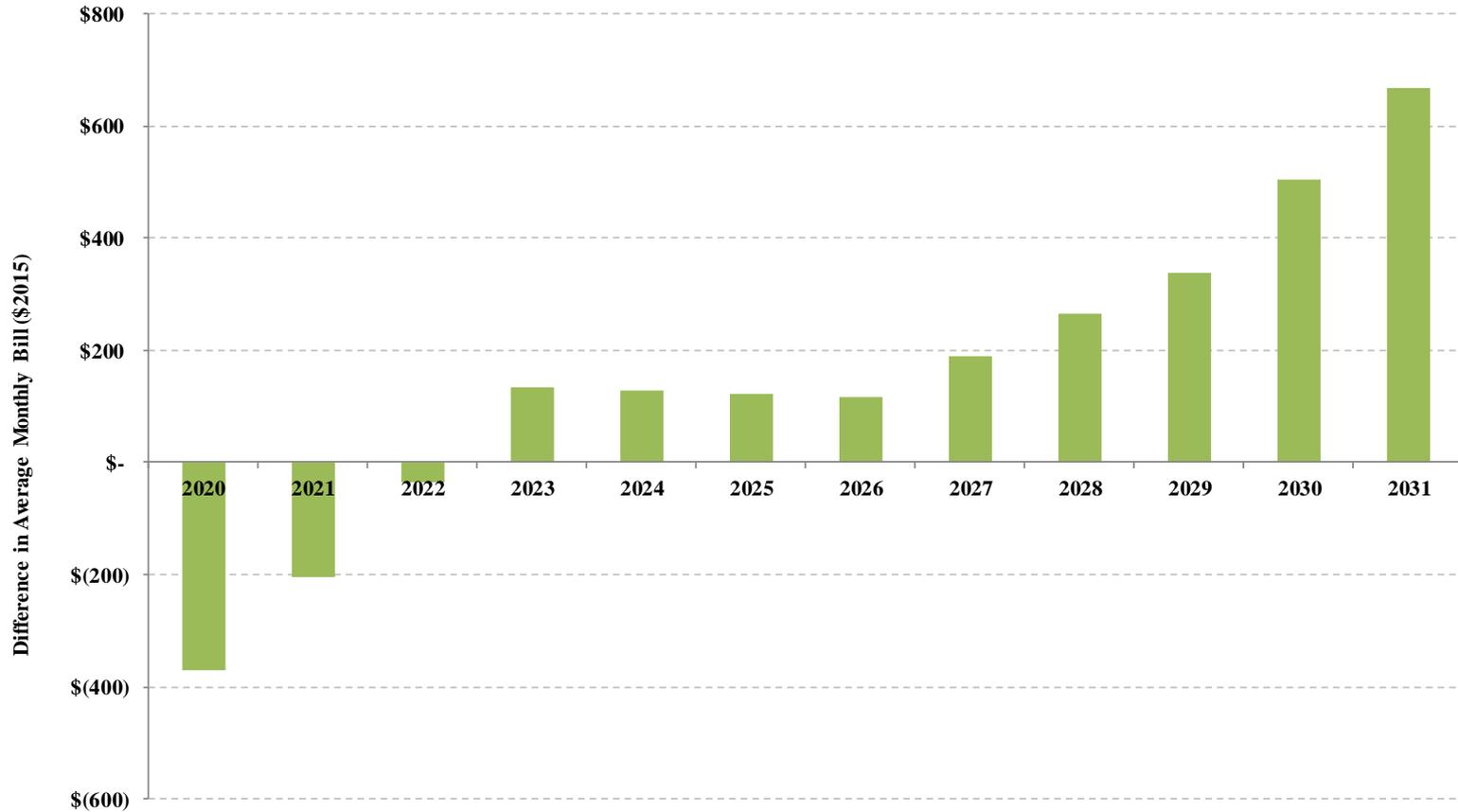
Average Electric Monthly Bills (\$2015)
Industrial Customers
RGGI+ VA Assumptions



Industrial Average Bill Impacts

Policy Scenario & Reference Case with Virginia Assumptions (2020-2031)

Average Monthly Bill Impacts
Industrial
RGGI+ VA Assumptions



Virginia Average Bill Impacts

Policy Scenario with Virginia Assumptions Industrial Results (2020-2031)

Average Bill Impacts
VA Industrial Customers
RGGI + VA Assumptions

Year			Difference between Reference Cases and Scenario Case (\$2015)				
			Average Monthly	Average Monthly Policy	Average Monthly Difference	Percent	
2020	\$	28,795.99	\$	28,423.91	\$	(372.08)	-1.3%
2021	\$	29,513.40	\$	29,310.18	\$	(203.22)	-0.7%
2022	\$	30,255.54	\$	30,221.18	\$	(34.36)	-0.1%
2023	\$	31,023.45	\$	31,157.95	\$	134.50	0.4%
2024	\$	32,234.14	\$	32,362.41	\$	128.27	0.4%
2025	\$	33,472.75	\$	33,594.79	\$	122.03	0.4%
2026	\$	34,740.44	\$	34,856.24	\$	115.80	0.3%
2027	\$	35,730.19	\$	35,920.23	\$	190.04	0.5%
2028	\$	36,751.45	\$	37,015.73	\$	264.28	0.7%
2029	\$	37,805.52	\$	38,144.04	\$	338.53	0.9%
2030	\$	38,744.92	\$	39,248.04	\$	503.12	1.3%
2031	\$	39,719.89	\$	40,387.60	\$	667.71	1.7%
Average (2020-2031)	\$	34,065.64	\$	34,220.19	\$	154.55	0.5%

VA Monthly Bill Impact for Years 2017-2031				
RGGI + VA Assumptions				
Customer Class	Reference Case Bill (\$2015)	Policy Scenario		
		Monthly Difference (\$2015)	Percent Difference	
Residential	\$ 181.82	\$ 0.53		0.3%
Commercial	\$ 1,022.67	\$ 4.24		0.4%
Industrial	\$ 34,065.64	\$ 154.55		0.5%

Virginia Average Bill Impacts IPM Scenario Summary Comparison

VA Monthly Bill Impact for Years 2017-2031

Customer Class	Reference Case Bill (\$2015)		Policy Scenario			
	RGGI Assumptions	RGGI + VA Assumptions	RGGI Assumptions		RGGI + VA Assumptions	
			Monthly Difference (\$2015)	Percent Difference	Monthly Difference (\$2015)	Percent Difference
Residential	\$ 181.42	\$ 181.82	\$ 1.19	0.7%	\$ 0.53	0.3%
Commercial	\$ 1,019.44	\$ 1,022.67	\$ 9.59	0.9%	\$ 4.24	0.4%
Industrial	\$ 33,934.27	\$ 34,065.64	\$ 370.20	1.1%	\$ 154.55	0.5%