NRDC Comments on VA DEQ's Proposed Regulation for Emissions Trading (9VAC5 Chapter 140, Rev. C17)

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NRDC Comments on VA DEQ's Proposed Carbon Regulation

On behalf of our over 12,000 members across the Commonwealth, the Natural Resources Defense Council (NRDC) strongly supports the promulgation of the Department of Environmental Quality's (DEQ) regulatory action, "Regulation for Emissions Trading" (9VAC5 Chapter 140, Rev. C17).

Just as important, NRDC also thanks the DEQ for its hard and ongoing work on this important issue on behalf of Commonwealth citizens.

The Threat of Climate Change to the Virginia Economy

The anticipated adverse impacts of climate change on Virginia's economy are well documented. Rising sea levels and hotter summers come at significant cost. By 2030, projections estimate that $139M in Virginia property will lie below the mean sea level, and $17.4B below the mean high tide line.[1] Additional climate-related damage from coastal storms could easily reach $135M by the 2030's. By 2050, those numbers grow, with $306M below the mean sea level, and over $19B below the mean high-tide line. Additional storm damage could easily exceed $500M by 2050.

Metropolitan areas such as Hampton, Virginia Beach, and Norfolk – home to the largest US naval base – will bear a disproportionate share of those costs.[2]

By 2050, the Commonwealth's commercial and residential sectors are projected to spend 8% more on electricity to keep cool during hot summers, at an estimated cost of $815M per year. Labor productivity, especially in high-risk sectors such as construction, manufacturing, agriculture, mining, and transportation, is projected to decline under such conditions – at a cost of $1.1B per year by mid-century. Extreme heat is also likely to impact crop yields for key agricultural commodities in Virginia: by the 2050's, corn yields are likely to decline by

[1] Risky Business, "The Bottom Line on Climate Change: Climate Risk in the Southeastern U.S. and Texas," July 2015, at 94.
[2] *Id.* at 97.

approximately 33%, while soybean yields fall roughly 16%.[3]

These projections demonstrate the economic costs of inaction. Rising seas levels will impact military facilities, a critical part of Virginia's economy. Extreme heat will cost farmers both in lost productivity and shrinking yields, and small businesses will see revenues shrink as rising energy costs cut into earnings.

The Threat of Climate Change to Virginians' Human Health

The dangers to Virginians' human health of dumping into our atmosphere unlimited amounts of carbon dioxide pollution, the main driver of already-costly climate change, is also well-documented, including in DEQ's "Regulation for Emissions Trading" NOIRA.

By the 2030's, Virginia is likely to see upwards of 20 days per year with heat in excess of 95-degrees, a three-fold increase from 2015. By 2050, the count could reach 33 days per year.[4] Such extreme heat results in not just rising energy expenditures, lost labor productivity, and depressed crop yields as discussed above.

This global warming is also bad for human health, mortality, and quality of life.

Excess heat increases death risk by 2.5% for every 1°F increase in heat waves, and average daily summer highs have already increased 3° since the 1960s. These dangers are real and already recorded: Virginia emergency departments and urgent care clinics recorded 498 heat-related visits over 10 days just last summer.[5]

In addition to heat-illness risks, increasing temperatures can also make Virginia shellfish and fish more dangerous to consume. As the Chesapeake Bay warms, both the *vibrio vulnificus* and *V. parahaemolyticus* bacteria can be more likely transmitted from seafood to humans.[6]

Global warming is also driving longer and more severe allergy seasons. In Richmond, 2017 saw the fourth highest tree pollen count recorded by Allergy Partners of Richmond, the increases of which also exacerbate asthma.[7]

Tick and mosquito-borne illness are also increasing in Virginia along with the temperatures of a warmed planet. Ticks carrying Lyme disease are rapidly spreading across a warming Virginia, increasing from only 12 Virginia counties to 72 counties over the past two decades. And the

[3] *Id.*
[4] *Id.*
[5] NRDC, "Climate Change and Health in Virginia," April 2018, at 1.
[6] *Id*. at 3.
[7] *Id*. at 4.

annual number of West Nile virus cases in Virginia are expected to triple between 2036 and 2049.[8]

Because of these and other[9] immediate and growing health and economic dangers discussed above, Virginia law unsurprisingly clearly encompasses carbon dioxide in its definition of air pollution: "Air pollution means the presence in the outdoor atmosphere of one or more substances which are or may be harmful or injurious to human health, welfare or safety, to animal or plant life, or to property, or which unreasonably interfere with the enjoyment by the people of life or property."[10]

Furthermore, limiting and reducing carbon pollution would also achieve the Air Pollution Control Board's charge to prevent harm to "public health, safety or welfare; the health of animal or plant life; [and] property, whether . . . recreational, commercial, industrial, [or] agricultural."[11]

Because of the health and economic dangers that unmitigated carbon pollution poses to Virginia's human health, its economy, and property, we therefore broadly support the DEQ's proposed rule to limit carbon dioxide in the Commonwealth, using the same means already proven effective in 1 in 5 states in the country: a sensible, achievable limit on electric sector carbon pollution, with subsequent annual reductions.

The below comments are intended to improve the functionality and effectiveness of the strong framework of the proposed rule.

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[8] *Id*. at 5.
[9] *See, generally,* NRDC, "Climate Change and Health in Virginia," April 2018, available at www.nrdc.org/resources/climate-change-and-state-level-health-impacts.
[10] Va. Code § 10.1-1300.
[11] 9 VAC 10.

Section 1: Recommendations for Improving the Economic, Climate, and Health Benefits of the Proposed Rule

Section 1 outlines NRDC's seven recommendations for improving the proposed rule. Each of these recommendations is focused on improving the proposed rule to ensure that the final regulation:

1) Maximizes Virginia's mitigation of climate change through meaningful but achievable carbon pollution reductions, by starting from a realistic 2020 baseline budget that is not arbitrarily high;

2) Maximizes energy sector resiliency and economic benefits through a sensible allowance allocation mechanism; and

3) Treats all electric sector carbon emitters equally, thereby eliminating market distortions while also minimizing electricity cost increases for Virginia families and businesses.

Sections 2 through 4 address some issues in greater depth, specifically:

- Section 2 (page 12)—Baseline: NRDC's updated IPM modeling illustrates that a 2020 baseline budget of 33 million is unjustifiably high, and that 28 million tons is more accurate. This section also outlines the environmental, economic, and human health benefits of capping and reducing Virginia's carbon pollution;

- Section 3 (page 18)—Allowance Allocation: The best allowance allocation option to ensure consumer benefits is to allocate to electric distribution companies, co-ops, and municipals; and

- Section 4 (page 22)—Treatment of Woody-biomass: There is an environmental and economic benefit to include woody biomass generation-related carbon pollution within the proposed program and its associated annual carbon budgets.

Each of the seven recommendations outlined below in Section 1—if incorporated into the final regulation—will drive economic benefits and mitigate climate change in the most efficient and equitable means currently available to the DEQ.

Recommendation 1: Limit Emissions Starting at a 2020 Baseline of 28 Million Tons

With 2017 emissions already well below 33 million tons,[12] and additional coal power units expected to close or reduce generation across the state,[13] the proposed rule's 33 million-ton 2020 baseline is too high.

NRDC recommends that the final rule instead set a 2020 emissions baseline of 28.0 million tons.

In order to determine the state's business-as-usual emissions and an appropriate annual reduction trajectory, the DEQ should review reputable data and projections to establish a baseline that is not artificially high.

To do so, the DEQ should rely on transparent, *up-to-date* estimates of what Virginia's business-as-usual emissions will likely be in 2020. Similarly, the DEQ should avoid industry-derived emissions projections that appear to be set unrealistically high, such as Dominion Energy's most recent Integrated Resource Plan, of 2017. DEQ's own proposal of either 33 or 34 million tons in 2020 is similarly flawed.

An incorrectly high year-1 baseline budget would significantly undermine the entirety of the program and jeopardize Virginia's ability to access the marked benefits of linking with the larger RGGI market.

To set an appropriate baseline, the DEQ should instead rely on and consider multiple up-to-date projections. One of these should be the federal EIA's Annual Energy Outlook (AEO) from early 2018, which shows emissions decreasing in the Virginia-Carolina region by 27% between 2017 and 2020.[14]

NRDC's own IPM modeling, conducted by ICF, also predicts similar emissions declines in Virginia between 2017 and 2020, a decline that continues the year-over-year reduction between 2016 and 2017. Preliminary results from NRDC's updated IPM modeling for Virginia (utilizing an updated 2018 data set) projects the state's power sector emissions to be 28.0 million short tons in 2020.

This more up-to-date modelling accurately reflects the reality of today's power sector in Virginian. Not only are additional coal retirements already planned in the Commonwealth, but renewable energy installations – most notably solar energy – are increasing in Virginia, concurrent with recently lower – and sometimes even declining - demand growth across

[12] U.S. EPA, Data for 2017 from EPA's Continuous Emissions Monitoring System (CEMS), *data query tool available at* https://ampd.epa.gov/ampd/, accessed March 2018.
[13] *See, e.g.,* http://www.richmond.com/news/virginia/dominion-to-eliminate-nearly-positions-after-review-of-power-generation/article_60633a02-01d5-50a8-bcfc-f2ccf04b8fb5.html.
[14] U.S. EIA, *Annual Energy Outlook 2018*, February 2018, https://www.eia.gov/outlooks/aeo/tables_ref.php. See Table 55.16 of the Reference Case for all Electric power projections for the VACAR (Virginia-Carolina) Electricity Market Module Region.

the state in 2017.[15] Combined, the three factors of lower in-state electricity demand, persistently declining gas prices, and growing low-cost renewable energy resources mean the state's emissions will be well under 33 million tons in 2020. As discussed in Section 2 below, NRDC's own IPM modeling supports the adoption of a 28 million ton baseline as a likely-to-occur starting point in 2020.

As also discussed further in Section 2 below, a sufficiently ambitious program will drive significant economic and health benefits, including lower energy bills and rates, as well as improved public health resulting from cuts in co-pollutants like NOx and SOx.

Recommendation 2: Allowance Allocations Must Deliver Consumer Benefit, Avoid Generator Windfalls, and be Monitored by a Stakeholder Advisory Group

As discussed further in Section 3 below, the DEQ must ensure the economic efficiency of the program by directing allowance value toward consumer benefit, rather than toward utility or generator windfall profits.

Therefore, the DEQ's proposed rule is correct to avoid imposing costs on Virginia families and businesses by awarding allowances directly to emitting generators for free. Doing so would allow the ultimate price of those allowances to be borne by Virginia families and businesses in the form of higher wholesale electricity costs, while providing an unreasonable windfall profit to generators.

NRDC therefore supports DEQ's proposal to utilize a consignment auction, as that mechanism provides an opportunity to recapture revenue that would otherwise be a windfall to generators. Indeed, these carbon allowances are inherently a "public good," and thus their value must be captured and utilized on behalf of all Virginians—not given away to polluters.

However, the DEQ should amend the proposed rule, specifically at 9VAC5-140-6215, to allocate allowances directly to distribution companies, based on pro rata share of load served, to ensure that allowance revenue goes directly to customer benefits.

In order to ensure market efficiency and a transparent, undistorted allowance price that levels the playing field for all generators, achieve maximum economic efficiency for Virginia citizens through allowance allocation, and align with the Grid Security and Modernization Act of 2018, a standing Emissions Trading Stakeholder Advisory Group (SAG) should also be established to monitor the implementation and performance of the final rule. The SAG's purpose would be to ensure the overall program and use of revenue is functioning transparently, efficiently, and effectively.

The SAG should be comprised of representatives of the Attorney General's Rate Counsel, low-

[15] *See, e.g.,* EIA Electricity Sales Data for 2017, *available at* https://www.eia.gov/electricity/data/eia861m/.

income consumer advocates, NGOs, SCC Staff, the Department of Mines, Minerals, and Energy, Environmental Justice communities, and the regulated community.

Recommendation 3: Net Carbon Emissions from Forest-derived Biomass Should be Covered by the Regulation

NRDC recognizes that there are many forms of biomass fuel currently used or under consideration in Virginia. These include landfill gas recovery, brewery wastes, agricultural plant residues and animal wastes, forest harvest residues, energy crops, whole trees and boles, and industrial/mill waste, among others. Many of these feedstocks can generate carbon benefits compared with fossil fuels, while others can have significant negative carbon impacts.

In these comments, we focus entirely on "forest-derived" biomass, by which we mean a biomass fuel that originates in a forest. We focus on three categories of forest-derived feedstocks used to produce electricity: (i) whole trees, boles, and other large diameter wood that would otherwise be used in merchantable end uses; (ii) harvest residues including tops, limbs, and slash that would otherwise be discarded or left to decay in the forest; and (iii) industrial and mill waste produced at a forest products processing facility that would otherwise be burned.

We support DEQ's draft proposal to require co-fired facilities to hold allowances for the carbon dioxide (CO_2) they emit, whether those emissions be from forest-derived biomass or fossil fuels. We urge Virginia to issue a final rule that covers the net carbon emissions from all utility sector biomass power facilities larger than 25 megawatts (MW). Specifically, the Commonwealth must account for the net emissions from forest-derived biomass combustion from power sector facilities greater than 25 MW, including both dedicated biomass-burning units and those that cofire with forest-derived biomass, and cover these facilities under the cap.

In Section 4, we describe a straightforward and easily implemented approach for the Commonwealth to determine the net emissions from these three categories of forest-derived biomass feedstocks. Based on this this approach, we recommend that Virginia regulate net emissions from forest-derived biomass in the following manner:

(i) CO_2 emissions from onsite waste that would otherwise be burned in an industrial setting without energy recovery will require zero allowances for each ton of carbon emitted;

(ii) CO_2 emissions from forest-derived residues that would otherwise decay will require approximately 0.69 allowances for each ton of carbon emitted;

(iii) CO_2 emissions from whole trees, boles, and large diameter materials that would otherwise have a merchantable end-use, including pulp, paper, fiberboard, engineered wood or lumber will require one allowance for each ton of carbon emitted.

Virginia should also require EGUs to furnish to DEQ an estimate of the proportion of their total forest-derived feedstocks annually that fall into these categories. Category (i) industrial wastes should only be certified by industrial facilities. In the event an EGU uses a *de minimis* amount of Category (iii) merchantable tree feedstocks, their total emissions can be treated as Category (ii) forest harvest residues.

Finally, Virginia must reject "sustainable forestry" as a proxy for carbon impacts of forest-derived biomass. "Sustainability," however defined, is not a measure of carbon impacts. The designation says very little, if anything, about the amount of CO_2 emitted by a given biomass source or the net effect of those emissions on atmospheric CO_2 concentrations over time.

Recommendation 4: The DEQ Should Monitor Potential Shifting of Emissions Out-of-State

The DEQ should work to ensure the integrity of the program is not eroded by emissions leakage, which is the increase of emissions from power plants outside Virginia to supply in-state load due to a carbon price on in-state generation, beyond current business-as-usual levels of imports *absent* a Virginia carbon price.

The DEQ can do so by 1). designing an economically efficient program with minimal market distortions; 2). maximizing consumer benefits through efficiency investments by allocating allowances to distribution companies; and 3). driving significant levels of in-state renewable energy development. These will all deliver least-cost carbon reductions and mitigate the impact of carbon prices on carbon-based power flows across state lines.

Emissions leakage can be minimized through the cost-effective development of Virginia's largely untapped, clean resources like solar and energy efficiency in buildings.

To ensure the program does not inadvertently lead to increased fossil-based electricity imports from out-of-state, the DEQ should establish an annual program review process for the duration of the program, to assess whether interstate power flows are shifting *as a result of the carbon price*. (Importantly, a modest price on carbon is but one of many variables that can influence interstate power flows; any such analysis would need to account for those in a comprehensive manner to draw attribution conclusions.)

This work could be incorporated into the Emissions Trading SAG. The RGGI states have already built in such emissions monitoring and reporting that assesses leakage, and we urge Virginia to do so as well.[16]

[16] *See, generally,* https://rggi.org/sites/default/files/Uploads/Electricity-Monitoring-Reports/2014_Elec_Monitoring_Report.pdf.

Recommendation 5: The Proposed Rule is Correct to Minimize Administrative Cost by Relying on RGGI's Allowance Tracking and Trading Infrastructure

NRDC supports the DEQ's proposal to ensure allowances comport with, and are fully tradable on, RGGI's pre-existing platform, due to its low administrative costs, third party market monitor reports, and robust cybersecurity.

Recommendation 6: Ongoing Review of the Program Should Include an Assessment of Benefits Delivered to Environmental Justice Communities

Climate change is inherently an environmental justice issue, as coastal communities and low-income communities ultimately bear the worst brunt of its impact. Therefore, the program should make significant cuts to carbon dioxide and ensure the consumer and energy efficiency benefits flow to the low-income citizens most impacted not just by climate change, but energy costs as well.

Additionally, because carbon dioxide is not harmful in locally-higher concentrations, and there do not appear to be specific Virginia plants in proximity to at-risk communities whose capacity factors will increase under a carbon program, a carbon market in Virginia appears unlikely to create "hot spots" of pollution in frontline communities. And as the cap for carbon emissions is lowered, it can also create additional benefits of further reducing associated co-pollutants that cause health problems in communities close to their source.

But to ensure this is the case over the course of the program, the regular program review recommended below should also incorporate an annual environmental justice review, including tracking and reporting on carbon and co-pollutant emissions trends over time from the state's power plant fleet (and in communities in proximity to those plants).

Recommendation 7: The Regulation's Design and Emissions Impact Must be Reviewed at Regular Intervals

As RGGI has demonstrated, it is good practice to build in regular program reviews to ensure the framework is working effectively.[17] Similarly, as Virginia adopts and implements its program, it may need to be adjusted over time, to ensure it is functioning efficiently and is driving significant and additional carbon pollution reductions. Program reviews can ensure that the cap is set (and updated) at the correct level to drive carbon emissions reductions well beyond BAU, while also maximizing the development of a clean energy economy in the Commonwealth. Virginia's program should thus undergo internal review on a regular basis, and this must include stakeholder and public input, as RGGI has done.

[17] *See, e.g.,* https://rggi.org/program-overview-and-design/program-review.

The first review should occur in 2020, to review 2019 emissions and ensure the 2020 budget in the final rule reflects the reality of Virginia's power sector emissions. Additionally, as Virginia pursues linking with RGGI, it should integrate itself directly into that program's review processes.

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SECTION 2: IPM Modeling Results: 2020 Emissions Baseline of 28.0 Million Tons, and the Benefits of a RGGI-linked Carbon Limit

Mitigating climate change in the manner as outlined in the proposed rule, by capping and annually reducing carbon pollution and linking to the already-successful RGGI program, will drive significant additional economic and health benefits in the Commonwealth (as shown below).

Those benefits are not limited to direct economic benefits in the form of lower electricity bills, and indirect economic benefits in the form of increased public health. The state will also benefit from increased energy sector diversity and from job growth associated with finally tapping into Virginia's considerable renewable energy and energy efficiency potential in a meaningful way.

The state's policy of increasing its energy independence can also be advanced through this regulation, by prioritizing and supporting the development of native Virginia resources – energy efficiency, solar, and wind energy – and sending fewer dollars out-of-state to import carbon-intensive gas.

However, to fully realize the rule's environmental and economic benefits for the Commonwealth, the DEQ must *first* set both a meaningful and sufficiently stringent initial baseline budget. The proposed regulation fails to do this, and we urge DEQ to correct that flaw in the final regulation.

The 2020 Baseline Budget is Arbitrarily High and Must Be Revised Downward

The proposed rule's initial 2020 baseline budget is set arbitrarily high, as it does not reflect the reality of a Virginia power sector that already emits less than 33 million tons annually. For the program's stringency and success, NRDC recommends that the baseline be lowered to better reflect the expected energy market conditions and their impact on Virginia's near-term electricity mix and system.

According to the latest EPA data, Virginia's 2017 power-related emissions were 32.4 million, down 11 percent from 2016 levels.[18] Power sector emissions are expected to continue declining, as the state, its residents, and its utilities continue to transition to cleaner, more efficient energy sources, driven by fundamental power market conditions, state policies, and customer choices.

It is true that the additional gas generation capacity of Dominion's under-construction Greensville NGCC plant will emit significant carbon pollution. However, as reflected by federal projections and NRDC's own modelling, carbon pollution from that plant will be less than the

[18] U.S. EPA, Data from EPA's Continuous Emissions Monitoring System (CEMS), *data query tool available at* https://ampd.epa.gov/ampd/, accessed March 2018

net emissions reductions in Virginia attributable to reduced utilization of the state's coal fleet.

Indeed, federal projections from the U.S. Energy Information Administration (EIA), for example, now anticipate a 27% decrease in power sector emissions between 2017 and 2020 in the combined Virginia-Carolina region.[19] This finding of significantly decreasing emissions corresponds with NRDC's own recently updated 2018 modeling.

NRDC retained ICF to conduct modeling with ICF's Integrated Planning Model (IPM®).[20] This modeling is a continuation of and update to NRDC's prior modeling efforts with ICF, including for the federal Clean Power Plan and the VA DEQ's NOIRA comment period. This recent modeling incorporates more up-to-date assumptions, all chosen by NRDC. (See Table 1 below.)

In NRDC's initial comments to the VA DEQ in 2017, NRDC presented IPM modeling results based on government sources and market data as of Spring 2017.[21] In that 2017 modeling effort, NRDC provided modeling of both "business-as-usual" and carbon cap policy scenarios. In those comments, NRDC suggested a 2020 baseline of 30-32 million tons, based on the results of this 2017 modeling effort.

Amid rapidly changing market conditions, that 30-32 million ton baseline recommendation is now out-of-date, and should be lower based on updated modeling.

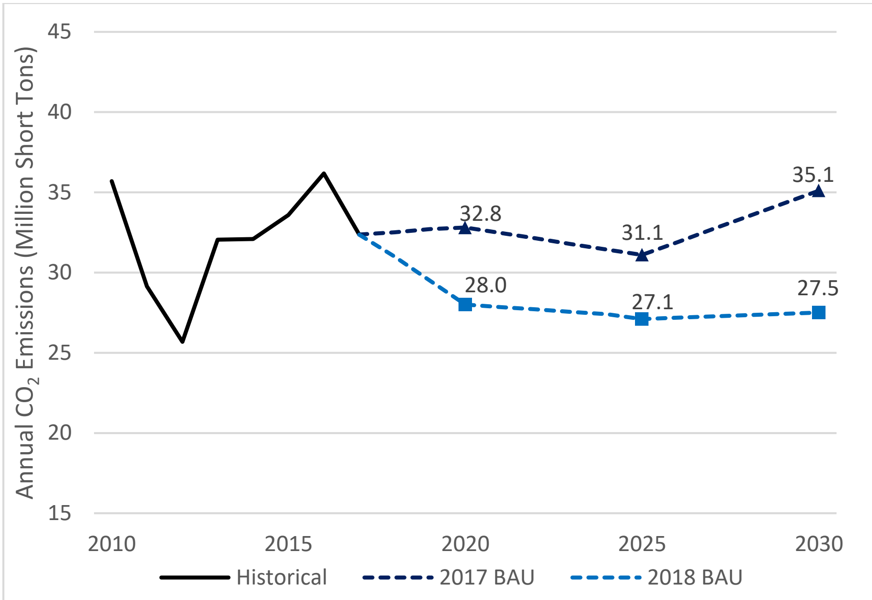
To reflect accelerating power sector shifts, NRDC now recommends a revised baseline of 28 million tons, based on our preliminary 2018 modeling results. The revision downward is a function of updated reference case assumptions, including lower gas prices and lower demand projections in U.S. EIA's Annual Energy Outlook (AEO) 2018, as compared to AEO 2017. (See Figure 1 below.)

[19] U.S. EIA, *Annual Energy Outlook 2018*, February 2018, https://www.eia.gov/outlooks/aeo/tables_ref.php. See Table 55.16 of the Reference Case for all Electric power projections for the VACAR (Virginia-Carolina) Electricity Market Module Region.

[20] ICF's Integrated Planning Model (IPM®) is a detailed model of the electric power system that is used routinely by the electricity industry and regulators, including RGGI, to assess the effects of environmental regulations and policy. IPM® determines the most cost-effective pathway for the electricity industry, subject to reliability requirements and environmental constraints, and economically builds & retires new electricity capacity. The outputs of IPM® modeling include carbon and other pollutants, wholesale electricity prices, natural gas prices, retail bills, electricity generation by fuel type, & capacity retirements & builds. The modeling presented here reflect an NRDC analysis conducted by ICF. All assumptions and policy scenarios were developed by NRDC.

[21] See NRDC Comments to DEQ on Proposed Emissions Trading Regulations, submitted July 26, 2017.

Figure 1: Historical and Modeled Power Sector Carbon Emissions



Historical data derived from EPA's Continuous Emissions Monitoring System. Both 2017 and 2018 BAU modeling reflect IPM outputs for years 2020, 2025, and 2030. Both BAU cases assume no carbon price or policy in the state of Virginia during the modeling period.

The downward emissions revision expressed in the figure above is generally consistent with EIA's 2018 Annual Energy Outlook.

Based on federal projections and NRDC's own updated modelling, therefore, the proposed rule's 33 million-ton 2020 budget is out of date and therefore arbitrary for the purposes of finalizing the rule, and should be revised to 28.0 million tons.[22]

The proposed Emissions Containment Reserve (ECR) is an appropriate means for addressing lower than expected emissions, and NRDC supports DEQ's inclusion of that mechanism. However, the ECR is not intended to close an emissions "hot air" gap of up to 5 million annual tons, between the baseline budget as proposed and the expected emissions in 2020. Rather, the ECR is intended to address outcomes in which emissions are lower than anticipated *due to unforeseen circumstances*.

Therefore, the DEQ should not rely on the ECR as a self-correcting tool, and instead must revise its proposed 2020 budget downward to 28.0 million tons—in line with the most up-to-date projections of what emissions are likely to be in the first year of the program.

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[22] A baseline overallocated by 5 million tons of "hot air" would erase nearly half of the net reductions the state would otherwise achieve through 2030 if it instead adopted a more accurate baseline of 28 million tons.

Table 1: NRDC's Modeling Assumptions

Modeling Assumptions		
Element	**2017 Reference Case**	**2018 Reference Case**
Builds, Retirements, and State Policies	Reflects announcements and state policies as of Q2 2017	Reflects announcements and state policies as of Q1 2018
Demand Natural Gas Prices	AEO 2017 Reference Case without the Clean Power Plan	AEO 2018 Reference Case without the Clean Power Plan
Technology Costs	Wind and solar costs from NREL'S 2017 Annual Technology Baseline; all other costs from AEO 2017. ITC/PTC extension included in renewable energy costs.	Wind and solar costs from NREL'S 2017 Annual Technology Baseline; all other costs from AEO 2018. ITC/PTC extension and solar tariffs included in renewable energy costs
Nuclear	60 year life (no extension to 80 years allowed)	Extension to 80 year life allowed
Wind	Wind limit in VA (only 750 MW of new wind can be built).	Wind limit in VA (only 750 MW of new wind can be built). Model breaks reported wind down into offshore and onshore wind.
Energy Efficiency	Only savings included in AEO2017 baseline (e.g. no incremental savings added)	Only savings included in AEO2018 baseline (e.g. no incremental savings added)
Battery Storage	No Ability to Model Storage	Ability to Model and Economically Build 4hr Battery Storage
Carbon Cap	No cap on Virginia emissions	No cap on Virginia emissions
RGGI Participation	NJ joins RGGI in 2020 (modeled as emissions capped as part of RGGI)	NJ joins RGGI in 2020 (modeled as emissions capped as part of RGGI)
RGGI Emissions Trajectory	2.5% annual decline in RGGI Cap from 2020-2030; cap held constant post-2030	RGGI's 2020-2030 new model rule

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NRDC's Updated Modelling Shows Economic and Health Benefits in Virginia under the Proposed Rule, Similar to Those Already Experienced in RGGI States.

Limiting power sector carbon pollution can be good for Virginia's economy and the health of its residents.

In addition to a 2018 "business-as-usual" baseline case with no carbon limit, ICF also completed a preliminary case in which Virginia emissions are included in the RGGI program starting in 2020. In this case, Virginia's cap was based on the VA DEQ's proposed baseline of 33 million tons with an annual reduction target matching RGGI's 2020-2030 new model rule.

This carbon policy modeling shows that Virginia can significantly reduce carbon emissions without hampering energy affordability. In addition, as discussed in Section 3, a well-designed program and allowance allocation process can drive significant economic, energy security, and public health benefits for families and businesses in the Commonwealth.

Retail Rates and Bills Are Not Negatively Impacted by Linking to RGGI

Reflecting the economic competitiveness of renewables and other lower-emitting resources, NRDC's modeling finds no significant impact on retail rates or bills between a no carbon policy and carbon policy case. In fact, retail rates and bills *are slightly lower*. (See Tables 4 and 5.)

Tables 4 and 5: Decreased Rates and Increasing Clean Energy

Retail Rates (2012$/MWh)			
State	2020	2025	2030
No Carbon Policy	$ 99.60	$ 98.10	$ 96.60
VA in RGGI	$ 99.00	$ 97.60	$ 96.00

% Change in Final Bill versus "No Carbon Policy"			
State	2020	2025	2030
VA in RGGI	-0.6%	-0.4%	-0.6%

In addition, the 2018 modeling scenarios above did not include the impact of additional energy efficiency or energy savings. If allowance revenue, as discussed in the next section, were directed toward energy efficiency programs, as has been shown to be effective in the successful RGGI program,[23] bills and rates could be even lower under an improved final rule.

[23] *See, generally,* RGGI, "The Investment of RGGI Proceeds through 2014," September 2016, *available at* https://rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2014.pdf.

Carbon Costs: Carbon Allowances Prices Will be Modest

NRDC's preliminary modeling shows RGGI allowance prices will remain quite modest, even with the inclusion of Virginia's emissions. (See Figure 6 below.)

Figure 6: Projected Carbon Allowance Prices in Preliminary NRDC IPM Modelling

RGGI Carbon Allowance Prices (2012$/Ton)			
State	**2020**	**2025**	**2030**
No Carbon Policy	3.57	3.93	4.42
VA in RGGI	3.45	3.78	4.24

In fact, in the preliminary case above where Virginia joins RGGI (reflecting the Virginia DEQ Proposed Rule), the carbon allowance price is lower in the 2020-2030 period.

Given this, NRDC again recommends that Virginia revises its 2020 baseline downward to 28 million tons. This would provide the state with meaningful emissions reductions, while also keeping the state's and region's energy prices affordable and reasonable.

Health Impacts: A RGGI-linked Virginia Carbon Cap Directly Improves State Health

Reducing carbon pollution also significantly reduces the co-pollutants nitrous oxide (NOx) and sulfur dioxide (SOx). By 2030, the state could reduce NOx emissions by an additional 2,700 tons and SO2 emissions by an additional 400 tons. (See Figure 7.)

Figure 7: Health Improvements by Reducing Co-Pollutants

Thousand Short Tons	**2020**		**2025**		**2030**		
	VA in RGGI	No Carbon Policy	VA in RGGI	No Carbon Policy	VA in RGGI	No Carbon Policy	% Reduction
Emissions - NOX	9.45	11.56	8.77	10.68	7.97	10.74	**-26%**
Emissions - SO2	4.01	4.58	3.94	4.37	4.09	4.50	**-9%**

The reductions above represent a reduction in annual NOx and SOx emissions of 26 percent and 9 percent, respectively, by 2030.

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Section 3: Allowance Allocation Implications and Design Options

The final regulation should be designed not only to deliver meaningful reductions in carbon emissions and the related economic benefits of clean energy. The program should also be designed to maximize consumer benefits, namely by recovering and reinvesting the value of allowances for the benefit of all Virginians.

All emissions allowances have a dollar value as "discovered" in the marketplace, regardless of whether a generator pays for that allowance or receives it for free.[24] After allowance are distributed (either through auction or other means), buyers and sellers, often with the help of emissions brokers, set a market price. The market then leaves plants owners with two options: (1) maintain emissions levels and purchase allowances to cover those emissions; or (2) reduce emissions levels and sell allowances to other plant operators or third parties.

Regardless of how the allowance was procured (for free or purchased, as discussed below), the dollar value of each held allowance *must be included by generators in their wholesale market bids to PJM*.[25] The value of allowances utilized by carbon emitters are then *recouped by the generator when the electricity is sold.* If the DEQ does not design a carbon regulation and allocation method that ultimately delivers that allowance value back to Virginia families and businesses, such a giveaway would equate to a publicly-subsidized windfall to generators, while consumers are unnecessarily saddled with higher costs.[26]

Thus, the program should be judged by the standard of whether or not the inherent full market value of allowances can be recovered from the generator that receives the electricity payment, and then reinvested in rebates, renewable energy, energy efficiency, and other investments that minimize compliance costs and maximize benefits to Virginia families. Conversely, the program should not allow the market value of allowances to accrue directly to generators as a windfall profit, with no benefit going to consumers to offset the higher wholesale electricity costs.

How the Value and Cost of Allowances Function

Regardless of how carbon allowances are allocated, the allowances function in the same way after the DEQ allocates them:

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[24] *See, e.g.,* SOX Market, NOX Market, and RGGI Carbon Market.

[25] *See* PJM Interconnection, LLC. *A Review of Generation Compensation and Cost Elements in the PJM Markets*. 2009, available at http://www.pjm.com/~/media/committees-groups/committees/mrc/20100120/20100120-item-02-review-of-generation-costs-and-compensation.ashx.

[26] *See, generally,* Grubb, et. al. *Climate Policy and Industrial Competitiveness: Ten Insights from Europe on the EU Emissions Trading System*. August 11, 2009.; Analysis Group, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's Second Three-Year Compliance Period (2012-2014)," July 2015.

At the end of each compliance period, each generator must surrender sufficient allowances to cover all its emissions during that period, as allowed under its DEQ air permit(s). Under IRS[27] and PJM[28] rules, when a generator submits a bid into the wholesale market, it must include the value of any pollution allowances necessary to cover the emissions associated with that generation in that bid. That allowance value must be included in the bid, regardless of whether the generator had to purchase allowances (in which case the revenue can be reinvested on behalf of consumers) *or* received them for free (in which case the generator keeps the proceeds, in a significant wealth transfer from consumers to generators or utilities).

Determining the Best Allowance Allocation Method

While the basic framework of a carbon allowance program is relatively straightforward, the DEQ decides in advance how it will initially allocate allowances. In doing so, the DEQ should ensure the inherent market value of the allowances accrues to Virginians and the Virginia economy—rather than simply providing a windfall to generators by distributing them to polluters for free.

For example, according to the projected carbon allowance price of $4.24 in 2030 as outlined above in Section 2, the value of Virginia's proposed allocation of 23.8 million allowances in 2030 would be over $100 million in that year. That is real dollar value that the DEQ can ensure, through efficient regulatory design and interagency coordination, is ultimately returned to Virginia families and businesses. Generators will likely claim that they need allowances to fund their investments in equipment to reduce emissions, but because they are reimbursed for the allowance cost in the wholesale market, free allocation would result in a windfall to polluters at the expense of the consumer.

With that fundamental illustration of allowance value, we outline below three "menu" options for allocating valuable carbon allowances.

Allocation Option #1: Full Consumer Benefit Allocation through Consignment Auction

To ensure that the value of allowances is used for the benefit of Virginians, the DEQ could allocate allowance value on a pro rata basis to consumers via a consignment auction on behalf of electric distribution companies. Allowances (and subsequent dollar value) would be distributed based on each company's percentage of total state load (electricity need).

In this approach, the dollar value of the allowances (as determined in the marketplace in the consignment auction) can ultimately return to electric billpayers via their distribution company, under the direction and oversight of state regulators and other already-existing oversight bodies (importantly, this construct would require the active cooperation of the SCC,

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[27] Code of Federal Regulations, Title 18, Conservation of Power and Water Resources, Part 101.

[28] PJM Interconnection, LLC. "PJM Manual 15: Cost Development Guidelines, Revision: 10," June 1, 2009, pg 11, available at http://www.pjm.com/documents/~/media/documents/manuals/m15.ashx.

as outlined further below).

The allowances are allocated on a pro rata basis to consumers via the distribution companies, based on each company's percentage of total state load. For example, if the state's emissions budget for a compliance period is 100 tons, a distribution company with 70% of load would receive 70 allowances, a distribution company with 15% of load would receive 15, a co-op with 13% of load would receive 13, and a municipal with 2% of load would receive 2.

How those allowances are utilized would be overseen by the SCC, in close consultation with DEQ, utilities, efficiency providers, DMME, consumer advocates, the Emissions Trading SAG, and other stakeholders, in the case of Dominion and Appalachian Power, and by the respective Boards in the case of co-ops and munis. Given the range of generator types and ownership structures, allowances should be sold in a transparent and open manner, with regulated monopoly generators competing in an open, transparent market with merchants. Sale and transfer of money from any one regulated monopoly affiliate to another should be supervised by the SCC.

The SCC would ensure, through the already existing IRP and rate cases proceedings, or perhaps through a new docket, that revenues from any allowances sold accrue to Dominion or Appalachian Power bill payers' benefit. Indeed, the SCC has sufficient authority[29] to decide directly how the allowance revenues are utilized, to ensure maximum customer benefit. Such benefits could take the form of cost-effective energy efficiency investments to lower customer bills (as well as further reduce carbon emissions from that distribution company); direct bill crediting; or investment in the most cost-effective zero-emissions resources to further reduce emissions and thus free up additional allowances. In RGGI, there have been significant benefits delivered to consumers as a result of smart investments of allowance proceeds.[30]

In the event Dominion or Appalachian Power must purchase allowances to meet the permitting obligations of one of their generators, SCC oversight can assure that such a decision to comply was the least- cost means available to the utility for meeting its generator's emissions obligations.

Municipal boards and co-op boards would serve in a similar capacity, ensuring that any revenues or costs associated with selling or surrendering allowances ultimately serve the best interests of their bill payers.

Merchant generators would be assured access to allowances through sale of allowances by the distributions companies, and the subsequent open allowance market.

This approach is most preferred for its efficiency. Administratively, the DEQ already has experience with a similar NOx allowance allocation and auction. Oversight bodies (the SCC

[29] *See, generally,* Code of Virginia, Title 56. Public Service Companies, Article 1. In General. http://law.lis.virginia.gov/vacode/title56/chapter1/.

[30] *See, generally,* "The Investment of RGGI Proceeds through 2014," The Regional Greenhouse Gas Initiative, September 2016, *available at* www.rggi.org/docs/ProceedsReport/RGGI_Proceeds_Report_2014.pdf.

and muni and co-op boards) are in place to ensure that allowance costs and related generation and compliance decisions are prudently incurred, and that any revenues are re-invested in such a way that serves the bill payers' best interests.

Allocation Option #2: Allocation to Covered Generators, Based on Output

A second approach to capture the economic value of allowances, as is proposed by DEQ, is to allocate them to covered fossil generators, based on their previous MWh output of energy.

While this approach may have certain benefits over the option discussed below (allocation based on emissions), in this approach electricity customers do not directly receive the benefit of allowance-related revenue, nor will they necessarily receive the benefit of oversight of the disposition of such revenues. In the case of merchant generators, they will receive a windfall at customer expense.

Allowance Allocation Option #3: Allocation of Allowances Directly to Fossil Emitters

This method, most akin to the early sulfur dioxide acid rain reduction program in Virginia and elsewhere, would allocate allowances directly to fossil generators, based on each generator's share of total emissions.

This is the worst approach for Virginia families and businesses, because neither the state nor the bill payers recover any value; that value remains a windfall to generators and utilities. While the value of allowances would be included in PJM wholesale bids, no mechanism exists to ensure that recouped value (or the value of sold allowances) is returned to the final electricity customer. Indeed, this windfall would essentially create transfer payments from customers to generators.

The DEQ is correct not to propose this approach in the proposed rule, as doing so would mean a transfer of the value of allowances from the businesses and families of the state directly to the pockets of the power plant owners.

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Section 4: Net Emissions Forest-derived Biomass Should be Included under the Cap

Summary: NRDC recognizes that there are many forms of biomass fuel currently used or under consideration in Virginia. These include landfill gas recovery, brewery wastes, agricultural plant residues and animal wastes, forest harvest residues, energy crops, whole trees and boles, and industrial/mill waste, among others. Many of these feedstocks can generate carbon benefits compared with fossil fuels. Others do not.

In these comments, we focus entirely on “forest-derived” biomass, by which we mean a biomass fuel that originates in a forest. We focus on three categories of forest-derived feedstocks used to produce electricity: (i) whole trees, boles, and other large diameter wood that would otherwise be used in merchantable end uses; (ii) harvest residues including tops, limbs, and slash that would otherwise be discarded or left to decay in the forest; and (iii) industrial and mill waste produced at a forest products processing facility that would otherwise be burned. As we describe below, there is considerable variability in carbon impacts among these feedstocks, which underscores the need for Virginia to differentiate across feedstocks and account for the net carbon emissions from different types of forest-derived biomass fuels.

We support DEQ’s draft proposal to require co-fired facilities to hold allowances for the carbon dioxide (CO_2) they emit, whether those emissions be from forest-derived biomass or fossil fuels. However, we urge Virginia to issue a final rule that covers the net carbon emissions from all utility sector biomass power facilities larger than 25 megawatts (MW). Specifically, the Commonwealth must account for the net emissions from forest-derived biomass combustion from power sector facilities greater than 25 MW, including both dedicated biomass-burning units and those that cofire with forest-derived biomass, and cover these facilities under the cap.

In these comments we describe a straightforward and easily implemented approach for the Commonwealth to determine the net emissions from these three categories of forest-derived biomass feedstocks.

Biomass recommendation 1: Based on this this approach, we recommend that Virginia regulate net emissions from forest-derived biomass in the following manner:

(i) CO_2 emissions from onsite waste that would otherwise be burned in an industrial setting without energy recovery will require approximately zero allowances for each ton of carbon emitted;

(ii) CO_2 emissions from forest-derived residues that would otherwise decay will require approximately 0.69 allowances for each ton of carbon emitted.

(iii) CO_2 emissions from whole trees, boles, and large diameter materials that would otherwise have a merchantable end-use, including pulp, paper, fiberboard, engineered wood or lumber will require approximately 1.0 allowances for each ton of carbon emitted.

Biomass recommendation 2: Virginia should require EGUs to furnish to DEQ an estimate of the proportion of their total forest-derived feedstocks annually that fall into these categories. Category (i) industrial wastes should only be certified by industrial facilities. In the event an EGU uses a de minimus amount of Category (iii) merchantable tree feedstocks, their total emissions can be treated as Category (ii) forest harvest residues.

Biomass recommendation 3: Virginia must reject "sustainable forestry" as a proxy for carbon impacts of forest- derived biomass. Sustainability, however defined, is not a measure of carbon impacts; the concept or designation says very little, if anything, about the amount of CO_2 emitted by a given biomass source or the net effect of those emissions on atmospheric CO_2 concentrations over time.

Forest-derived Biomass is Not "Carbon Neutral," and Stack Emissions from Biomass are Typically Higher than Fossil Fuels

Forest-derived biomass is not categorically a "carbon neutral" fuel and its emissions cannot be assumed to be zero. Stack emissions of CO_2 from burning forest-derived biomass are typically comparable to or greater than coal per unit of energy produced (due to the inefficiency of biomass combustion), even according to industry analyses.[31]

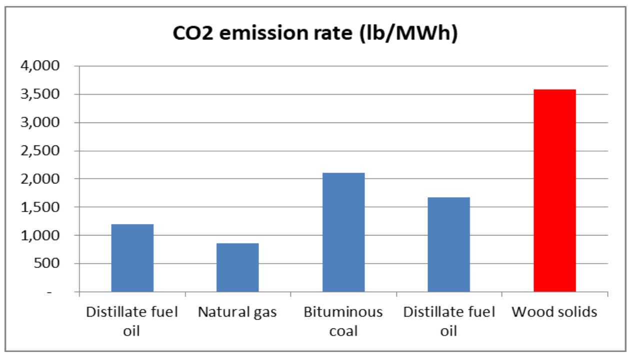
This fact is demonstrated in the following chart (developed by the Partnership for Policy Integrity) showing the U.S. Energy Information Administration (EIA) fuel emissions factors per unit fuel energy content. Biomass accounts for the top three highest-emitting categories of solid fuel per unit of energy production:

Fuel code	Fuel	lb/MMBtu
OBS	other biomass solids	233
BLQ	black liquor	222
WDS	wood solids	207
BIT	bituminous coal	206
MSB	biogenic muni waste	200
MSN	non-biogenic muni waste	200
SLW	sludge waste	185
DFO	distillate fuel oil	163
RFO	residual fuel oil	163
LFG	landfill gas	130
OBG	other biomass gases	127
NG	natural gas	117

[31] Kinney, Suz-Anne, "Wood vs. Coal: Moisture Content and Carbon Emissions," Forest2Market Market Watch, February 14, 2012, https://blog.forest2market.com/wood-vs-coal-moisture-content-and-carbon-emissions

These data above are expressed on a heat-input basis (pounds of CO_2 per million Btu of energy inherent in the fuel). When fuels are burned in a power plant, the efficiency of conversion of fuel to energy affects the CO_2 emission rate on an output basis (lb CO_2 per MWh). Wood-burning power plants are extraordinarily inefficient, resulting in stack emissions comparable to or greater than fossil fuels per MWh of electricity produced.

To illustrate how this inefficiency translates to high CO_2 emissions per MWh, the figure below (also developed by the Partnership for Policy Integrity) compares 2016 data from two Dominion plants: 1) the Chesterfield plant, which has several burners combusting a variety of fuels; and 2) the Pittsylvania plant, which burns wood. CO_2 stack emissions from the wood-burner are 170% higher than those from the coal burner, and 414% higher than those of the natural gas burner at the Chesterfield plant:



Virginia Should Determine the Net Emissions from Varying Feedstocks

In some cases, stack emissions from burning forest-derived biomass fuels can be discounted over time to account for the alternative fates of the woody materials. For this analysis we recommend that Virginia choose a timeframe that extends to the year 2030, which is the timeframe underlying the Virginia carbon cap plan.[32] This timeframe is critical from both a scientific and policy perspective. The potential impact of CO2 emissions in the short term on climate tipping points have been shown to be significant,[33] and limiting temperature increase to 2°C above pre-industrial levels requires immediate greenhouse gas emissions reductions. For example, Ricke and Caldeira (2014) found that the median time between an emission and maximum warming is 10.1 years.[34] Carbon emissions reductions must therefore be realized within short timeframes – measured in years, not decades - that are relevant to Virginia's 2030 climate policy imperative and broader international carbon reduction goals.

[32] State Air Pollution Control Board, VA Cap Policy Assumptions, Carbon Dioxide Trading Program (Rev. C17) Proposed Regulation, November 16, 2017

[33] Executive Office of the President of the United States, *The Cost of Delaying Action to Stem Climate Change,* 2014.

[34] Ricke, R. L. and K. Caldeira, 2014. *Maximum Warming Occurs About One Decade After a Carbon Dioxide Emission,* Environ. Res. Lett. 9 124002.

<u>Forest derived residues that would otherwise decay:</u>

When wood decomposes, it releases CO_2. Forest-derived “residues” (for example, branches and tops from harvest operations) that decompose on site release “decay emissions.” These emissions would be avoided if the material were used instead as fuel for electricity. However, these decay emissions are not instantaneous; they occur over a time period specified by the woody material’s rate of decomposition. Nevertheless, stack emissions can reliably be adjusted to determine the ***net increase,*** after some time period has elapsed, from burning the feedstock, accounting for decay emissions.

<u>Onsite waste that would otherwise be burned in an industrial setting without energy recovery:</u>

Similarly, true “waste” materials that would otherwise be burned at industrial facilities without energy recovery (for example, lack liquor at pulp mills or bark/sawdust at sawmills) can be burned to produce electricity. While this electricity generation produces stack emissions, many parties agree that these “alternate fate” emissions should be considered when determining *net* emissions. For facilities burning black liquor or other materials where the alternative fate is unquestionably incineration without energy recovery, the difference between direct stack emissions (combustion for electricity) and the alternative fate emissions (also combustion) is typically zero.

Moreover, true industrial wastes are customarily burned at the facility generating the electricity. These conditions allow the Commonwealth to determine with a reasonable degree of confidence that the net carbon benefits are contemporaneous, occur onsite, can be reported relatively easily, and verified at the electricity generating unit (EGU) if necessary.

<u>Whole trees, boles, and large diameter materials that would otherwise have a merchantable end-use:</u>

Carbon from whole trees and boles that are merchantable – for example as paper, OSB/engineered wood, or lumber - is sequestered in long-lived end uses. Burning these feedstocks instead produces instantaneous stack emissions. Therefore, net emissions from biomass-burning facilities utilizing these types of feedstocks are demonstrably equal to stack emissions over the time period through 2030.

Biomass proponents argue that these stack emissions can be mitigated in the future when new forests regrow on the harvested land. However, a host of research has demonstrated that there is uniformly a significant delay between combustion and the purported mitigation, during which time carbon emissions persist in the atmosphere.

A well-established body of peer-reviewed scientific analyses shows that burning trees and other large diameter materials for electricity creates a carbon debt for a period ranging from

35 to more than 100 years, even accounting for forest regrowth and avoided fossil fuel use.[35] Even assuming forest regrowth, net carbon emissions from these feedstocks do not result in contemporaneous or timely emissions reductions from affected EGUs, and will not generate emissions reductions within a timeframe consistent with Virginia's carbon reductions objectives.

Proposed Method for Calculating Net Emissions

Because the net emissions of forest-derived feedstocks vary significantly, the Commonwealth should promulgate net emissions factors associated with each of the three feedstock classes. Below we propose a simple approach for Virginia to determine the net emissions for: (i) industrial and mill waste; (ii) forest-derived residues from forestry operations; and (iii) whole trees and other large diameter boles that would otherwise be merchantable for long-lived end uses.

Virginia has at its disposal a simple method to calculate net emissions developed by the Partnership for Policy Integrity and published in Environmental Research Letters.[36] The accompanying emissions accounting tool is a simple Microsoft Excel spreadsheet model that estimates alternative fate emissions through time.

The method allows policymakers to determine net carbon impacts of distinct feedstocks and to adjust emissions allowances for covered biomass-burning facilities. For this analysis, we recommend that Virginia choose a timeframe extending to the year 2030, in line with the policy assumption underlying the Virginia carbon cap plan.[37]

Step 1: Calculate cumulative "net" emissions

The cumulative net emission is the difference between the CO_2 combustion emissions at the stack and the "alternate fate" of the carbon, analyzed over a specified time period - in this case, through 2030. This difference represents the net additional CO_2 that was emitted by burning

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[35] Mitchell, S., Harmon, M., and O'Connell, K., *Carbon Debt and Carbon Sequestration Parity in Forest Bioenergy Production*, GCB Bioenergy, May, 2012.
Colnes, A., et al., *Biomass Supply and Carbon Accounting for Southeastern Forests*, The Biomass Energy Resource Center, Forest Guild, and Spatial Informatics Group, February 2012 www.biomasscenter.org/images/stories/SE_Carbon_Study_FINAL_2-6-12.pdf
Hagan, J., *Biomass Energy Recalibrated*, The Manomet Center for Conservation Sciences, January 2012. http://magazine.manomet.org/winter2012/biomass.html
Walker, T., et al., "Biomass Sustainability and Carbon Policy Study," Manomet Center for Conservation Sciences, June 2010, www.mass.gov/eea/docs/doer/renewables/biomass/manomet-biomass-report-full-hirez.pdf.
Schulze, E. D., C. Körner, B. E. Law, H. Haberl and S. Luyssaert. 2012. *Large-scale Bioenergy from Additional Harvest of Forest Biomass is Neither Sustainable nor Greenhouse Gas Neutral*. GCB Bioenergy: 4(6): 611-616.
Stephenson, A. L., and MacKay, D., *Life Cycle Impacts of Biomass Electricity in 2020: Scenarios for Assessing the Greenhouse Gas Impacts and Energy Input Requirements of Using North American Woody Biomass for Electricity Generation in the UK*, UK Department of Energy and Climate Change, July 2014. www.gov.uk/government/uploads/system/uploads/attachment_data/file/349024/BEAC_Report_290814.pdf
Ter-Mikaelian, M., et al., *Carbon Debt Repayment or Carbon Sequestration Parity? Lessons from a Forest Bioenergy Case Study in Ontario, Canada,* GCB Bioenergy, May 2014.
[36] Booth, M., *Assessing the net emissions impact of residues burned for bioenergy*, February, 2018. http://iopscience.iop.org/article/10.1088/1748-9326/aaac88/meta
[37] State Air Pollution Control Board, VA Cap Policy Assumptions, Carbon Dioxide Trading Program (Rev. C17) Proposed Regulation, November 16, 2017

the wood for electricity.

In the case of industrial waste/residues that would otherwise be burned without energy recovery, the stack emissions equal alternative fate emissions; the difference is zero and therefore cumulative net carbon emissions are equal to zero.[38]

In the case of materials that are merchantable for long-lived end uses, the alternative fate emissions are zero as the carbon is stored for periods far greater than the 2030 timeframe considered under the Virginia plan. Therefore, the net emissions (represented as the direct stack emissions minus the alternative fate emissions) are equal to the direct stack emissions themselves from combustion for electricity.

In the case of forest-derived woody residues that would otherwise decay, the decomposition emissions over time are calculated in the spreadsheet using decay-constants specific to woody material in the Southeastern US from the literature or provided by the Environmental Protection Agency (EPA). In the calculation below, we assume a decay-constant of 0.0625, which represents the average of softwood (0.057) and hardwoods in the region (0.082).[39] The "net emissions" curve over time is the difference between direct stack emissions and these decay emissions, represented by the blue line in the figure below.

Step 2: Calculate the ratio of cumulative net emissions to cumulative total stack emissions, over time.

For forest harvest residues, that ratio is illustrated by the dashed line in the figure below, designated as Net Emissions Impact (NEI). The NEI is a percentage: it measures the percent of the total stack emissions that persists in the atmosphere after a given time period.

Step 3: Evaluate the NEI at a specific time:

As discussed above, we recommend that Virginia choose a timeframe to the year 2030 – the policy assumption underlying the Virginia carbon cap plan.[40] Assuming a start date of 2019 or 2020 for the carbon trading program, reading the NEI from the graph below at year 10 produces a NEI of approximately 0.695 for forest-derived residues that would otherwise decay. (See Figure 8 below.) This means that approximately ten years after the onset of combustion (by the year 2030), about 70% of the stack emissions still represent a net increase in atmospheric carbon loading.

[38] This analysis assumes that the stack emissions from biomass is equal to those from coal, which is a generally supported estimate.
[39] United States Environmental Protection Agency, 2014
[40] State Air Pollution Control Board, VA Cap Policy Assumptions, Carbon Dioxide Trading Program (Rev. C17) Proposed Regulation, November 16, 2017

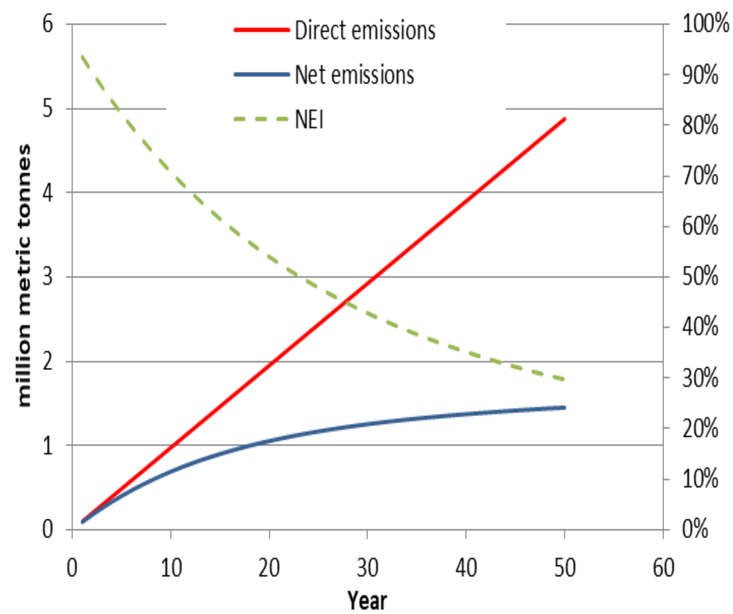

Figure 8 (Source: Partnership for Policy Integrity)

In sum, the Commonwealth should promulgate biomass emissions factors for three categories of forest-derived biomass. Based on the NEI considerations above:

(i) CO_2 emissions from onsite waste that would otherwise be burned in an industrial setting without energy recovery would require approximately zero allowances for each ton of carbon emitted;

(ii) CO_2 emissions from forest harvest residues that would otherwise decay would require approximately 0.69 allowances for each ton of carbon emitted;

(iii) CO_2 emissions from whole trees, boles, and large diameter materials that would have a merchantable end-use, including pulp, paper, fiberboard, engineered wood or lumber would require approximately 1.0 allowances for each ton of carbon emitted.

In addition, Virginia should require EGUs to furnish an estimate to DEQ of the proportion of their total forest-derived feedstocks annually that fall into these categories. Category (i) industrial wastes should only be certified by industrial facilities. Since many industrial facilities use only black liquor and other mill residues as their sole source of forest-derived materials (which are presumed to be incinerated if not burned for energy), this provides an effective "industrial exemption" in the carbon trading program, but one that is based on a scientific and explainable rationale.

For utility sector biomass-burning power facilities greater than 25 MW, both dedicated facilities and those that co-fire with biomass, EGUs should report to DEQ an estimate of the fraction of total forest-derived feedstock that is comprised of Category (ii) materials [forest residues] and Category (iii) materials [merchantable trees/boles]. In the event an EGU uses a *de minimis* amount of Category (iii) merchantable tree feedstocks, their total emissions can be treated as Category (ii) forest harvest residues.

Virginia Must Reject "Sustainable Forestry" as a Proxy for Carbon and Climate Impacts of Forest-derived Biomass

"Sustainability", however defined, is not a measure of carbon impacts. In other words, the concept or designation says very little, if anything, about the amount of CO_2 emitted by a given biomass source or the net effect of those emissions on atmospheric CO_2 concentrations over time. Below we assess two commonly cited instances in which sustainability is erroneously equated with "carbon neutrality."

(a) Best management practices (BMPs), forest certifications, and other "sustainable forestry" regimes.

Sustainable forestry is based on ecological and management considerations, not carbon accounting. Even if fully specified to include considerations of forest growth and removals, sustainability criteria will fail to fully account for changes in carbon emissions, and cannot be justified scientifically as a proxy for carbon accounting.

According to a recent summary in the *Journal of Forestry*:

> *An assumption that bioenergy harvesting in forests managed on a sustained yield (also called sustainable yield) basis does not create a carbon deficit is one of the most common errors in forest bioenergy accounting…Stating that sustained yield management is carbon neutral is incorrect because it fails to account for the case involving no harvest for bioenergy in the reference fossil fuel scenario.*[41]

As such, an established "sustainable forestry" certification regime or best management practice, while plausibly beneficial for ecosystems and wildlife protection, cannot be treated as providing evidence that biomass harvested for energy production is carbon-beneficial. Carbon accounting is the only defensible means to determine carbon benefits.

(b) Reference point accounting.

Reference point accounting monitors carbon stocks over time across some pre-defined region, independent of the specific activities (logging, burning, emissions, etc.) that take place within that region. Under this approach, biomass harvested in regions where overall forest

[41] Ter-Mikaelian, M., S. J. Colombo, and J. Chen. *The Burning Question: Does Forest Bioenergy Reduce Carbon Emissions? A Review of Common Misconceptions About Forest Accounting.* Journal of Forestry, 113(1): 57-68.

stocks are increasing is deemed carbon beneficial.

Such logic is erroneous an insupportable. Regional rates of forest growth simply cannot detect, quantify, or reflect the carbon emissions from an individual biomass-burning facility. The simplest way to understand this logical flaw is to imagine a biomass-burning EGU sited in a region where overall forest stocks are increasing, then that same EGU using the same feedstocks sited in a region where overall stocks are decreasing. Under the reference point accounting approach, the EGU in the first scenario would be considered to have zero stack emissions, but not in the latter. Such an accounting method fails a basic test of logical consistency. It also decouples carbon emissions outcomes from the single most impactful factor: the EGUs choice of what biomass feedstocks to burn for bioenergy production. This significantly dampens incentives for biomass-burning EGUs to move away from sourcing known high-carbon sources of biomass and towards lower carbon sources.

Reference point accounting was roundly rejected by the U.S. EPA's own Scientific Advisory Board in its first assessment of the agency's Framework for Biogenic CO_2 Emissions, and its position has not changed since then:

> *The choice of a fixed reference … implies that forest biomass emissions could be granted an exemption simply because the location of a stationary facility is in an area where forest stocks are increasing. The reference point estimate of regionwide net emissions or net sequestration does not indicate, or estimate, the difference in greenhouse gas emissions (the actual carbon gains and losses) over time that stem from biomass use. As a result, [it] fails to capture the causal connection between forest biomass growth and harvesting and atmospheric impacts and thus may incorrectly assess net CO_2 emissions of a facility's use of a biogenic feedstock.*[42]

A recent report by the Chatham House, a distinguished UK think tank with a history of independent and rigorous research, reached the same conclusion:

> *It is often argued that biomass emissions should be considered to be zero at the point of combustion because carbon has been absorbed during the growth of the trees, either because the timber is harvested from a sustainably managed forest, or because forest area as a whole is increasing (at least in Europe and North America).*
>
> *These arguments are not credible. They ignore what happens to the wood after it is harvested (emissions will be different if the wood is burnt or made into products) and the carbon sequestration forgone from harvesting the trees that if left unharvested would have continued to grow and absorb carbon. The evidence suggests that this is*

[42] U.S. Environmental Protection Agency, Scientific Advisory Board, Biogenic Carbon Emissions Panel, *Review of EPA's Accounting Framework for Biogenic CO2 Emissions from Stationary Sources*, September, 2011. http://yosemite.epa.gov/sab/sabproduct.nsf/0/57B7A4F1987D7F7385257A87007977F6/$File/EPA-SAB-12-011- unsigned.pdf

true even for mature trees, which absorb carbon at a faster rate than young trees.[43]

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Conclusion

One in five states in America are already well underway with similar mechanisms to the one proposed by DEQ. NRDC anticipates that if the DEQ adjusts the final rule to 1). Reflect the lower emissions of 28.0 million tons we can expect in Virginia in 2020; 2). Allocate carbon allowances to distribution companies to maximize consumer benefits, and 3). Include whole-tree woody-biomass emissions under the carbon limit, that Virginia will see similar economic and environmental success under the proposed program.

[43] Brack, D., *Woody Biomass for Power and Heat: Impacts on the Global Climate,* Chatham House, The Royal Institute of International Affairs, February 2017.