Report of the Biomass Advisory Panel

12/30/2024

www.DOF.Virginia.gov
900 Natural Resources Drive, Suite 800, Charlottesville, VA 229003
(434) 977-6555; VDOF@DOF.Virginia.gov

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Executive Summary

In the 2023 General Assembly session, House Bill 2026 (HB2026) directed the Virginia Department of Forestry (DOF) to convene an advisory panel to examine the use of biomass for electricity generation in the Commonwealth and submit a report of the panel's findings and recommendations to the General Assembly.

The Biomass Advisory Panel (BAP) was directed to consider biomass energy policies in other states, potential forest benefits from using biomass, the availability of biomass material for utilization, technological advances related to biomass energy generation, along with a life-cycle carbon analysis (LCA) of woody biomass utilization. DOF contracted with the University of Virginia School of Engineering and Applied Sciences to conduct the LCA.

The analysis of energy policies in the other PJM member states indicates that most states treat forest biomass as a renewable energy source. DOF provided information on the forest health benefits associated with the utilization of woody biomass. Biomass markets currently provide direct and indirect benefits for forest health and have the potential to provide greater benefits if they were expanded. DOF also provided information on the availability of woody biomass material. Forest inventory data indicates that there is considerable additional biomass material produced in the forest annually. This report does not indicate any technological advancements that will alter woody biomass generation in the near term.

The LCA evaluated the atmospheric carbon impacts of woody biomass utilization by first modeling the current situation with the three Dominion Energy power plants (located in Altavista, Hopewell and Southampton) continuing to operate. This baseline scenario showed that the net atmospheric carbon levels associated with the operation of the biomass plants was negative (less carbon released into the atmosphere) largely because the carbon sequestration from forest growth outweighed all other parameters.

The LCA then modeled several alternative scenarios to examine what would happen if the three facilities did not operate and this analysis required significant assumptions. Critical assumptions included the fate of timber harvest residuals including limbs, treetops, and tree trunks. These materials could be left to decay or burned on site, and some could be used for alternative forest products. The difference in carbon impacts from these processes reflect differences in rates at which harvested materials are decomposed back to the atmosphere. The carbon balance is strongly influenced by what fraction of harvested materials is used to create durable wood products versus consumed to produce bioelectricity. Another scenario considered was the potential for forestland to be converted to non-forest use after harvest.

Consideration of foregone sequestration – the loss of future sequestration that would have occurred if a tree was not cut down – was specifically called for in the legislation. A separate analysis was performed to examine the magnitude of foregone sequestration compared to the other parameters. Foregone sequestration was found to be positive – associated with more carbon being released – but smaller in magnitude relative to the forest ecosystem flux values.

Two scenarios were included to model the source of electricity generation that would replace the electricity currently coming from biomass. One was the current mix of power being used in Virginia minus biomass and the second assumed that electricity generation will follow the mandates in the Regional Greenhouse Gas Initiative (*RGGI) and the VCEA.

Assumptions are critical to this type of analysis and differing assumptions can significantly alter the outcome. Members of the advisory panel represented a range of perspectives, and it was not always possible to reach consensus on model parameters. The model approach did account for alternative viewpoints by including

*****_The State Air Pollution Control Board voted to adopt the regulation repeal to remove the Commonwealth of Virginia from RGGI at its [June 7, 2023 meeting](). The [final regulation repeal]() was published in the Virginia Register on July 31, 2023._

multiple scenarios and by running sensitivity analyses. While there are differences of opinion on various parameters this LCA model tested multiple assumptions and represents one viable analysis conducted according to established methodologies.

The LCA results show that all modeled scenarios result in less carbon in the atmosphere, with continued operation of the biomass facilities or without. Combustion of woody biomass for electricity does increase carbon emissions, particularly in the short term. The LCA shows that emissions would be higher over the long term if roundwood makes up a significant portion of the woody biomass mix, which is not a common practice in Virginia.

There are multiple sources of data that show Virginia's forests sequester and hold a vast storehouse of carbon. Many decades of forest growth happened as the result of the active management of more than 400,000 private landowners in response to available markets. The health of the forests that store this carbon pool is now at risk from multiple threats. These forest health threats include invasive plants, exotic insects and diseases, changing weather patterns, lack of natural fire regimes, land conversion and fragmentation.

Intentional management is needed to create the conditions that are missing from our forests to make them more resilient. Removing the right trees in a responsible manner can create conditions that our forests require for desirable regeneration. Markets for low-value forest materials provide an incentive for landowners to invest in forest protection and restoration. There is no historical precedence in Virginia to indicate that the loss of markets for sustainably sourced forest products will improve forest health.

The LCA demonstrates the potential to reduce atmospheric carbon by increasing the health and productivity of our forests. Biomass energy production provides a low-cost means for forest landowners to implement practices that will improve the health, productivity and resilience of our forests.

Chapter 1 – Introduction and Overview

In the 2023 General Assembly session, House Bill 2026 (HB2026) and Senate Bill 1231 (SB1231) amended the Virginia Clean Economy Act (VCEA) to enable woody biomass to continue to be used as a source of electric power generation in Virginia and for specific biomass energy facilities to be included as eligible sources in the renewable energy standard. Those three facilities are Dominion Energy's Hopewell, Southampton and Altavista plants. This legislation reflects the importance of biomass energy as a market for residual woody material from timber harvesting and from forest products manufacturing and addresses the need to ensure that woody biomass is produced and utilized sustainably. One key factor to be considered is the effect these three plants have on atmospheric carbon levels.

Purpose and Background

The legislation directs the Virginia Department of Forestry (DOF) to convene an advisory panel to examine a range of elements related to the use of biomass for electricity generation, including a life-cycle carbon analysis (LCA), and to submit a report of the advisory panel's findings and any recommendations to the General Assembly by Dec. 1, 2024. This report is submitted in response to that legislative mandate.

The same legislation also directed DOF to develop best management practices (BMPs) for the sustainable harvesting of biomass. For the biomass-fueled electric generation to qualify under the Renewable Portfolio Standard and be eligible for the sale of renewable energy credits, the biomass must be harvested in compliance with these biomass BMPs. The legislation directed that the BMPs include an LCA, developed in coordination with the Virginia Department of Environmental Quality (DEQ) and relevant stakeholders, that includes all carbon emissions, including supply chain emissions, forgone sequestration, and the emissions from burning biomass resources for electricity generation. Working with the advisory panel consisting of stakeholders, DOF was able to characterize the various elements of the LCA at a high level.

The Biomass BMPs and summary of the high-level LCA was distributed in December of 2023. Based on stakeholder concern regarding the operability of the proposed BMPs, these were revised in 2024. The current Biomass BMPs took effect on July 1, 2024. (Best Management Practices (BMPs) For the Sustainable Harvesting of Biomass)

Report Elements

The Biomass Advisory Panel (BAP) was convened to examine the following factors related to the use of woody biomass for electricity generation:

1. policies in the southeastern U.S. and other states participating in the PJM regional transmission organization interchange as they relate to the use of biomass for electricity generation;
2. potential benefits for the Commonwealth's hardwood forest health as a result of using biomass resources for electricity generation;
3. the amount of forest-related materials, agricultural-related materials, and solid woody waste materials that can be sustainably consumed annually without disrupting existing markets;
4. consideration of technological advances in biomass energy generation;
5. and a LCA analysis, developed in coordination with DEQ and relevant stakeholders, that includes all carbon emissions, including supply chain emissions, forgone sequestration, and the emissions from burning biomass resources for electricity generation.

Biomass Advisory Panel Members

Robert Farrell, State Forester, Virginia Department of Forestry
Terry Lasher, Assistant State Forester, Virginia Department of Forestry
Mike Dowd, Virginia Department of Environmental Quality
Thomas Ballou, Virginia Department of Environmental Quality
Ava Lovain, Virginia Department of Environmental Quality
Larry Corkey, Virginia Department of Energy
Brent Hughes, Virginia Department of Energy
Elizabeth Willoughby, Dominion Energy
Christina Rodi-Hager, Dominion Energy
Michael Davis, Northern Virginia Electric Cooperative
Corey Conners, Virginia Forestry Association
Kyle Shreve, Virginia Forestry Association (Advantus Strategies)
Blair St. Ledger-Olsen, Virginia League of Conservation Voters
Scott Barrett, Virginia Tech, College of Natural Resources and the Environment
Martha Moore, Virginia Farm Bureau
Rachel Henley, Virginia Farm Bureau
Susan Seward, Virginia Forest Products Association (Seward Consulting)
Lesley Moseley, Virginia Forest Products Association
Ron Jenkins, Virginia Loggers Association
Brad Copenhaver, Virginia Agribusiness Council (Meadowview Strategies)
David Carr, Southern Environmental Law Center
Josephus Almond, Southern Environmental Law Center
Judy Dunscomb, The Nature Conservancy
Nikki Rovner, The Nature Conservancy

Participants

Travis Rickman, Office of the Secretary of Agriculture and Forestry
Amanda Davis, Virginia Department of Forestry
Zoe Bergman, Virginia Department of Forestry
Jennifer Leach, Virginia Department of Forestry
Ember Jenison, Virginia Department of Forestry
Rabita Reshmeen Banee, Department of Energy
Edward Cronin, Department of Energy
Ava Lovain, Virginia Department of Environmental Quality
Molly Parker, Dominion Energy
Elizabeth Gayne, Dominion Energy
Sabina Dhungana, United States Forest Service
Kara Alley, Spotts Fain
Zach Jacobs, Virginia Farm Bureau
Kiara Winans, Virginia Tech

Request for Proposals

To accomplish the carbon LCA, DOF issued a Request for Proposals in February of 2024. DOF received two qualified responses and awarded the contract to Dr. Lisa Colosi Peterson of the University of Virginia's (UVA) Life-Cycle Analysis (LCA) Lab at the Department of Civil and Environmental Engineering. Dr. Peterson is the founding director of UVA's LCA Lab. Dr. Peterson was assisted in this project by Ms. Nafisa Ahmed, a PhD student in environmental engineering at UVA. Her dissertation focuses on climate impacts of bioenergy technologies, most notably biochar and bioenergy with carbon capture and storage. Abigail Van Eerden, an undergraduate student at UVA contributed to the LCA as well as content for this report.

The BAP held six in-person meetings at DOF Headquarters in Charlottesville, with virtual attendance provided for each meeting as well. (Seven meetings were originally planned, but the July meeting was dropped from the schedule.)

Meeting 1: May 31 – Introduction of the LCA contractor, Dr. Lisa Colosi Peterson, from the University of Virginia, and an overview of the process, report elements and meeting schedule.

Meeting 2: June 18 – Overview and discussion of the LCA framework and approach to the LCA.

Meeting 3: Aug. 23 – Discussion of the draft data, results and progress to date.

Meeting 4: Sept. 20 – Review of shared documents, placeholder LCA results, an update on the other report elements, and a review of the overall project timeline.

Meeting 5: Oct. 4 – Review of the previous meeting, as well as responses to specific stakeholder comments and questions. Updates to LCA modeling, anticipated changes to future drafts, and overall draft status.

Meeting 6: Oct. 21 – Final meeting to review the revised LCA report.

Relevance of Woody Biomass as an Energy Source

Forests cover 62% of Virginia and 80% of these forests are privately owned, reflecting the collective stewardship of over 400,000 landowners. As an industry, forestry accounts for more than 108,000 jobs with an economic impact of over $23 billion. Woody biomass utilized for electricity generation represents a small part of the overall forest economy. Per unit, woody biomass is the least valuable forest product in the marketplace. However, woody biomass consumed by the three Dominion facilities does play an important role in forestry in Southern Virginia. The market for woody biomass enables loggers to remove trees at no cost to the landowner, facilitating forest management practices that would otherwise represent a considerable expense to the landowner. Much of the forest management work that needs to be accomplished to improve the health and resilience of our forests depends on markets like this for low-value, unmerchantable or invasive trees. This market has also greatly reduced the need for open burning of forest residuals to prepare for reforestation. While it is not included in this report, sawmills also rely on the biomass market to dispose of byproducts, such as wood chips and shavings, which they must dispose of to keep operating. Biomass energy accounts for less than 5% of Virginia's electricity supply but it does provide a dispatchable energy source that does not release stored carbon from fossil fuels. Given the anticipated growth in demand for electricity, biomass provides one more option in an all the above energy policy. Perhaps less important in Virginia where we have reliable transportation, woody biomass provides the ability to store considerable amounts of fuel at the power plant at very low risk.

Biomass energy also provides an economic contribution to the Commonwealth. From a recent report: "In Virginia, the wood-based biomass power generation industry directly employed 188 people and generated $183 million in direct output to the state's economy in 2017. Including ripple effects, the industry created a total of 2,049 jobs and contributed $395 million in total output to the state's economy." (Economic Contributions of Wood-based Biomass Power Generation Industries in Virginia, Pokharel et al., 2022)

While woody biomass is a plentiful, sustainable, renewable resource, burning it for electricity does release carbon back into the atmosphere. The purpose of the advisory panel was to examine the atmospheric carbon impacts from woody biomass along with related issues. Determining the carbon impacts of the continued operation of the three Dominion facilities requires first estimating the current carbon impacts. Then follows the real challenge of making assumptions about how forestry practices would change in the absence of this market for biomass. Also, how the electricity would be produced to replace the biomass power must also be considered. Finally, all these factors must be projected into the future to estimate the long-term effects.

Chapter 2 – Regional Biomass and Energy Generation Policies

HB2026 directs the BAP to look at policies in the southeastern U.S. and other states participating in the Pennsylvania-New Jersey-Maryland (PJM) Interconnection as they relate to the use of biomass for electricity generation. This review also helps to determine appropriate alternative energy supply scenarios for the LCA.

The PJM Interconnection is a regional transmission organization that orchestrates the transmission of electricity between 13 states (Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia) in the Mid-Atlantic, as well as the District of Columbia (D.C.).

The PJM enables interstate transmission of electricity, meaning the electricity generation portfolio of each member state contributes to the electric portfolio of the PJM as a whole. While not possible to determine which state provided electricity to another state in the PJM, the policies and legislation from each member state can inform and parameterize possible alternative energy scenarios. This is due to the electricity generation being bid into the PJM energy market, which follows the ups and downs of energy load needs to ensure estimated capacity needs are constantly met. However, determining the exact energy generation source cannot be extrapolated.

While it may be possible to determine the current makeup of the participating states based off data provided by the PJM Interconnection, it would be more challenging to predict the future mix of electricity sources.

The energy policies of the 13 PJM states were assessed for the following elements.

Renewable Portfolio Standard (RPS)

Legislation in nine out of 13 member states have established an electric portfolio standard, generally referred to as “Renewable Portfolio Standard” (RPS). Generally speaking, an RPS establishes a schedule that electricity providers must follow, while defining the amount of electricity sold to customers that must come from renewable or clean resources defined by the respective states.

Some states also have a Solar Renewable Portfolio Standard (SRPS).

Renewable Energy Credits (RECs)

Within an RPS, electric providers must generate or acquire a specific number of Renewable Energy Credits (RECs) each year. One REC equates to one megawatt-hour (MWh) of electricity generated via a qualifying renewable or clean resource. To meet RPS requirements, a utility must demonstrate that a specific percentage of its electricity comes from renewable energy sources, which is represented by the retirement of a REC.

Compliance Fees

Each year, commission-regulated utilities and municipal electric companies are allocated a certain number of RECs or Solar Renewable Energy Credits (SRECs). Submission of either indicates the entity has complied with portfolio standards. If a commission-regulated utility or municipal electric company fails to comply with the renewable energy or solar photovoltaic profile standards, meaning they have remaining RECs or SRECs, they must pay a compliance fee. This means they can compensate for the remaining percentage of eligible energy by paying the correlating compliance payment.

While the structure above can apply generically to most RPSs, each RPS has its own details that define which electricity providers and customers the schedule applies to, what qualifies as a renewable/clean resource, whether resources must be harvested in a sustainable or efficient way to be considered renewable/clean (the manner resources are harvested can increase or decrease the embodied emissions of the electricity), what the compliance fee is if a electricity provider fails to adhere to the schedule, and any instances which would allow for a supplier to deviate from the schedule.

These details, especially the definition of what qualifies as a renewable or clean resource, gives insight to what surrounding states consider to be a qualified, improved alternative, in terms of greenhouse gas emissions, to non-renewable energy resources. This information also provides further detail to what types of renewable resources will constitute each states' electric portfolios, which is important as different renewables have different carbon intensities.

While the PJM Transmission is a helpful boundary to evaluate the energy policies of its member states to inform possible alternative energy scenarios, RGGI is another organization that has had implications on Virginia electric generation emissions. RGGI is a "cooperative regional effort among…states to reduce carbon dioxide (CO_2) emissions from power plants within each participating state." RGGI requires a 30% decrease in carbon emissions by 2030. It is important to note that the State Air Pollution Control Board voted to adopt the regulation repeal to remove the Commonwealth of Virginia from RGGI at its June 7, 2023 meeting. The final regulation repeal was published in the Virginia Register on July 31, 2023.

Energy Policies by State

Delaware

Legislation

Subchapter III A of Title 26, otherwise known as the Renewable Energy Portfolio Standards Act, established Delaware's RPS in 2005. The RPS requires commission-regulated utility or municipal electric companies' retail electricity sales (except those to customers over 1,500 MW) to have a minimum cumulative percentage of 40% of electricity from eligible energy resources in the year 2035.

The SRPS establishes a required cumulative percentage of electricity generated from solar photovoltaics, which culminates to 10% in the year 2035. The legislation calls for continuing establishment of minimum percentages of electricity from eligible energy sources and solar photovoltaics by the Delaware Public Service Commission, for 2036 and subsequent years. These standards apply to the retail sales of commission-regulated utilities and municipal electric companies owned within the State of Delaware, but these entities can fulfill the RPS and SRPS requirements from energy sources located within, or imported into, the PJM region. RECs are allocated to commission-regulated utilities and municipal electric companies every year.

Eligible Energy Resources

These include power from wind, solar, oceans, geothermal steam engines, fuel cells powered by renewable energies, gas from the anaerobic digestion of organic material, hydroelectric engines (30 Gigawatts (GW) or less), biomass that is sustainably cultivated and harvested (as determined by the DNREC) and not used in a waste-to-heat facility, and methane gas captured from landfills.

Compliance

Compliance payment is equal to $25/MWh deficiency ($0.025/kilowatt-hour (kWh) deficiency) for the RECs, and $150/MWh deficiency ($0.15/kWh -hour deficiency) for the SRECs. These payments are made to the Delaware Green Energy Fund. If a commission-regulated utility or municipal electric company is paying for more than 15% of their RECs for two consecutive years, then the following year the entity must only comply to the RPS or SRPS minimum percentage requirement of the immediately preceding year until the entity pays for less than 15% of its RECs or SRECs. This policy ensures the compliance cost does not fall on the consumers. The legislation includes a plan for a PJM-wide distribution of RECs and SRECs and establishes credits issued by the PJM Interconnection (General Attribute Tracking System) may be eligible to satisfy the requirements of the Delaware RPS and SRPS.

Washington D.C.

Legislation

Chapter 14A of the Code of the District of Columbia (D.C.) established in the RPS and SRPS in 2005. The RPS requires 100% of retail electricity sales in 2041, and all subsequent years, to be powered by Tier I renewable resources. The legislation required Tier II renewable resources to drop to 0% in 2020, leaving room for non-renewable resources to constitute part of the electric makeup of retail sales of electricity until 2041, when Tier I makes up 100% of retail sales of electricity.

A separate schedule, a SRPS, exists for a required cumulative percentage of electricity generated from solar photovoltaics, which culminates to a minimum of 15% in the year 2041 and all subsequent years.

Eligible Energy Resources

The legislation divides energy up into Tier I and Tier II renewable sources. "Tier I renewable sources" includes power from solar, wind, "qualifying biomass" used at a generation site that reaches at least 65% efficiency after a year of operation and was opened after Jan. 1, 2007, methane from anaerobic decomposition at a landfill or wastewater treatment facility, geothermal, ocean, fuel cells producing energy from a Tier I resource, and raw or treated wastewater.

"Qualifying biomass" includes mill residue, slash, brush, yard waste, a waste palette, crate, or dunnage, tree crops, vineyard materials, grain, legumes, sugar, other crop by-products or residues, and co-fired biomass. It excludes old growth timber, construction and demolition-derived wood, whole trees not part of a closed-loop biomass system that are cleared solely for the purpose of energy production, unsegregated solid waste, and post-consumer wastepaper.

Retail electricity selling of one (1) MWh of electricity generated via one of these resources is equal to one REC.

"Tier II renewable sources" includes power from hydroelectric other than pumped storage generation, waste-to-energy, qualifying biomass used at a facility that started generation on or before Dec. 31, 2006, achieves total system efficiency of less than 65%, or uses black liquor. By excluding Tier II renewable resources starting in 2020, electricity generated at biomass facilities that began operating on or before Dec. 31, 2006, that do not reach a total system capacity of at least 65%, or that use black liquor, is no longer eligible to satisfy the RPS.

The RPS and SRPS apply to all D.C. retail electricity sales. The electricity allocated to satisfy the requirements of the RPS and SRPS can be generated by a Tier I (or Tier II before 2020) renewable source located within the PJM Interconnection region or, until Jan. 1 2029, a Tier I (or Tier II before 2020) renewable source located within a state that is adjacent to the PJM Interconnection region that was certified by the Commission as of March 22, 2019.

Compliance

In Washington D.C., this amount is equal to $0.05/kWh deficiency for a Tier I renewable source, $0.01/kWh for a Tier II renewable source, and $0.48/kWh - deficiency for a SREC in 2024, with this compliance fee slowly dropping to $0.10/kWh deficiency for a SREC in 2042 and all subsequent years. These payments are made to the D.C. Renewable Energy Development Fund.

To the extent practicable, the General Attribute Tracking System of the PJM Interconnection is used to track the fulfillment of the RPS and SRPS.

Illinois

Legislation

Illinois established its RPS in 2001, making it mandatory in 2007 with the Illinois Power Agency Act. The goals of the Act have been amended by legislation in the following years. In 2021, via Senate Bill 2408 (SB2408), otherwise known as the Climate and Equitable Jobs Act, Illinois established a “clean power” goal of reaching 100% clean energy by 2050. Clean power is defined as energy generation that is at least 90% free of carbon dioxide emissions. There is a separate RPS, which regards renewable energy resources, not clean energy. This RPS has less legally binding language than other RPSs, stating that the “long-term renewable resources procurement plan shall attempt to meet the goals for procurement of renewable energy credits at levels of…”

The schedule culminates in no less than 40% by 2030 and each subsequent year. The legislation continues that “the Agency (Illinois Power Agency) shall attempt to procure 50% by delivery year 2040.” Once again, the phrase ‘shall attempt’ is less binding than ‘shall.’

Eligible Energy Resources

Renewable energy resources, which would be eligible to satisfy the requirements of the RPS via RECs, include power from wind, solar thermal energy, photovoltaic cells and panels, biodiesel, anaerobic digestion, crops and untreated and unadulterated organic waste biomass, and hydropower that does not involve new construction or significant expansion of hydropower dams, waste heat to power systems, or qualified combined heat and power systems. Retail electricity selling of one (1) MWh of electricity generated via one of these resources is equal to one REC. SB2408 specifically excludes “tree waste" as a renewable energy resource.

Of the at least 10,000,000 RECs delivered annually by the end of the 2021 delivery year and increasing ratably to reach 45,000,000 RECs delivered annually from new wind and solar projects by the end of delivery year 2030, the legislation calls for 55% of the RECs to be procured from photovoltaic solar and 45% to be procured from wind.

Indiana

Legislation

Indiana has a voluntary Clean Energy Portfolio Standard Program that is set to expire on Dec. 31, 2025, with no plan to renew it. It was established in 2011 by Chapter 27 of the Indiana Code. It calls for at least 10% of the total electricity obtained by the participating “electricity supplier” to meet the energy requirements of its Indiana retail electric customers during the base year to be clean energy.

An electricity supplier is any public utility that sells retail electric service to customers in Indiana as of Jan. 1, 2011. While the electricity supplier can import electricity powered by a clean energy resource, at least 50% of the electricity used to satisfy the Clean Energy Portfolio Standard must be generated within the state of Indiana. This allows for at most 50% of the Clean Energy Credits to be satisfied by out of state electricity generation. This results in less of an incentive for a regional decrease in emissions, and more of an incentive for an in-state reduction of emissions.

However, nuclear electricity that is generated by a customer-owned distributed generation facility that is interconnected to the electricity supplier's distribution system in accordance with the commission's interconnection standards, electricity that is supplied back to the electricity supplier for use in meeting the electricity supplier's electricity demand requirements in accordance with the commission's net metering rules, combined heat and power, and natural gas facilities in Indiana, constructed after July 1, 2011, can only be used to fulfill 30% of the Clean Energy Credits. This means at least 70% of the Clean Energy Credits must be satisfied with the other clean energy resources.

Compliance

If an entity complies with the Clean Energy Portfolio Standards, it can establish a shareholder incentive consisting of the authorization of an increased overall rate of return on equity, not to exceed 50 basis points over a participating electricity supplier's authorized rate of return. This is the incentive for this voluntary Clean Energy Portfolio Standard. There are no compliance fees, since this is not a mandatory program.

Maryland

Legislation

Maryland has a Renewable Energy Portfolio Standard that was founded in 2004 by Maryland Code §7-701. It has an RPS with a separate schedule specifically for solar energy, establishing a schedule culminating in 52.5% of electricity sales at retail in the State to be derived from Tier 1 renewable sources and Tier 2 renewable sources for the year 2030 and every subsequent year. Additionally, it determines that at least 14.5% should be from solar energy by 2030 and every subsequent year. Of the 52.5%, 50% must come from Tier 1 renewable sources, and 2.5% from Tier 2 renewable sources.

These percentages apply to all retail electricity sales in the state by electricity suppliers, except for specific exceptions laid out in the code. For municipal electric utilities, in the year 2022 and every subsequent year, at least 20.4% of sold electricity must come from Tier 1 renewable sources, at least 1.95% from solar energy, and no more than 2.5% from offshore wind energy.

Eligible Energy Resources

“Tier 1 renewable resource” is defined as power from solar energy, including energy from photovoltaic technologies and solar water heating systems; wind; qualifying biomass; methane from the anaerobic decomposition of organic materials in a landfill or wastewater treatment plant; geothermal, including energy generated through geothermal exchange from or thermal energy avoided by, groundwater or a shallow ground source; ocean, including energy from waves, tides, currents, and thermal differences; a fuel cell that produces electricity from a Tier 1 renewable source; a small hydroelectric power plant of less than 30 megawatts in capacity that is licensed or exempt from licensing; poultry litter-to-energy; waste-to-energy; refuse-derived fuel; thermal energy from a thermal biomass system; and raw or treated wastewater used as a heat source or sink for a heating or cooling system. A “Tier 2 renewable source” is defined as hydroelectric power other than pump storage generation.

“Qualifying biomass” is defined as “…a nonhazardous, organic material that is available on a renewable or recurring basis.” This includes mill residue, commercial soft wood thinning, slash, brush, yard waste, a pallet, crate, or dunnage, agricultural and silvicultural sources, including tree crops, vineyard materials, grain, legumes, sugar, and the crop by-products= or residues, gas produced from the anaerobic decomposition of animal waste or poultry waste, a plant that is cultivated exclusively for purposes of being used at a Tier 1 renewable source or a Tier 2 renewable source to produce electricity, and biomass used for co-firing. It does not include old growth timber, which means at least it comes from a forest “5 acres in size with a preponderance of old trees, of which the oldest exceed at least half the projected maximum attainable age for the species” It also must exhibit several of the following characteristics: “shade-tolerant species are present in all age and size class, randomly distributed canopy gaps are present; a high degree of structural diversity characterized by multiple growth layers reflecting a broad spectrum of ages is present; an accumulation of dead wood of varying sizes and stages of decomposition accompanied by decadence in live dominant trees is present; and pit and mound topography can be observed.” Qualifying biomass also does not include sawdust and wood shavings, unsegregated solid waste or post-consumer wastepaper, black liquor, or any product derived from black liquor, or an invasive exotic plant species.

Compliance:

In Maryland, this amount in 2024 is equal to $0.0275/kWh deficiency and in 2035 and every subsequent year is equal to $0.02235/kWh deficiency for every Tier 1 deficiency that is not a solar deficiency.

The 2024 value for a kWh deficiency for solar is $0.06 and the 2030 and every subsequent year value is $0.0225. For Tier 2 kWh deficiencies, the compliance fee is $0.015. These payments are made to the Maryland Strategic Energy Investment Fund.

Michigan

Legislation

The Renewable Energy Standard was established in 2008 by Act 295, also known as The Clean and Renewable Energy and Energy Waste Reduction Act. SB271 of 2023 amended the schedule of the Renewable Energy Standard. The RPS requires all electric providers to have a 60% renewable portfolio in 2035 and every subsequent year. There is a separate Clean Energy Standard, which requires all electric providers to have a 100% clean energy portfolio by 2040 and in every subsequent year.

These standards are mandatory for investor-owned utilities, and voluntary for cooperative utilities, municipal utilities, and alternative electric suppliers. Electricity that is produced within the territory of the regional transmission organization of which the electric provider is a member is eligible to satisfy the Renewable Energy Standard. The PJM Transmission qualifies as said regional transmission organization.

Eligible Energy Resources

Renewable energy resources are defined as “a resource that naturally replenishes over a human, not a geological, time frame and that is ultimately derived from solar power, waterpower, or wind power. Renewable energy resources do not include petroleum, nuclear, natural gas, industrial waste, post-use polymers, tires, tire-derived fuel, plastic, or coal. A renewable energy resource comes from the sun or from thermal inertia of the earth and minimizes the output of toxic material in the conversion of the energy and includes, but is not limited to, all of the following: **biomass** (landfill gas, gas from a methane digester using only feedstock, **trees and wood used in renewable energy systems that are placed in commercial operation, if the trees and wood are derived from sustainably managed forests or procurement systems**), solar and solar thermal energy, wind energy, kinetic energy of moving water (waves, tides, or currents, water released through a dam), geothermal energy, thermal energy produced from a geothermal heat pump, landfill gas produced from solid waste facilities, and municipal wastewater treatment sludge, wastewater, sewage, food waste and food production, processing waste, animal manure, and organics separated from municipal solid waste.”

Similarly to the Renewable Energy Standard Portfolio, the Clean Energy Standard is measured using Clean Energy Credits (CECs) used by an electric provider in a year. CECs are representative of generation of electricity via a clean energy system, which is defined as “an electricity generation facility or system or set of electricity generation systems that generates electricity or steam without emitting greenhouse gas, including nuclear generation, is fueled by natural gas and uses carbon capture and storage that is at least 90% effective in capturing and permanently storing carbon dioxide, is an independently owned combined cycle power plant fueled by natural gas that reduces greenhouse gas emissions using carbon capture and sequestration and other available applications, including, but not limited to, carbon removal technologies.”

New Jersey

Legislation

The RPS was established in 1991 and requires a minimum 50% of all kWh sold in New Jersey by each electric power supplier and each basic generation service provider to be from Class I Renewables by the year 2030. It has a separate requirement for 1.1% of all kWh sold in this state by each electric power supplier and each basic generation service provider to be from solar. The SREC reaches a peak at 5.1% in 2023, but slowly declines to 1.1% in 2030.

A 2018 amendment, Assembly Bill Number 3723, calls for the board to “complete a study that evaluates how to modify or replace the Solar Renewable Energy Credit program to encourage the continued efficient and orderly development of solar renewable energy generating sources throughout the State.”

A Class 1 Renewable Energy is defined as “electric energy produced from solar technologies, photovoltaic technologies, wind energy, fuel cells, geothermal technologies, wave or tidal action, small scale hydropower facilities with a capacity of three MWs or less…, methane gas from landfills, methane gas from a **biomass facility**

provided that the biomass is cultivated and harvested in a sustainable manner, or methane gas from a composting or anaerobic or aerobic digestion facility that converts food waste or other organic waste to energy."

Compliance

In New Jersey, this amount in 2024 is equal to $0.218/kWh deficiency and in 2033 and every subsequent year is equal to $0.128/kWh deficiency for every solar deficiency.

North Carolina

Legislation

The RPS was established in 2007 and requires investor-owned utilities to provide 12.5% renewable energy by 2021. For electric cooperatives, as well as municipal utilities, there is a requirement to provide 10% renewable energy by 2018. There are caveats to the RPS, including a solar-specific requirement of 0.2% solar by 2018, a swine-waste requirement of 0.2% by 2024 for investor-owned utilities, and 0.2% by 2026 for municipal utilities and electric cooperatives.

Electricity generators are allocated a certain number of RECs, the submission of which indicates the entity has complied with the portfolio standards. Eligible energy resources include solar-electric, solar thermal, wind, hydropower up to 10 MWs, ocean current or wave energy, biomass that uses Best Available Control Technology (BACT) for air emissions, landfill gas, combined heat and power (CHP) using waste heat from renewables, hydrogen derived from renewables, electricity demand reduction, or facilities that were built in 2007 or later and are either a nuclear energy facility, including an uprate to a nuclear energy facility, or a fusion energy facility.

Compliance

North Carolina does not have a set compliance fee, but the North Carolina Utilities Commission may set a fee is a utility does not comply.

Ohio

Legislation

The Alternative Energy Resource Standard was established in 2008. HB6, passed in 2019, is the latest amendment. It requires 8.5% of electricity supplies to come from renewable resources by the year 2026. There is no language on a continuing standard after that year. A separate solar schedule also exists, but it has been reduced to 0% required solar from the year 2020 to 2026.

Eligible Energy Resources

"Qualifying renewable resource" is defined as a facility uses or will use solar energy as the primary energy source, has obtained a certificate for construction of a major utility facility from the power siting board prior to June 1, 2019, and is interconnected with the transmission grid that is subject to the operational control of PJM interconnection, LLC, or its successor organization. Nuclear also qualifies. Biomass is considered an 'advanced energy resource' but is not eligible to satisfy a REC.

Compliance

In Ohio, this amount is not permitted to drop below $.045/kWh deficiency.

Pennsylvania

Legislation

The Alternative Energy Portfolio Standard was established in 2004, and plateaued in 2021, requiring Tier 1 energy sources to constitute for 8% of the electric portfolio, and for Tier 2 energy sources to constitute for 10% of the electric portfolio. Tier 1 energy resources include a PV minimum, which remains at 0.5%.

Eligible Energy Resources

Tier 1 energy resources are “new and existing facilities which produce electricity using the following sources/technologies: photovoltaic energy, solar-thermal energy, wind, low-impact hydro, geothermal, biomass, wood pulping and manufacturing byproducts from energy facilities **within the state**, biologically derived methane gas, coal-mine methane, and fuel cells. Tier 2 energy resources are “new and existing waste coal, distributed generation (DG) systems less than 5 MW in capacity, demand-side management, large-scale hydro, municipal solid waste, wood pulping and manufacturing byproducts from energy facilities **located outside the state**, useful thermal energy, and integrated gasification combined cycle (IGCC) coal technology.

Compliance

AECs are tracked by the PJM GATS system. Retail electricity sellers are annually allocated a certain number of AECs, the submission of which indicates the entity has complied with the portfolio standards. These AECs can be banked and used for three (3) years from their issuance. Not complying with the Alternative Energy Portfolio results in a charge of $45 per MWh for shortfalls in Tier I and Tier II resources, and a separate fee for the solar PV minimum is calculated as 200% times the sum of:

1) the market value of solar AECs for the reporting period and
2) the levelized value of up-front rebates received by sellers of solar AECs.

Virginia

Legislation

The Clean Economy Act established the RPS in 2020. It culminates in Phase II Utilities (Dominion Energy) reaching 100% renewable energy by 2045 and every subsequent year and Phase I Utilities reaching 100% renewable energy by 2050 and every subsequent year. There is no separate schedule for solar or wind, but there are requirements for the MWs of solar and wind that must be built or procured by certain deadlines.

The legislation allows for the Standard to be monitored using a PJM monitoring system PJM GATS, and allows for some of the electricity used to satisfy the Standard’s requirements to come from the PJM grid. However, the legislation does make it mandatory for at least 75% of all RECs used by a Phase II Utility to come from RPS eligible resources located in the Commonwealth starting in the year 2025.

Eligible Energy Resources

VCEA lists the following as eligible for the satisfaction of a Renewable Energy Certificate: resources that generate electric energy derived from solar or wind located in the Commonwealth or off the Commonwealth's Atlantic shoreline or in federal waters and interconnected directly into the Commonwealth or physically located within the PJM region; falling water resources located in the Commonwealth or physically located within the PJM region that were in operation as of Jan. 1, 2020, that are owned by a Phase I or Phase II Utility or for which a Phase I or Phase II Utility has entered into a contract prior to Jan. 1, 2020, to purchase the energy, capacity, and renewable attributes of such falling water resources; non-utility-owned resources from falling water that (1) are less than 65 MW, (2) began commercial operation after Dec. 31, 1979, or (3) added incremental generation representing greater than 50% of the original nameplate capacity after Dec. 31, 1979, provided that such resources are located in the Commonwealth or are physically located within the PJM region; waste-to-energy or landfill gas-fired generating resources located in the Commonwealth and in operation as of Jan. 1, 2020, provided that such resources do not use waste heat from fossil fuel combustion; or **biomass-fired facilities** in operation in the Commonwealth and in operation as of Jan. 1, 2023, that (1) supply no more than 10% of their annual net electrical generation to the electric grid or no more than 15% of their annual total useful energy to any entity other than the manufacturing facility to which the generating source is interconnected and are fueled by forest-product manufacturing residuals, including pulping liquor, bark, paper recycling residuals, biowastes, or biomass, provided that biomass results from harvesting in accordance with best management practices for the sustainable harvesting of biomass developed and enforced by the State Forester; or (2) are owned by a

Phase I or Phase II Utility, have less than 52 MWs capacity, and are fueled by forest-product manufacturing residuals, biowastes, or biomass, provided that biomass harvesting in accordance with best management practices for the sustainable harvesting of biomass developed and enforced by the State Forester.

Compliance

In Virginia, this amount is equal to $0.045/kWh deficiency and increases 1% annually. It is important to note that an increasing compliance payment makes it more expensive over time for utilities to not meet the RPS. There is language in Virginia's Clean Economy Act that a utility does not have to comply with the RPS if it will affect the energy security of their customers. This language allows for a utility to continue to produce electricity using non-renewables.

States Without an RPS – Current Electric Makeup

While it is much harder to predict the future electric portfolio of states that do not have an RPS, knowing the current electric portfolio gives insight to the current electric makeup of the PJM as a whole.

Kentucky

Kentucky consumes 523.23 trillion British Thermal Units (BTU) of coal and 402.5 trillion BTU of natural gas every year and produces 686.8 trillion BTU of coal and 97.2 trillion BTU of natural gas.

Tennessee

Tennessee consumes 440 trillion BTU of natural gas, 371.6 trillion BTU of nuclear, and 204.7 trillion BTU of coal. It produces 371.6 trillion BTU of nuclear electric power.

West Virginia

West Virginia 536.6 trillion BTU of natural gas, and 284.8 trillion BTU of coal. It produces 3,492.1 trillion BTU of natural gas, and 2,160.9 trillion BTU of coal.

Application of the Policies to the LCA

Base Case Power Scenario

The power currently produced at the three biomass plants in Hopewell, Altavista and Southampton is dispatchable. Therefore, the energy that replaces it in these alternative scenarios should ideally also be dispatchable. Dispatchable energy is defined as energy production that can be turned on or off, meaning it can respond to changes in demand more readily than intermittent energy, which is defined as energy that is not consistently available and fluctuates due to environmental factors, like sunlight or wind. The LCA compares the carbon intensity of this base case power scenario to all the alternative scenarios, to determine which scenario is the least carbon intensive.

According to the Biomass BMPs report from 2023 the three biomass plants cumulatively produce 918,086-1,024,958 MWh of energy annually. To calculate the kilograms of carbon equivalent emitted per year, the average amount of MWh produced (971,522 MWh) by the three biomass plants was multiplied by the carbon intensity (kg CO2e/MWh) of the production of electricity by biomass.

LCA Alternative Scenarios

There are three alternative power scenarios approached in the LCA, namely, (1) replacement power from the PJM or (2) Virginia portfolios, continuing to produce electricity at current levels and (3) replacement power from the Virginia portfolio, according to RGGI standards and the VCEA. After running multiple alternative scenarios which are plausible under the relevant legislation using available data, it was established that the former scenarios, 1 and 2, (the current PJM and Virginia numbers are strikingly close) represent the worst-case alternative scenario, in terms of carbon emissions, and the latter scenario (3) represents the best-case alternative scenario in terms of carbon emissions. By calculating the carbon emissions of the best- and worst-case scenarios, it is possible to evaluate the relative carbon intensity of the base case (continued biomass energy production) as compared to the best and worst possible alternatives. This streamlines the process, as it can be assumed the cumulative carbon emissions of other alternative scenarios will fall within the range established by these three scenarios. Additionally, these scenarios represent the generation of electricity from a mix of all the relevant resources.

The alternatives for replacement power in Virginia were informed and parameterized by both the current electric portfolio of Virginia (alternative power scenario 2) and Virginia policies, legislation, and organizations (alternative power scenario 3). The PJM alternative scenario (1) was informed by the current electric portfolio.

As in the base-case scenario, in the alternative power scenarios, the average amount of energy that would be lost if these plants were to stop operating (971,522 MWh) was multiplied by the carbon intensity (kg CO2e/MWh) of the production of electricity in the PJM, or in Virginia. This was done by assigning the carbon intensity of each of the resources used in the Commonwealth or region to the percentage of the electricity portfolio that it constituted.

PJM Imports (alternative energy scenario 1) or Virginia Portfolio (alternative energy scenario 2) at Current Levels

Imported electricity is dispatchable energy, which would functionally replace the dispatchable nature of the biomass facilities. Virginia is a net importer of electricity. The majority of which comes from the PJM Interconnection, with a small portion coming from the Tennessee Valley Authority.

According to the 2022 Virginia Energy Plan, 18.4% of the energy consumed in Virginia in 2020 was imported. Energy produced from nuclear fuel and natural gas are two major imports, along with electricity via transmission lines. The current electricity generation within the PJM can be broken down as follows: 1) Gas: 50% 2) Nuclear: 18.1% 3) Coal: 22.4% 4) Solar: 1.8% 5) Wind: 0.8% 6) Hydro: 4.2% 7) Oil: 2.5% 8) Other renewables: 0.4%. (PJM Quarterly *State of the Market report,* pg. 317, 2023).

As described earlier, the carbon intensity of each of the resources used in the region was assigned to the percentage of the electricity portfolio that it constituted, and then multiplied by the average amount of energy that would be lost if these plants were to stop operating (971,522 MWh).

The current electricity generation of the Virginia Portfolio is as follows: 1) Gas: 63.70% 2) Nuclear: 25% 3) Coal: 0.90% 4) Solar: 7.11% 5) Wind: 0.05% 6) Biomass: 3.72% (biomass is not included in the alternative case scenarios). Of these resources, gas, nuclear, coal, and renewables with storage are all dispatchable. When the carbon intensity of each of these resources was assigned to the percentage of the electricity portfolio that it constituted, and then multiplied by the average amount of energy that would be lost if these plants were to stop operating, the annual amount of carbon emissions from the current Virginia Portfolio was almost the same as the PJM Portfolio annual carbon emissions.

These numbers, however, only represent the current carbon intensity of the PJM Interconnection and Virginia Portfolio, which continue over the 100-year period in alternative power scenarios 1 and 2. As explained earlier, the third alternative is replacement power from the Virginia Portfolio, according to RGGI standards and the VCEA.

Virginia Portfolio According to RGGI/VCEA Requirements

Virginia’s membership in RGGI required a 30% decrease in carbon emissions by 2030. The VCEA calls for 100% renewable energy from every utility by 2050. In application this means that by 2050, Virginia’s Portfolio would only consist of solar energy (with or without battery storage), wind energy (with or without battery storage), hydropower, and nuclear energy. In the LCA, the carbon emissions of solar and wind were calculated with lithium-ion battery storage, in order to make them dispatchable, and a more effective replacement of the three biomass plants. Details on renewables with storage and nuclear are as follows:

Nuclear

In 2022, nuclear electricity accounted for 31% of in-state electricity generation. There are two nuclear power stations in Virginia, one in Surry and one in North Anna, which cumulatively generate 28,571,516 MWh of energy. The Inflation Reduction Act (IRA) of 2022 has monetary incentives, like tax credits and investments, for nuclear generators that are put into service after 2024.

Additionally, Small Modular Reactors (SMRs) are a form of nuclear energy generation that could increase the total amount of nuclear energy in Virginia's electric profile. SB454, passed in April 2024, allows for Dominion to recover costs for Small Modular Reactors from customers, up to $1.40 per month for a residential customer using 1,000 kWh of electricity a month, until Dec. 31, 2029. This covers research, development, construction, operation and deconstruction of SMRs. Because nuclear is dispatchable and monetary incentives exist for it, and the VCEA doesn’t explicitly say nuclear is nonrenewable, it could be possible for a new plant to be constructed in Virginia, especially with the data centers in the northern part of the state.

Renewables and Storage

While renewables, which are the type of energy most incentivized by the VCEA, are intermittent by nature, building out storage capacities for renewable energies would allow them to be dispatchable. However, this type of long duration energy storage technology is currently under development and has yet to be proven to be reliable. The VCEA requires Dominion to construct 200 MW or acquire 2,700 MW of storage by 2035 (at least 35% of energy storage capacity will be purchased from persons other than a public utility, which has implications for forested land in Virginia). Because of this storage requirement and incentives for renewables in the VCEA, and the need for dispatchable energy, it is assumed that stored renewable energy would replace the generation lost by the biomass plants closing. Current limitations in storage will result in the need for more reneewable generation capacity which would contribute to further loss of land utilized for agriculture and forestry uses.

Renewable

Renewable could also replace the energy generation of the biomass plants, but due to its intermittent nature, it would not fill the same demand the biomass supplied. This could be a mix of solar and wind. Solar development specifically has implications for Virginia forests, as forests and previously agricultural areas are at highest risk of being cleared for utility scale solar. The VCEA requires Dominion to construct 16,100 MW of solar or onshore wind, 200 MW of which shall be on previously developed project sites (non-residential, agricultural, silvicultural).

Chapter 3 – Potential Forest Health Benefits from the Use of Woody Biomass

While the LCA is specific to atmospheric carbon, any examination of the continued use of woody biomass in Virginia must also consider potential impacts on forest health and the forest economy. As described in the 2022 DOF report Assessment of the Environmental Benefits of Virginia's Forests and Forest Economy, the Commonwealth is blessed with abundant and productive forests. Forests cover 62% of the state and the annual growth in wood volume is more than double the volume removed through harvesting, or from storms and tree mortality.

While our forests are healthy and growing overall, they face increasing threats to their sustainability. Threats to the forest include:

- Exotic pests and diseases that threaten the survival of entire tree species
- Competition from invasive plant species
- Changing weather patterns
- Lack of natural fire regimes and catastrophic wildfires
- Over-browsing by deer
- Forest fragmentation and conversion to other land uses

Utilization of forest products is not a threat to the forests of Virginia. Quite the opposite, a lack of diverse markets for forest products hampers the ability to implement management practices to improve forest health and resilience. Virginia forestland is 80% privately owned. These landowners rely on revenue from the forest to pay annual expenses and to manage and protect their forest from the threats listed above. The availability or lack of markets in a given area has a profound impact on the sustainability of the forests found there. Woody biomass can play an important role in the health and sustainability of two of Virginia's most important forest types, southern yellow pine and oak hickory forests.

Pine forests make up 20% of forest acreage statewide, but these forests account for half of the total wood volume and annual timber value derived from forests. Pine trees grow best in full sunlight and new pine forests are typically established after the previous forest is cleared (from timber harvest, storm or intense fire). The pine stand starts with many young trees growing close together. As a pine stand ages, competition due to close spacing causes growth to slow and increases risk from pests, disease and wildfire. Thinning the pine stand by removing a significant number of the smaller trees allows the stand to continue healthy growth. In a pine stand managed for large timber trees, thinning can be completed several times. Most of the pine trees removed during the thinning harvests can be used for pulp or wood products. There are other smaller pine trees (and some hardwood trees) that are cut but that cannot be used for pulp. These can be utilized for biomass energy rather than being left onsite to decay.

Extremely important for our ecology and economy, the oak-hickory hardwood forests make up 60% of the forest acreage of Virginia. These forests provide a good example of how the woody biomass market can benefit forest resilience.

It is easy to understand why people generally view timber harvesting as "bad" for the forest. Simply put, forests are dominated by trees and timber harvesting removes them. What we know is that forests are dynamic ecosystems that change over time, following a progression called forest succession. Different tree species have different requirements for growth, mainly related to the amount of sunlight their seedlings require. Our pine forests require full sunlight as seedlings. Our oak hickory forest is made up of many species that require a range of light conditions, but they all require some amount of direct sunlight.

This means that for our forests to regenerate they require trees to be removed, meaning they are **disturbance dependent**. Our forests don't just survive disturbance, they require disturbance. That disturbance can be from fire, storms, or from timber harvesting. Removing the right trees, in a responsible manner, can create the conditions that forests require.

For a long time, Virginia has seen strong market demand for mainly the highest quality hardwood trees, of which there are typically a small number on any given acre of forest. The same acre of oak-hickory forest will have a greater number of low-value trees that can be sold but at lower profit. Then there are many trees that are not valuable enough to warrant cutting and hauling. Because private forest landowners depend on timber income to pay for forest management, our past markets have encouraged the practice of "take the best and leave the rest," known in forestry terms as "high-grading." Over time, this is contributing to a slow change in the species makeup of the forest.

Virginia's oak-hickory forests are still healthy and growing, but they are also growing old. There are not enough young oaks growing in the shade because there is not enough sunlight for seedlings to grow into saplings. The shady conditions are enabling other hardwood trees like maple and beech to become established. These are not bad trees as they are native species,but they aren't the species that dominate 60% of our forest ecosystem. This is not just about timber, the oak-hickory species mix is critical for wildlife and the entire ecosystem.

The sustainability of the oak-hickory forest depends on being able to remove the low-value and unmerchantable trees to provide sunlight for desirable species to grow. Having an economic incentive to remove the low-value or unmerchantable trees would enable forest landowners and forest managers to implement practices that encourage the sustainability of the oak-hickory forest. Again, woody biomass for energy would provide an economic incentive for needed forest management work.

Less directly, biomass energy markets support the regional forestry supply chain by providing a market for low-value material that can increase the profitability of forest management for private landowners, loggers, contractors and haulers. This increases the capacity of the forestry workforce available to provide a full range of forest management practices.

Biomass also provides a critical outlet for residuals from primary wood processors like sawmills, which cannot operate long without a way to economically dispose of sawdust, chips, and shavings. Forestry operates as a closed loop, the loss of any segment of the market leads to disruptions in the other parts. Our forests are facing growing threats. Their long-term health and sustainability depends on thoughtful human intervention at the landscape scale. Diverse markets for wood products provide the economic incentive for private landowners to invest in, and for loggers and contractors to implement these practices.

Chapter 4 – Woody Biomass Feedstock Availability

There are 11.6 million acres of timberland (forests available for timber harvest) located within the draw radius of these three facilities. The draw radius was defined as a 64-mile straight line from each facility. This straight-line distance roughly matches the farthest extent of the 75-mile road-distance around each facility. This is an industry standard maximum one-way haul distance for timber harvesting. Combining the three radii creates a total draw area of 19.7 million acres. This includes all land cover types, not just forestland. This area is 76% in Virginia and 24% in North Carolina.

The forest includes 5 million acres of upland hardwood, 4 million acres of pine forest, 1.1 million acres of bottomland hardwoods and 1.5 million acres of mix pine hardwood stands. 91% of the forest (10.5 million acres) in the draw radius is privately held. The forests within the draw radius currently store 487 million short tons of carbon (aboveground + belowground) with 409 million short tons of aboveground carbon. Each year the carbon stocks grow by 14.87 million short tons of carbon, 8.87 million short tons of carbon is removed through harvests or lost to land conversion, for a net increase of 6 million short tons of carbon on average.

Given the total annual carbon emissions attributable to producing and burning forest residuals (0.32 - 0.39 million short tons per year) this is equivalent to 5.3% to 6.6% of the net carbon being captured by the forest within the draw radius each year. Figure 1 below demonstrates the annual total available dry tons of biomass available above ground (AG) compared to the merchantable biomass (greater than 5”) and the available difference to sustainably meet current biomass need for the three Dominion Energy plants.

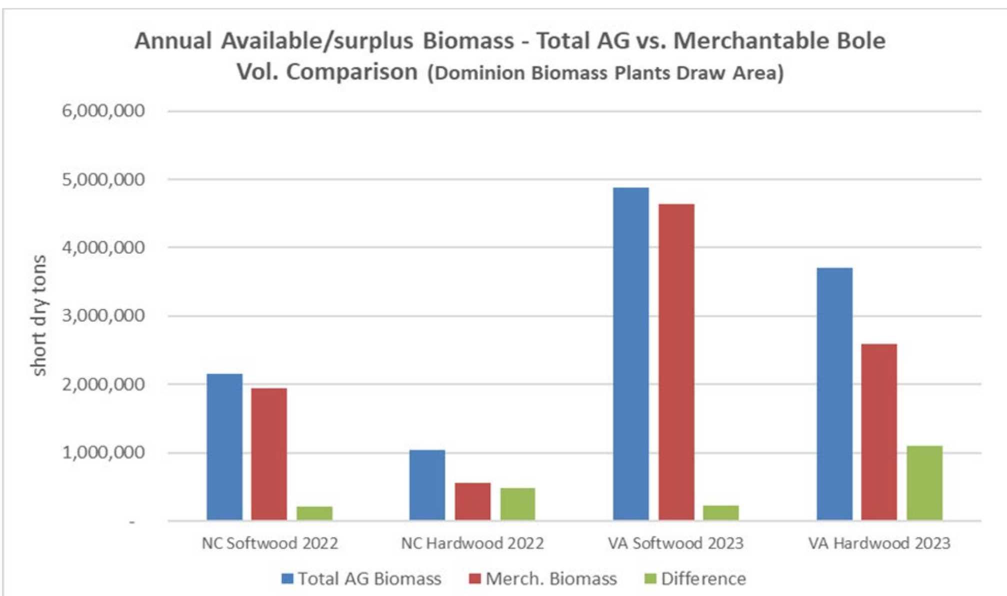

Figure 1. Annual Available Surplus Biomass vs. Merchantable Biomass within Dominion Energy Draw Radius (2024)

Thanks to collaborative efforts between the USDA Forest Service and DOF, routine assessments can be performed of many different aspects of our forests. The longest running and most intensive of those efforts is the national Forest Inventory and Analysis (FIA) program. FIA functions as a sort of national “tree census” that provides critical status and trend information utilizing routine measurements of the forest around fixed points on both public and private forest lands across the nation. In Virginia, one-fifth of the inventory points is re-measured each year to ensure the entire state is re-measured every five years. This provides an excellent assessment of how the forest is growing on a statewide and regional basis. One important use of this data is to evaluate the sustainability of our forests from a timber production standpoint.

Because wood is made of stored carbon, this measure also provides a basis for estimating the amount of carbon being sequestered and stored in our trees. The Forest Service used this information to estimate the amount of carbon uptake in the forest for each state (See Figure 2). The graph shows that Virginia's forests ranked third in the nation in 2019 for annual net carbon uptake. This is impressive considering that Virginia ranks 26th in the total number of acres of forest for each state.

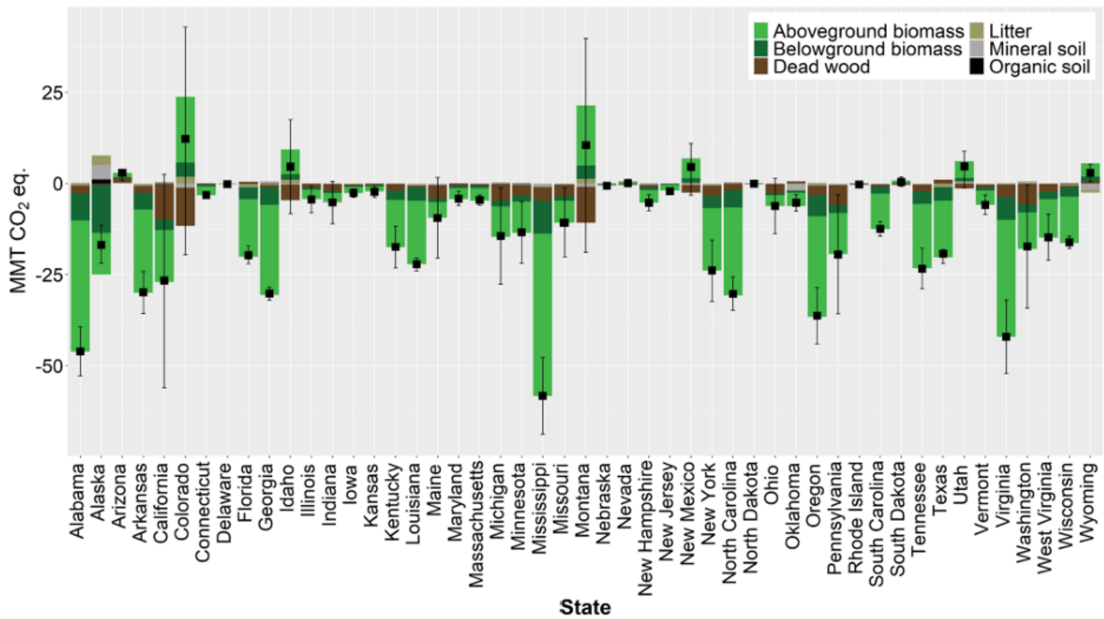

Figure 2. Estimated annual emissions and removals by carbon pool for forestland that remains forest in each of the 49 states

One measure of forest sustainability is expressed as the Growth to Drain Ratio (GDR). This reflects how much the forest is growing compared to how much is being harvested or dying on an annual basis. A GDR of greater than one, indicates that the volume of wood being added through tree growth exceeds the amount of wood being harvested or lost to mortality or damage. Virginia's GDR has been over 2:1 for over the last ten years.

In Virginia we have another source of information on the productivity of our forests. Virginia's primary wood using facilities such as sawmills pay an annual Forest Products Tax based on the volume of wood that they procure as raw material. Their annual reporting provides sixty years of data on the amount of Virginia wood being utilized. Over those past 60 years, the amount of wood being utilized from our forests has doubled. In the past 20 years, our wood utilization has increased by roughly 40% while tree growth has increased at an even faster pace.

A third measure of forest activity in Virginia is provided by our timber harvest water quality inspection program. Virginia's industry-leading notification law requires that every timber harvest be reported to DOF, enabling the agency to monitor every harvest to ensure sediment is kept out of streams and bodies of water. Based on this program, it is clear that the number of timber harvests and acres of forest harvested have been decreasing steadily for 10 years. This shows that the increased timber production has come from fewer acres, another indication of the increasing productivity of our forests. This can be attributed to two major factors; one is increasing tree growth due to better forest management. The second is better utilization of the material on a given acre because of new markets for forest products that enable more trees (and more material of each tree) to be utilized.

In the U.S., biomass accounts for 5% of total primary energy use. Globally, biomass is becoming more popular in developing countries to avoid fossil fuel use. The U.S. is a net exporter of biomass. In 2021, the U.S. exported 8 million tons of biomass in the form of wood pellets. Forestry products constitute more than 85% of total biomass used for energy purposes. Woody biomass can be split into two categories: primary and secondary feedstocks. Primary feedstocks include tree components like tops/limbs, whole trees cut down during trimming, or misshapen or diseased trees that cannot be used for traditional forestry products (not considered to be high-quality stocks). Secondary feedstocks include byproducts from wood processing, such as chips and sawdust.

Chapter 5 – Technological Advances in Biomass and Energy Generation

Emerging and developing technologies pertaining to both biomass electricity generation and other forms of electricity generation have implications on the LCA, specifically in the assignment of carbon intensities to the base case and alternative power scenarios (see Chapter 2). Bioenergy in strategic locations with Carbon Capture, appropriate distribution infrastructure, and storage could decrease the carbon emissions of biomass electricity generation in Virginia. Other technologies, like renewable energy storage, enables renewables to be dispatchable forms of energy, which could functionally replace the three biomass generators in Virginia, if they were shut down. Small Modular Reactors (SMRs) are an emerging and incentivized technology in Virginia, which could partially replace the electricity lost if the three biomass generators were to shut down. While there has been no research published to predict future increases in efficiency of biomass power plants, if biomass power plants were to become more efficient over time, as technologies have in the past, their carbon emissions can be expected to decrease over time. While there is no emerging technology that improves the efficiency of biomass power plants, there is technology that decreases the carbon emissions of biomass power plants.

Bioenergy with Carbon Capture and Storage (BECCS)

BECCS is a process by which biomass is converted into electricity or fuel. The carbon emitted from this process is captured, and then stored underground. Carbon Capture and Storage is cited in the Michigan legislature as being a possibility for qualifying natural gas as clean energy. Additionally, with the technology of Bio Energy with Carbon Capture and Storage, which would greatly decrease the level of carbon emissions of a biomass-fueled generator, biomass could be considered a clean power in a state like Illinois, where “clean power” is defined as energy generation that is 90% or greater free of carbon dioxide emissions. However, according to a study by Hanssen et al., BECCS can result in either positive or negative GHG emissions depending on the required land-use change and the efficiency of the bioenergy supply chain. This is where legislative requirements for the harvesting of biomass to be sustainable, and efficient practices of biomass harvesting, have a great impact on the GHG emissions of a biomass life-cycle. The table in Chapter 2 shows which states in the PJM have Best Management Practice requirements of biomass harvesting.

Renewables and Storage

Renewable energy, namely solar and wind, can generate electricity, which is then stored in batteries for later use when energy demand exceeds the amount renewable resources are able to produce at that time. The three biomass facilities in Altavista, Hopewell, and Southampton currently serve as reliable dispatchable energy providers, meaning the electricity generated at them can easily respond to peaks in demand. Renewables like solar and wind are dependent on natural cycles, meaning they cannot respond to peaks in energy demand if there is not ample solar or wind energy available. However, with advancements in storage, renewables could be used to replace some of the dispatchable nature of biomass electricity generation. This would result in increased land use change, and an increase in embedded carbon emissions, as the production of lithium-ion batteries is carbon-intensive. There are other forms of renewable energy storage, including thermochemical, thermal, pumped energy storage, compressed air, hydrogen, chemical, and magnetic energy storage. In Virginia lithium-ion batteries and pumped energy storage are most common.

Small Modular Reactors

SMRs are nuclear reactors that have a power capacity of up to 300 MW(e) per unit, and are much smaller than average nuclear reactors, meaning they require less land-use change and materials for construction. They are also less expensive to build. SMRs are a form of nuclear energy generation that could increase the total amount of nuclear energy in Virginia's electric profile. SB454, passed in April 2024, allows for Dominion Energy to recover costs for SMRs from customers, up to $1.40 per month for a residential customer using 1,000 kilowatt hours of electricity a month, until Dec. 31, 2029. This covers research, development, construction, operation, and deconstruction of Small Modular Reactors. HB1491 does the same for Appalachian Power Company and expires on July 1, 2034. Uranium mining was made illegal in Virginia in 1982, so increased Small Modular Reactors would result in a need for increased imports of uranium.

Chapter 6 – Life-Cycle Carbon Analysis

The intent of the biomass carbon LCA was to determine the net effect of burning woody biomass to produce electricity on the level of carbon in the atmosphere over the long term. The LCA accomplishes this by comparing atmospheric carbon levels resulting from the current operation of the three biomass power plants relative to an alternative scenario where the three power plants are shut down. Since the desired outcome is to add less carbon to the atmosphere, the preferred result of the LCA is a scenario resulting in a more negative number. The LCA report provided by the contractor is available here: [Carbon Life Cycle Assessment of Electricity Produced from Forest-Derived Biomass in Virginia].

The LCA considers these main components:

1) The amount of carbon going into and out of the forest. As trees grow, they add wood, which is made of carbon. When trees die and decay, or burn in a fire, carbon is released back into the atmosphere. In the analysis this is termed "forest ecosystem flux." Because our forests are generally healthy and growing the overall net value in the LCA is negative and at a very large magnitude, meaning our forests result in much less carbon in the atmosphere. The "forest" in the LCA includes just the 11.6 million acres of forests that lie within a 64-mile radius from each facility.
2) The amount of carbon released through the use of – and eventual decay of – forest products such as pulp for paper and cardboard, or for building materials is termed "harvest products flux." Since carbon is released, this is a positive number in the LCA.
3) The amount of carbon released due to the equipment and vehicles used to harvest and transport woody biomass is another positive number.
4) The carbon resulting from the combustion of biomass to make electricity is the largest positive number.

These first four factors are used to calculate the "default base" case, the current situation with the three facilities in operation. The sum of these four factors, calculated annually and cumulatively over 100 years, results in a negative number, indicating that the net effect from producing electricity from these three facilities using woody biomass is less carbon in the atmosphere. This is mainly because the carbon emissions are more than offset by the substantial amount of carbon being taken up by the growth of the forest.

It is important to note that the LCA only considers a fraction of the forest growth in the analysis. It is estimated that the three facilities use about 15% of the forest material available as harvest residuals each year. So, the LCA only considers 15% of the forest ecosystem and harvest products fluxes (net carbon uptake) in the analysis.

The considerable challenge for the LCA is to model the alternative case and forecast how carbon fluxes would change if the biomass facilities were not operating. Obviously, the carbon from biomass combustion and from processing and transport would each drop to zero. These changes will be offset somewhat by any carbon released by production of replacement electricity that no longer comes from woody biomass. The more difficult question is what will happen to the forest and related products. Since we cannot predict what will happen with certainty, the LCA is run with several likely potential scenarios.

There are two main elements to consider in the alternate scenarios. The first is what happens to woody biomass material still produced during timber harvests. Termed "harvest residuals," these materials include limbs, treetops and tree trunks. Nearly all woody biomass is collected on timber harvesting operations that occur for a purpose other than just to collect woody biomass. Therefore, most harvests would likely still occur even if this market no longer existed. Without a biomass market, residual materials could be left to decay or burned on site, and some could be used for alternative forest products.

Some larger materials such as low-quality tree trunks – termed roundwood – can be used for either biomass or pulpwood. As a raw material, pulpwood is more valuable than biomass, and both loggers and landowners have an economic driver to use roundwood for pulpwood rather than biomass. However, if the hauling distance is too far, or if there is not sufficient current demand for pulpwood, it may be more economical in the moment to sell that material for biomass instead. Because these alternative uses have impacts on atmospheric carbon, the effect was examined in the LCA.

In the LCA, a significant portion of harvested roundwood is allocated to long-lived wood products and the associated carbon is considered to be stored for decades. When the model assumptions are changed to increase the amount of roundwood being consumed for biomass, there is a corresponding decrease in the amount of roundwood going into long-lived forest products. This results in the model showing more carbon released in the short-term. There is no data available to determine the proportion of biomass that comes from roundwood. The LCA included a sensitivity analysis to assess the potential impact of roundwood utilization at the three facilities. The LCA tested this effect by running analyses with the assumption that 50%, and then 100% of the biomass came from roundwood. At these exaggeratedly high proportions, the LCA showed fewer negative results. Woody biomass was still associated with lower atmospheric carbon, just not as low as the default base case.

The LCA included three alternative forest scenarios:

Decomposition: assuming the harvest residuals were left to decompose.

Site Prep Burn: assuming the harvest residuals are burned as part of a forest management practice to prepare for replanting.

Forest Conversion: assuming the lack of biomass as a market contributes to landowners choosing to convert forestland to another land-use after harvest. This scenario assumed that 5% of the forest area was converted per decade and that forest conversion including burning the harvest residuals.

The most likely forest scenario would be a mix of these three alternatives occurring each year. While each scenario was treated separately in the LCA, the result from any combination of the three will lie somewhere within the range of the three individual sets of results.

The LCA included two alternatives to reflect the carbon intensity of the electricity generated to replace what is currently coming from the three biomass facilities:

Virginia/PJM Power Mix: based on the carbon intensity from the current mix of power generation in Virginia with just biomass removed.

VCEA Power: based on the assumption that electricity generation will decarbonize over time in line with commitments in RGGI and the VCEA. Virginia/PJM values were used for years 1 and 2, this value was reduced by 30% for years 3-17, and years 18-100 assumed power generation with no combustion.

The LCA analysis includes three base case alternatives (base, 50% and 100% roundwood), three forest alternative scenarios (decomposition, burning, and conversion), and two alternative power scenarios (VA/PJM and VCEA) for 18 total possible outcomes. **All 18 outcomes of the LCA resulted in negative values, meaning that in all the biomass scenarios tested, forests contribute to net removal of carbon from the atmosphere over time.**

The current scenario (default base) resulted in nearly the same value after 100 years as the decomposition and burning scenarios and performed much better than forestland conversion. In 2050, the LCA showed the decomposition alternative was 10% better than the default base, and the other forest scenarios had similar values to the default base.

In the alternative base cases that included the 50% and 100% roundwood proportions, all the alternative forest cases performed better, except when compared to forest conversion at 100 years. The magnitude of the improvement ranged from 10% to 34%.

The other element to consider, in the alternate scenario where biomass is no longer utilized for energy, is to account for trees that might not be cut down. This includes individual trees that could be left standing during a timber harvest as well as timber harvests that might not occur at all. Standing live trees would continue to hold stored carbon, and would continue to capture additional carbon for as long as they live. The process of capturing and storing atmospheric carbon is termed carbon sequestration. When live trees are cut down, the loss of future additional sequestration is termed “foregone sequestration.” Foregone sequestration was identified in the legislation to be considered as part of the LCA.

Because foregone sequestration is not a flux, it cannot be directly added into an equation that computes overall carbon balance. A separate analysis was performed to specifically examine the magnitude of foregone sequestration compared to the other parameters. Foregone sequestration was found to be positive – associated with more carbon being released – but smaller in magnitude relative to the forest ecosystem flux values.

Chapter 7 – Conclusion

In the 2023 General Assembly session, HB2026 directed DOF to convene an advisory panel to examine the use of biomass for electricity generation in the Commonwealth. This report has been prepared for submission to the House Committee on Commerce and Energy and the Senate Committee on Commerce and Labor and provides the advisory panel's findings and recommendations.

DOF invited a range of stakeholders to serve on the BAP. The group held six in-person meetings, with options for virtual attendance as well. The panel was directed to consider biomass energy policies in other states, potential forest benefits from using biomass, the availability of biomass material for utilization, technological advances related to biomass energy generation, along with an LCA of woody biomass utilization. DOF utilized the state procurement process to publish a request for proposals and contracted with UVA's School of Engineering and Applied Sciences to conduct the LCA.

The analysis of energy policies in the other PJM member states indicates that most states treat forest biomass as a renewable energy source. DOF provided information on the forest health benefits associated with the utilization of woody biomass, referring to the 2022 DOF report: *Assessment of the Environmental Benefits of Virginia's Forests and Forest Economy*. Biomass markets currently provide both direct and indirect benefits for forest health and have the potential to provide greater benefits if expanded. DOF also provided information on the availability of woody biomass. Forest inventory data indicates that there is considerable additional biomass material produced in the forest annually. The report does not indicate any technological advancements that will alter woody biomass generation in the near term.

The LCA evaluated the atmospheric carbon impacts of woody biomass utilization by first modeling the current situation with the three Dominion Energy power plants continuing to operate. This baseline scenario showed that the net atmospheric carbon levels associated with the operation of the biomass plants was negative (reduced atmospheric carbon) largely because the carbon sequestration from forest growth outweighed the carbon released from combustion and other processes over the time frame of the analysis.

The LCA then modeled several alternative scenarios to examine what would happen if the three facilities did not operate. This analysis required significant assumptions about how forest markets, landowners and loggers, and the forest itself would function without the market for woody biomass. Critical assumptions included the fate of timber harvest residuals including limbs, treetops, and tree trunks. Outcomes for these materials include being left to decay, burned in place, or being used for alternative forest products. The long-term carbon impact from these processes depends heavily on the size of the material used for biomass. The model tested the impact of having 50% and then 100% of the biomass coming from roundwood. Another outcome considered was the potential for forestland to be converted to non-forest use after harvest.

Consideration of foregone sequestration – the loss of future sequestration that would have occurred if a tree was not cut down – was specifically called for in the legislation. It was accounted for by quantifying what mass of trees would have been left in place if forest stands were not clear cut to produce both industrial roundwood and biomass. The analysis did not estimate what amount of carbon those trees might have accumulated over time had they not been felled.

It was also necessary to model the source of electricity generation that would replace the electricity currently coming from biomass. Two scenarios were tested, one was the current mix of power being used in Virginia minus biomass. The second scenario assumed that electricity generation will follow the mandates in the RGGI and the VCEA.

Assumptions are critical to this type of analysis and differing assumptions can significantly alter the outcome. The advisory panel was not asked to reach consensus on the model approach or assumptions. There were significant differences of opinion amongst panel members, such as:

- The analysis follows a standard LCA timeframe of 100 years. Some panel members argued that results should also be examined at a shorter time frame because the VCEA requires the end of combustion as a power source by 2045. Over the long-term, the LCA takes into account the carbon sequestered through continued forest growth.
- The LCA attributes 15% of forest carbon flux in the draw-radius to woody biomass generation. Because these forests are a net sink for carbon, this credits biomass usage with 15% of the net forest carbon uptake. A higher percentage would result in a more favorable outcome for biomass and a lower percentage would result in the opposite.
- The LCA is run as if each of the alternative forest scenarios would occur on 100% of the harvest acres. It is understood that the realistic alternative will be some mix of the three alternatives and the resulting carbon impact would lie somewhere within the range of results shown by the three alternatives.
- Estimating the proportion of biomass that comes from roundwood. The LCA ran one scenario representing 50% roundwood and another for 100% roundwood. The actual proportion of roundwood is less than 50% so this analysis helps to show that roundwood proportion is significant at high levels. This does not help to find the level at which the roundwood proportion becomes significant.
- The amount of timber harvesting that occurs because the market for woody biomass exists. Based on guidance from industry experts, this study assumes that most woody biomass is residual material from timber harvests that would have occurred regardless of biomass harvesting. Some panel members believe that the biomass market results in additional harvesting and this results in significant foregone carbon sequestration and this is not adequately reflected in the carbon analysis.

While there are differences of opinion on various parameters, this LCA model represents one viable analysis conducted according to established methodologies.

The LCA results show that all modeled scenarios result in less carbon released into the atmosphere, mainly because carbon sequestration from the growth of the forest outweighs all other emissions. Combustion of woody biomass for electricity does increase carbon emissions, particularly in the short term. The LCA shows that emissions would be higher over the long term if roundwood makes up a significant portion of the woody biomass mix. Fortunately, there is no indication that roundwood makes up 50% or more of the woody biomass being utilized.

The volume of wood, and therefore carbon, in Virginia's forests has been routinely inventoried for decades and this volume grows year after year. This carbon sequestration is the result of the cumulative actions of over 400,000 private landowners pursuing their individual goals year after year in response to available markets. That forest carbon pool is now at risk from increasing insect and disease threats, aging trees, competing land uses, changing weather patterns and the loss of landowner incentives for management. There is ample evidence that diverse forest markets incentivize landowners to invest in forest sustainability.

There is no historical precedence in Virginia to indicate that the loss of markets for sustainably sourced forest products will improve forest health. The LCA demonstrates the tremendous potential to reduce atmospheric carbon by increasing the health and productivity of our forests. Biomass energy production provides a low-cost means for forest landowners to implement practices that will improve the health, productivity and resilience of our forests.

This report was prepared by the Virginia Department of Forestry to summarize the work of the Biomass Advisory Panel. The panel met multiple times and all member feedback was shared with the entire panel. Feedback and guidance from panel members was addressed, but consensus was not always achieved. Conflicting opinions are acknowledged in this report. The agency is thankful for the dedicated effort of all the panel members and for their respectful discourse throughout this process.

Appendix – Supporting Documents

The following letters may refer to previous communications received by the Virginia Department of Forestry from advisory panel members. Due to the volume of correspondence, additional information related to the panel's work is available upon request.

SOUTHERN ENVIRONMENTAL LAW CENTER

120 Garrett Street, Suite 400
Charlottesville, VA 22902

Telephone 434-977-4090
Facsimile 434-993-5549

MEMORANDUM

November 27, 2024 Sent Via Email

TO: Terry Lasher and Rob Farrell, VA Dept. of Forestry
CC: Lisa Colosi Peterson
FROM: David Carr, SELC

RE: Comments on HB2026 Biomass Report and Life Cycle Assessment posted 11/25/2024

SELC submits the following comments on the DOF HB2026 Biomass Advisory Panel Report (Report) and Life Cycle Assessment (LCA) posted on November 25, 2024. Please let us know if you have any questions.

The Decomposition Alternative Case is Lower Emitting than the Dominion Biomass Power Case

A major takeaway from the Report and LCA is that leaving harvest residues on site to decompose rather than removing for use in Dominion's biomass plants results in lower (10% less) net emissions over the first 25 years and lower emissions over 100 years. This result raises serious questions as to why Dominion should continue to receive RECs for its biomass power.

The executive summary and conclusion of the Report acknowledge that combustion of woody biomass for electricity increases carbon emissions in the short term. Va. Dep't of Forestry, *Report of the Biomass Advisory Panel*, Executive Summary, p.3 & Chapter 7, p.34 (2024). These sections of the report also suggest that all modeled scenarios result in less atmospheric carbon, which is due to similar forest uptake in all scenarios. *Id.* However, more detailed information about the short-term (i.e., 25-year) carbon impact of using woody biomass for electricity only appears toward the end of the report. *Id.* at p.32 ("In 2050, the LCA showed the decomposition alternative was 10% better than the default base [the Dominion biomass case] . . . ."). This approximate difference was observed both when the alternative power source was the current PJM mix (9% difference) and when a VCEA mix was projected forward (10% difference). Lisa Colosi Peterson et al., *Carbon Life Cycle Assessment of Electricity Produced from Forest-Derived Biomass in Virginia*, p.22, Table 3 (2024). Even at 100 years, the decomposition alternative case (without biomass power) was 4-7% better than the biomass power case. *Id.*

In other words, the LCA finds that using woody biomass for electricity results in more carbon emissions than letting the material decay on site and that such increased emissions persist for decades, beyond 2050 through year 100.

We believe the critical years for addressing climate impacts and compliance with the VCEA is between now and 2050. Recent global warming and high-intensity storms are driving home the importance of reducing emissions now and as much as possible in the next two and a half decades. By 2050, the VCEA seeks to eliminate carbon emissions from power plants with capacity of at least 25 MWs and requires utilities to produce electricity from 100% renewable sources.

Under the LCA, the Dominion biomass power case has similar emissions to burning the harvest residue on site in site prep burns. However, the literature does not support widespread site prep burning in Dominion's sourcing area. *See* Letter from SELC to Rob Farrell, State Forester & Terry Lasher, Assistant Forester, Va. Dep't of Forestry (Sept. 11, 2024) (attached as Attachment F). TNC VA also notes that herbicide use is more likely than site prep burn for site prep and hardwood control. Letter from TNC VA to Terry Lasher, Assistant Forester, Va. Dep't of Forestry (Oct. 31, 2024) (attached as Attachment B). While the LCA also models a forest conversion alternative, we find that forest conversion is unlikely to occur solely because of the loss of marginal revenue from biomass harvests. *See* Memorandum from SELC to Terry Lasher, Rob Farrell & Lisa Colosi Peterson (Oct. 8, 2024) (attached as Attachment D).

Given that decomposition of harvest residues in the absence of biomass demand is the more likely scenario, the higher emissions from biomass power relative to decomposition should be the focus of policy makers. The results of the LCA call into question whether Dominion should receive RECs for burning forest-derived wood. If the biomass power production is not reducing overall carbon emissions compared to the likely alternatives, why should Dominion receive the REC subsidies under the VCEA, which is seeking to zero out carbon emissions by 2045 (or 2050)? In addition, as discussed below, biomass power is more costly than most every other alternative. Clearly, given these results and the cost issue, biomass power subsidies via RECs should not be expanded.

Use of Roundwood Increases Emissions Significantly and its Use Should be Prohibited by the BMPs Required for Securing RECs

The LCA results show clearly that the use of roundwood for biomass power would significantly increase the emission profiles of Dominion's biomass plants. The S50 roundwood case has 15-23% more emissions than the site prep burn and decomposition cases, respectively, at year 2050, and the S100 roundwood case has 26-33% more emissions than the site prep burn and decomposition case, respectively, at year 2050. The percent increases are nearly as high in year 100. *See* Lisa Colosi Peterson et al., *Carbon Life Cycle Assessment of Electricity Produced from Forest-Derived Biomass in Virginia*, p.22, Table 3 (2024).

This demonstrates the need to exclude roundwood, as well as the need to monitor and enforce that exclusion to ensure no use of roundwood as feedstock. **The DOF BMPs allowing RECs for Dominion should be amended to have a specific, enforceable exclusion for roundwood.**

This roundwood finding also makes clear that biomass in Virginia should not be expanded, because more demand is likely to lead to use of more roundwood. *See* Austin M. Garren et al., *Characteristics of Forest Biomass Harvesting Operations and Markets in Virginia*, Biomass & Bioenergy, May 2022, at 4 ("When asked if they could increase biomass production utilizing only logging residues without using pulpwood-sized material, 63% said they could not.").

Failure to Consider Additional Tree Harvest Resulting from Biomass Demand, and as a Result, Failure to Consider True Foregone Sequestration

The Report acknowledges the statutory requirement to consider foregone sequestration and claims that the LCA satisfied that requirement "by quantifying what mass of trees would have been left in place if forest stands were not clear cut to produce both industrial roundwood and biomass." Va. Dep't of Forestry, *Report of the Biomass Advisory Panel* 34 (2024). By its own terms, **"[t]he analysis did not estimate what amount of carbon those trees might have accumulated over time had they not been felled."** *Id.* (emphasis added)

Because sequestration in this context refers to the removal of carbon from the atmosphere by trees through photosynthesis, foregone sequestration refers to the carbon that would have been removed by living trees had they not been harvested for biomass. Foregone sequestration is equivalent to additional carbon emissions. But the way the LCA purported to measure foregone sequestration does not account for such emissions. The LCA simply calculated the mass of the smaller trees that were removed for biomass and quantified that carbon as so-called "forgone sequestration." The LCA states: "For the BASE case, this quantity was defined as the mass of carbon embodied in unmerchantable "small" trees (DBH < 5 inches) removed during clear-cut harvests." LCA p.10. So the LCA clearly failed to account for the "foregone" sequestration that trees left standing would have absorbed over time.

The LCA failed to consider true foregone sequestration because it did not consider the likelihood that biomass demand leads to trees being harvested that would not have been harvested in the absence of biomass demand. SELC submitted evidence that indicated additional trees are harvested to meet biomass demand. *See* Letter from SELC to Rob Farrell, State Forester & Terry Lasher, Assistant State Forester, Va. Dep't of Forestry (July 9, 2024) (attached as Attachment H); Letter from SELC to Rob Farrell, State Forester & Terry Lasher, Assistant State Forester, Va. Dep't of Forestry (Sept. 11, 2024) (attached as Attachment F); Memorandum from SELC to Terry Lasher, Rob Farrell & Lisa Colosi Peterson (Sept. 26, 2024) (attached as Attachment E); Memorandum from SELC to Terry Lasher, Rob Farrell & Lisa Colosi Peterson (Oct. 8, 2024) (attached as Attachment D).

SELC contended throughout the process that the LCA must consider the additional harvesting resulting from biomass demand. SELC also provided scientific evidence showing that older, mature trees sequester more carbon than younger, fast-growing ones. *See* Memorandum from SELC to Terry Lasher, Rob Farrell & Lisa Colosi Peterson (Oct. 8, 2024) (attached as Attachment D).

Despite the industry claim that biomass demand provides landowners additional incentive to harvest, the LCA also did not consider that less harvesting would occur in the absence of biomass demand in the alternative scenarios. Less harvesting would have improved the carbon performance of the alternative scenarios.

The LCA confirms at page 28 that it did not undertake an analysis to model foregone sequestration by trees that could have been left standing in the no-biomass power case. An analysis by the Spatial Informatics Group, an expert in LCA modeling of forests and bioenergy, confirms that the LCA did not actually model foregone sequestration. This analysis also confirms the likelihood that biomass demand would lead to additional harvesting of trees, which would not have been harvested in the absence of biomass demand. This analysis was submitted to DOF and Dr. Peterson on October 11, 2024, and is attached as Attachment C.

The failure to consider additional harvesting and the failure to include the foregone sequestration of the trees that would have been left standing in the absence of biomass demand means the LCA did not meet the statutory requirement to include actual foregone sequestration. As a result, the LCA underestimates the difference in emissions between the biomass power base case and the non-biomass alternatives including the decomposition alternative.

The High Cost of Biomass Would Support Phasing out RECs for Woody Biomass

In terms of market effects of biomass power and its feedstock (considering item iii of the BAP charge- Report p.6), DOF should have considered the high cost of biomass power, owing largely to the high cost of biomass feedstock. As explained in more detail in our letter dated August 19, 2024 (attached as Attachment G), data available from the U.S. Energy Information Administration ("EIA") demonstrate that biomass electricity is expensive. EIA data from 2023 show that the levelized cost of energy of biomass per megawatt-hour exceeds that of many other energy-generation technologies, including advanced nuclear, new combined-cycle units, new geothermal, solar PV, onshore wind, and PV-battery hybrid. Only ultra-super critical coal is more expensive. Regional estimates from EIA suggest an even higher cost for new biomass in Virginia. Dominion's modeling as a part of its integrated resource plans in 2018 and 2020 reinforce the high cost of biomass electricity. Especially when paired with the VCEA-required emissions reductions (applicable to all carbon-emitting units, including ones fueled by biomass), cost considerations provide additional reason to decrease, rather than increase, Virginia's reliance on biomass electricity, both for consumers and the climate.

Conclusion

We ask that the deficiencies we have noted in the Report and LCA be addressed promptly.

We reiterate our request and understanding stated in our letters dated February 2, 2024, and November 13, 2023 (attached as Attachments I and J, respectively) that the DOF Biomass BMPs be revised to reflect the findings of the full LCA undertaken in 2024. As we discussed at the last meeting in 2023, the full LCA performed in 2024 was intended to inform potential revisions to the BMPs. We request that the BMPs be revised to specifically exclude roundwood from qualifying for RECs for Dominion and others. We further recommend that policy makers review whether RECs for biomass should be eliminated based on the results of the full LCA.

We thank you for your time and the opportunity to participate in this process.

David W. Carr, Jr.

David W. Carr, Jr., General Counsel

November 27, 2024

Terrance Lasher
Assistant State Forester
Virginia Department of Forestry
900 Natural Resources Drive, #800
Charlottesville, VA 22903

Dear Assistant State Forester Lasher,

The Virginia Forest Products Association ("VFPA") offers the following comments on the final draft report of the Life Cycle Analysis Report required by HB 2026 of the 2022 General Assembly session.

We greatly appreciate the fair, balanced and thorough approach taken by Dr. Peterson and her team from the University of Virginia. Basing the timeline on 100 years follows the proper science of the life cycle of a tree/forest stand. We have advocated throughout the stakeholder process that the life cycle assessment ("LCA") should follow the science and be as close to real world carbon release and sequestration as can be reasonably modeled. Further, Dr. Peterson's assumptions regarding forest ecosystem processes and transportation estimates are in line with other biomass carbon LCAs performed around the country.

We understand the use of Virginia's Timber Product Output (TPO) survey data for the amount going to energy use, but we would reiterate the 13% of the roundwood harvested for energy use is a high estimate and is not all going to go to be used by Dominion. Other users utilize roundwood for biomass energy usage either as a primary or secondary source, not all of which is burned in Virginia or even the United States. The forest product economics do not allow more to go to Dominion even if they would attempt to source more. Regardless of depressed stumpage prices, Dominion cannot compete with a market price for saw timber with a DBH of 10 inches or greater that could be used for forest products. Even lower grade timber of a saw diameter would have too much market value for Dominion to compete. Dominion's roundwood usage is more than likely a smaller percentage of the 13% estimated in the TPO.

With the above noted, there are certainly instances in which a market for roundwood would be beneficial for energy usage for the purposes of maintaining forest health. A financial incentive is needed for the purpose of felling damaged trees due to damage such as lightning strikes, crooked stock, metal debris from old fence lines, or disease from insect infestation. This roundwood has no value to be merchantable or safely run through a saw for forest product usage. With diseased trees or those infested with invasive species, removal of the tree from the forest is imperative for forest health. Incineration of the wood containing pests is the best way to permanently eradicate those pests and still achieve some financial gain for the landowner to continue to manage their land and replant healthy trees in the place of the removed, diseased species.

According to the Department of Forestry, southern pine beetle infestations, which require market incentives to precipitate removal, overlay almost directly the haul radius for each of the three Dominion plants. There is a documented area of diseased trees that need to be removed due to infestation in the draw radius. Incineration for energy provides a very beneficial outlet and incentive for these infested trees to be removed to keep forests healthy.

The data demonstrates that burning waste or any percentage of non-merchantable roundwood in a Dominion facility is no more/less harmful than other dispositions including natural decomposition or open-air burning on site. It is certainly preferable to land conversion, which results in a permanent loss of carbon sequestration. We applaud Dr. Petersen for her thoughtful analysis of all these scenarios.

VFPA believes utilization of biomass for energy strikes a necessary balance for forest health, timber supply for our industry, electricity generation, and environmental considerations. The advent of data centers, EVs, and general increased demand for electricity by both residential and business consumers necessitates a supply of dispatchable power. The outcomes of this LCA demonstrate that using woody biomass does not harm the Commonwealth's forest resource while it produces needed MWs of non-fossil fuel baseload generation. In VFPA's opinion, this is a win-win outcome.

We appreciate the Department following through in carrying out the provisions of HB 2026 and for considering our association's and industry's input in the process and final work product.

Sincerely,

Susan

Susan Seward
Director of Government Affairs

From: Elizabeth A Willoughby (Services - 6)
Sent: Friday, November 29, 2024 12:33 PM
To: Lasher, Terrance J. (DOF) <Terry.Lasher@dof.virginia.gov>
Cc: Melissa D Neff (Services - 6) <melissa.d.neff@dominionenergy.com>
Subject: Dominion Energy Comments on DOF's BAP and LCA
Importance: High

Terry,
Please see attached comments from Dominion Energy on the Department of Forestry's Report of the Biomass Advisory Panel and the Carbon Life Cycle Assessment of Electricity Produced from Forest-Derived Biomass in Virginia.

We appreciate the opportunity to provide this feedback to the Department of Forestry and for the time and efforts spent on drafting these reports.

Highlights:
Department of Forestry Report of the Biomass Advisory Panel:

- Dominion Energy has included clarifications and edits throughout the document in redline strikeout format with corresponding comment bubbles which provide rationale on some of our comments. In particular, the Company has several comments and edits throughout the Virginia Portfolio section of the report to accurately represent technological considerations as they pertain to our industry.

Carbon Life Cycle Assessment of Electricity Produced from Forest-Derived Biomass in Virginia document:

- It is important to note that during Phase 1 of the Biomass Advisory Panel, stakeholder input was gathered by the DOF which was utilized to issue an "LCA-lite" that contained some station specific data provided by Dominion Energy. Some of the assumptions provided in this assessment and the data used are not representative of biomass operations.

- The roundwood percentage usage is not representative of what the biomass facilities would consume. In accordance with the Biomass Advisory Panel report, the attached LCA provides "exaggeratedly high proportions" for roundwood.

If you have any questions, please let us know.
Liz Willoughby
Dominion Energy Environmental & Sustainability
Cell: 804 240-3234
Email: E.Willoughby@dominionenergy.com

VLA
LOG A LOAD FOR KIDS
VIRGINIA LOGGERS ASSOCIATION, INC.
"Voice for Virginia's Professional Loggers"

November 29, 2024

Terrance Lasher
Assistant State Forester
Virginia Department of Forestry
900 Natural Resources Drive, #800
Charlottesville, VA 22903

Assistant State Forester Lasher,

The Virginia Loggers Association was created in 2002to represent Virginia's logging and forest products industry. We appreciate the opportunity to serve on the taskforce and to submit our comments on the final draft report of the Life Cycle Analysis Report by Virginia Department of Forestry and required by HB 2026 of the 2022 General Assembly session.

Dr. Lisa Peterson, University of Virginia, confirmed the invaluable and important role of forest biomass as a source to produce electricity in the three biomass-sourced Dominion Energy utilities. More importantly the LCA proves without any doubt that forest bioenergy sequesters more carbon through new forests than all emissions through the bio-power emissions. Forests can produce energy for electricity, make essential wood and paper products, and grow new forests for our future. **No other energy source anywhere can make all the contributions of trees!**

Forests comprise nearly 16 million acres of Virginia's landscape and most have been managed and harvested many times to produce important solid wood, paper, medicinal and base materials for everyday products, energy, and significant ecological and environmental benefits. Yet, Virginia's forests are reported to be healthy and growing at a higher rate than all losses including natural mortality and harvesting. Following harvesting forests continue to grow absorbing CO_2 at rapid rates cleansing the air and producing oxygen well beyond its immediate borders.

Forest products are not just Virginia's third largest industry and economic contributor, this industry is much more. Our forests are natural and completely renewable and will be so forever!

Dr. Peterson perfectly considered the life span of trees, while maintaining focus on the legislative mandates of the Virginia Clean Economy Act. The LCA gives absolute evidence that trees are the answer to providing clean renewable, and reliable electricity safely for the environment and people while continuing to produce products essential to all.

Even accounting for the harvesting, hauling, and direct emissions from the utility, bioenergy is the clear way to go for producing electricity!

The LCA compared realistic alternatives which might occur if the three Dominion Energy biomass utilities close. Dr. Peterson examined three alternatives suggested by the taskforce if the bio-sourced utilities were closed. In each scenario, maintaining the biomass-sourced Dominion Energy plants with continued forest management was a favorable choice.

The scenarios that replace the utility shutdown might even be much worse than those Dr. Peterson selected for analysis. We can only guess at what might be, but we can imagine many worse scenarios that would emit even more carbon into the atmosphere.

Logging has been and will always be absolutely necessary to healthy and productive forests. By working to meet the goals of forest landowners and societal needs, loggers carry out the dangerous harvesting and hauling of raw forest materials from our forests, across our highways, and finally to the mills which process these raw materials into the essential products everyone uses. Loggers always sort forest harvests into products of greatest value, tree size appropriate, and available markets and could not afford to carry valuable sold wood and paper products to bio-fuel plants.

Forest biomass comes from the tops and limbs of trees which actually have no other value except to provide heat, energy, and landscaping materials. It is the least valuable of all tree parts and has played a significant but minor role in energy policies in Virginia and across the United States. Across the globe, biomass energy has served millions of people for their electricity by replacing coal.

VLA believes Dr. Peterson and her team from the University of Virginia thoughtfully conducted a thorough review of forest science and created an excellent and sound LCA study. VLA fully supports utilizing a timeline of 100 years, which follows the known science of the life cycle of a tree or forest stand and not on predetermined or artificial deadlines. Dr. Peterson's assumptions regarding forest ecosystem processes and transportation estimates are in line with other biomass carbon LCAs performed around the country as well.

VLA feels it is of vital importance to emphasize the 100-year term is not just a term pulled out of the air without scientific basis, but is a term normally used by researchers trying to inform sound policy. A 100-year term fits the forest life cycle and that fact is also well recognized by respected scientists everywhere. VLA feels this is our social duty and responsibility to inform energy policy while ensuring our forests are not compromised by any short-sighted term that match shorter terms just to meet dates which are yet to be verified or time-tested and proven.

VLA conducted a survey of loggers finding that that most loggers do not harvest biomass. Of the few loggers who harvest biomass, we believe the bulk of the biomass comes from the tops, limbs, and very small unmerchantable trees. Forest biomass is used in making energy pellets, firewood, while some is just left to rot on the ground. **We estimate that only 4% and 7% are more likely an accurate representation of roundwood being utilized by Dominion Energy.** Finally, we cannot over emphasize that roundwood containing higher valued wood products will always go to the higher value wood products market and not into biomass. This small amount, even at the 13% used by Dr. Peterson will not affect the overall carbon story where forestlands will be net carbon sinks even after accounting for all the emissions related to transportation and burning of utilized residues.

The Department of Forestry, the University of Virginia's team, and taskforce worked diligently to meet the requirements of HB 2026 and provide policy makers real science-based guidance for making informed policies for the citizens of Virginia. We used logical models, framework, well-accepted LCA principles, forest science, and experience to create the life cycle carbon assessment for a very important part of our energy policy and forest management policy.

We know that biomass is an essential source both for Virginia's renewable energy mix and for our industry. Biomass is not the only source, but is an important source to be used with other reliable sources to ensure reliable and sustained energy for future generations.

Sincerely,

Virginia Loggers Association
Board of Directors and Executive Director

Virginia Agribusiness Council
The Unified Voice of Agribusiness

November 30, 2024

Terrance Lasher
Assistant State Forester
Virginia Department of Forestry
900 Natural Resources Drive, #800
Charlottesville, VA 22903

Assistant State Forester Lasher,

The Virginia Agribusiness Council (VAC) appreciates the opportunity to submit these comments on the final draft of the Life Cycle Analysis (LCA) Report, as required by HB 2026 from the 2023 General Assembly. The Virginia Agribusiness Council represents over 40,000 farmers and agribusinesses and the entire agriculture and forestry industry supply chain, which is responsible for a $105 billion total economic impact to the Commonwealth annually. We supported the legislation during the 2023 session and commend the Department of Forestry for leading the workgroup discussions over the past two years. And although we were not members of the advisory work group that worked on this report, we attended nearly every meeting as a member of the public and followed this process very closely.

We would like to begin by recognizing Dr. Peterson and her team at the University of Virginia for their thorough analysis and the creation of both base case and alternative scenarios within a limited timeframe. We are particularly appreciative of their decision to use a 100-year timeframe for the analysis, aligning with the natural life cycle of a tree and forest stand rather than a scientifically arbitrary deadline. Our industry has consistently advocated for a life cycle assessment that mirrors real-world carbon dynamics as closely as possible, and Dr. Peterson's assumptions regarding forest ecosystem processes and transportation estimates are in line with national biomass carbon LCAs.

However, we do have concerns about some underlying assumptions. Specifically, we believe that the estimate of 13% of roundwood harvested for energy use is too high. Not all of this roundwood will be used by Dominion Energy, and there are other users that also consume roundwood for biomass energy. The forest product economics suggest that Dominion's share is likely significantly lower.

That being said, we recognize that markets for roundwood used in energy production can benefit forest health. As noted in the report, such markets incentivize forest management, especially for trees damaged by natural events or disease. Biomass energy provides a financial incentive for landowners to remove diseased or invasive species, which is crucial for maintaining forest health. For example, southern pine beetle infestations, the areas of which align with the source areas for Dominion's biomass facilities, are an important reason for such removal, and incineration offers an effective solution.

We also want to address the issue of forgone sequestration. Research shows that younger, growing forests sequester carbon more quickly than older, declining forests. As long as forest land remains intact, forgone sequestration is limited over time. The inclusion of land conversion and field burning scenarios in the LCA helps highlight the significant carbon loss that occurs when forests are destroyed or burned in uncontrolled settings.

Finally, we agree that any replacement for biomass power must be reliable and dispatchable. Virginia's 2022 Energy Plan stresses the importance of baseload generation to meet increasing power demands due to population growth and economic expansion. Therefore, any alternative scenarios must consider reliable power sources for a fair carbon comparison.

Finally, the Council would like to express our sincere gratitude to the Department and all stakeholders for their efforts throughout this process. We once again commend Dr. Peterson and her team at the University of Virginia for completing the LCA in such a short timeframe. Biomass energy plays an essential role in Virginia's renewable energy future, as well as in supporting our forest industry, and we appreciate the Department's thorough approach in addressing HB 2026's requirements.

Thank you for considering our comments.

Sincerely,

Cliff Williamson
Executive Director

November 30, 2024

Rob Farrell
State Forester
Virginia Department of Forestry
900 Natural Resources Drive, #800
Charlottesville, VA 22903

State Forester Farrell,

The Virginia Forestry Association (VFA) wishes to submit these comments on the final report of the Life Cycle Analysis required by HB 2026 of the 2023 General Assembly session. VFA is a statewide trade association representing the landowners and businesses that support Virginia's third largest private industry. We supported the legislation during the 2023 General Assembly session and appreciated the Department of Forestry for leading the workgroup discussions over the last two years.

We would like to start our comments by commending Dr. Peterson and her team from the University of Virginia for conducting a thorough review and creating her base case and alternative scenarios in a very condensed amount of time. We applaud her utilizing an analysis timeframe of 100 years for the cycle of carbon, which follows the proper science of the life cycle of a tree or forest stand and not on predetermined deadlines. VFA has advocated throughout the stakeholder process that the life cycle assessment, as called for in the legislation, should be as close to real world carbon release and sequestration as can be reasonably modeled using sound LCA principles. Dr. Peterson's assumptions regarding forest ecosystem processes and transportation estimates are in line with other biomass carbon LCAs performed around the country.

That said, we would like to address a few of the assumptions made in the underlying base case. We understand the use of Virginia's Timber Product Output (TPO) survey data for the amount of roundwood utilized for energy use, however, we would reiterate that 13% of the roundwood harvested for energy use is a high estimate and it is not possible for all of the biomass be used by Dominion in the market. Other users utilize roundwood for biomass energy usage either as a primary or secondary source, not all of which is burned in Virginia. The forest product economics do not allow more to go to Dominion even if they would attempt to source more. Dominion's roundwood usage is more than likely a much smaller percentage of the 13% estimated in the TPO. We understand the time constraints the Department was under and was unable to run additional scenarios, but we would like to state for the record that 5% (S05) and 10% (S10) of the 13% are more likely accurate representations of roundwood being utilized by Dominion.

With the above noted, there are certainly instances in which a market for roundwood utilized for energy production is beneficial for maintaining forest health. As correctly noted in Chapter 3 of the final report, forest health is disturbance dependent, and markets are needed to incentivize a healthy forest ecosystem. A financial incentive where none other exists for high-value forest products is needed for the purpose of felling damaged trees due to threats such as lightning strikes, crooked stock, metal debris from old fence lines, or disease from insect infestation. This roundwood has no mercantile value and will likely be left standing by the forest landowner. Biomass energy usage can provide such a market incentive to perform proper forest management. With diseased trees or those infested with invasive species, removal of the tree from the forest is imperative for forest health. Incineration of the wood containing pests is the best way to permanently eradicate those pests and still achieve some financial gain for the landowner to continue to manage their land and replant healthy trees in the place of the removed, diseased species.

According to the Department of Forestry, southern pine beetle infestations, which require market incentives to precipitate removal, overlay almost directly with the haul radii for each of the three Dominion biomass facilities. There is a documented area of diseased trees that need to be removed due to infestation in the draw radius. Incineration for energy provides a very beneficial outlet and incentive for these infested trees to be removed to keep forests healthy. A 2018 study from the University of Idaho showed that market forces and incentives to perform proper forest management will play a pivotal role in land use decisions and keeping forestland as a carbon sink.[1]

We also had a vigorous debate during several of the workgroup meetings regarding forgone sequestration. As we have cited in the past, numerous studies have shown that younger and growing forest stands sequester carbon at a significantly faster rate than those forests that are mature or in decline. Multiple studies by the US Forest Service[2] over the last decade show that younger forests sequester more carbon and act as a more efficient carbon sink. A study published in 2019 in the Proceedings of the National Academy of Sciences found young forests sequester more carbon per year than old growth forests[3]. These studies suggest that forgone sequestration is limited over a longer period of time, even on forestland that has been harvested as long as the tract remains in forest land use. Land conversion would lead to an alternative scenario with significant forgone sequestration, and we appreciate the LCA including both land conversion and field burning alternatives to show the difference in carbon sequestration when the carbon is released from forest loss or burning in uncontrolled settings without new growth.

We would also note the vast majority of states the report cites participating in the PJM and RGGI treat biomass as renewable and includes biomass in their Renewable Portfolio Standard. Virginia is not an outlier and these other states recognize the importance of biomass among the other types of renewable energy, especially when harvested in a sustainable manner. These states recognize what has been stated by the Intergovernmental Panel on Climate Change (IPCC) in their 2022 sixth assessment report. The IPCC stated bioenergy has large mitigation potential, especially if agriculture and forestry sectors devise management strategies that enable biomass production and

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[1] Latta, Gregory, et. al. "A Land Use and Resource Allocation (LURA) modeling system for projecting localized forest CO_2 effects of alternative macroeconomic futures." 2018. https://www.sciencedirect.com/science/article/abs/pii/S1389934116304683?via%3Dihub

[2] McKinley, Duncan, et. al, U.S. Forest Service, "A synthesis of current knowledge on forests and carbon storage in the United States" 2011. https://doi.org/10.1890/10-0697.1

Gray, Andrew, et. al, U.S. Forest Service, "Carbon stocks and accumulation rates in Pacific Northwest forests: role of stand age, plant community, and productivity." 2016. https://research.fs.usda.gov/treesearch/52237

[3] Pugh, Thomas, et. al, Birmingham Institute of Forest Research, "Role of forest regrowth in global carbon sink dynamics". 2019. https://www.pnas.org/doi/10.1073/pnas.1810512116

use for energy in conjunction with the production of food and timber, reducing the conversion pressure on natural ecosystems.[4]

We agree with the report referencing any replacement power for biomass must be dispatchable, reliable power. Virginia's 2022 Energy Plan states "Whether it is nuclear, hydrogen, natural gas, biomass, or renewables paired with battery storage, having reliable baseload generation capacity is critical to meeting future energy needs. Forecasted power demand has increased meaningfully, and all forecasts show Virginia's power needs increasing consistently on an annual basis. This rate of increase will become more pronounced as the Commonwealth's population increases, the economy expands, more Virginians choose to buy electric vehicles, and more business and jobs come to Virginia, especially in energy intensive industries such as data centers."[5] In order to be a realistic assessment of the carbon to biomass contained in some of the alternative scenarios, reliable power must be included in the analysis.

Again, VFA wishes to thank the Department and all the stakeholders for their work during the stakeholder process. We applaud the University of Virginia's team for completing the life cycle analysis in a very short timeframe. We believe biomass plays an essential role both for Virginia's renewable energy mix and for our industry. We appreciate the Department's diligence in carrying out the provisions of HB 2026 and for incorporating our input into the final product.

Sincerely,

Sonnia Montemayor
Interim Executive Director
Virginia Forestry Association

[4] IPCC Sixth Assessment Report. 2022. Page 751.
https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf.

[5] Virginia Department of Energy, "2022 Virginia Energy Plan". 2022. Page 12. https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf.

December 1, 2024

Rob Farrell
State Forester
Virginia Department of Forestry
900 Natural Resources Drive, #800
Charlottesville, VA 22903

Dear State Forester Farrell,

As a member of the stakeholder group, Virginia Farm Bureau represents the voices of over 34,000 farm families that make up a large percentage of 80% of private forest landowners across the Commonwealth. We were in support of HB 2026 as it passed and believe that this stakeholder process and study demonstrate that biomass is beneficial to the Commonwealth achieving its renewable energy goals.

We support biomass energy production to continue to be categorized as a renewable energy source for purposes under the Virginia Clean Economy Act (VCEA) and VA/PJM scenario. It is essential in planning for the VCEA goals that dispatchable energy sources remain in place to allow for dependable power for the Commonwealth's businesses and residents. Electricity produced from forest-derived biomass is a renewable and dispatchable energy source which this report supports showing instances when the base case becomes the preferred energy source over all alternatives including decomposition with VCEA and VA/PJM Power.

The basis for the study is appropriate being conducted utilizing 100 years for the cycle of carbon. We think that this timeframe simulates an appropriate life cycle assessment which is consistent with other examples of modeling that the stakeholders examined. This is evidenced by the description of the data, calculations and assumptions to align it with other published studies.

Foregone sequestration was an important factor discussed throughout the stakeholder meetings. It should be noted that many studies show new growth and younger forest stands sequester carbon at a faster rate compared to old forest stands.[1] Continuing land use in forestry along with proper management should assist in continued carbon sequestration as opposed to the alternative land use changes of land conversion.

Best management practices (BMPs) are sometimes incentivized to support forest health and decrease the instances of insect/disease infestations that damage or destroy marketable wood products that can lead to an increase in forest fires. Biomass energy production is one of many incentives to support BMP use by landowners but is often not the largest income generator. According to DOF and the US Forest Service, pre-commercial thinning of pine stands is one BMP that decreases the infestation of Southern Pine Beetle (SPB). Much of the draw radius for the three biomass energy plants is susceptible to SPB. The cut and remove option are the most effective treatment that also allows landowners to benefit from the sale of harvested trees while removing beetles from the area.[2] Wood will be used for the highest value for wood products first and if it has no value for wood products it may be used to generate energy which subsequently will kill all SPB life stages. Having options, such as biomass energy production, is important to support a landowner's ability to look at all components of incorporating forest health into their management plan.

One aspect of the final report that we question the validity of the assumptions is the amount of roundwood diverted for biomass electricity production. The Viginia Timber Product Output (TPO) survey showed that 13% of roundwood is utilized for energy use. A closer look at the TPO rationale and design shows the definition for the “Bioenergy/fuelwood” is “roundwood products and mill residue byproducts used to produce some form of energy (heat, steam, etc.) in residential, industrial, or institutional settings.[3]” This is not a full representation of sole roundwood harvest and includes other mill residue byproducts. This also accounts for both primary and secondary energy production, meaning some of this does not go on the grid as forest product biomass energy production accounted for in this study. This supports the concern that the S50 and S100 values are too high. Therefore, we believe for this study Dominion utilizes more accurately the amounts of 5% (S05) and 10% (S10) of the 13% TPO bioenergy/fuelwood.

Virginia Farm Bureau recognizes the time and effort of the DOF staff in bringing together a robust stakeholder process and for the time taken by all stakeholders. Dr. Peterson and her UVA team conducted a thorough LCA analysis in a condensed timeframe. Forest landowners consider biomass to be an integral and essential part of renewable energy sources for Virginia and for the forestry industry. Thank you for considering our comments for the final LCA report for HB 2026.

Sincerely,

Martha Moore, Senior Vice President, Governmental Relations
Virginia Farm Bureau Federation

[1] Forest Carbon from Young vs. Old Forests, NCASI, https://www.ncasi.org/wp-content/uploads/2021/01/NCASI22_Forest_Carbon_YoungVsOld_print.pdf
[2] *Story Map: Southern Pine Beetle*, USDA; US Forest Service, Story Map Series www.arcgis.com/apps/MapSeries/index.html?appid=39012ceaf9f942c69ea40540cce5235a Cite
[3] Annual Monitoring of US Timber Production: Rationale and Design, Coulston et al. https://academic.oup.com/forestscience/article/64/5/533/5033855