Economic Contributions of Wood-based Biomass Power Generation Industries in Vermont
2022 Version

Prepared for
Vermont Agency of Natural Resources
Montpelier, Vermont

Prepared by
Shivan Gc and Raju Pokharel, Michigan State University
Jagdish Poudel, Michigan Department of Natural Resources
Ram Dahal, Wisconsin Department of Natural Resources

NORTHEAST-MIDWEST STATE FORESTERS ALLIANCE

Department of Forestry
MICHIGAN STATE UNIVERSITY

FORESTS, PARKS & RECREATION
VERMONT
AGENCY OF NATURAL RESOURCES

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Executive Summary

Decarbonizing the electricity sector requires greater reliance on renewable energy sources, including biomass. Vermont is a net importer of electricity, with roughly 80% of its supply coming from out-of-state sources, mainly Canada. Since 2015, nearly all of Vermont's in-state electricity generation has been renewable, and by 2023 the state reached 100% renewable generation from in-state sources. In 2023, hydroelectric power accounted for the largest share of Vermont's renewable electricity generation (57%), followed by solar (16%), biomass (15%), and wind (13%) respectively. Nearly all the state's power generated from biomass came from wood and wood-derived fuels. Unlike many other renewable sources, woody biomass can provide consistent, around-the-clock baseload power. When harvested and managed sustainably, wood-based biomass helps reduce greenhouse gas emissions compared to fossil fuels, supports employment and income in rural, forest-dependent communities, provides a market outlet for low-value forest materials, helps divert waste from landfills, and can contribute to improved forest health.

This report analyzes the economic contributions of Vermont's wood-based biomass power generation industry, providing an overview of the state's electric power generation sector and its role in the broader economy. The analysis is part of a series of coordinated comparable reports produced for multiple Northeast Midwest U.S states along with California, Georgia and Virginia. Forest resource statistics used in the report were drawn from the U.S. Forest Service's Forest Inventory and Analysis (FIA) data, while economic modeling was conducted using the 2022 Impact Analysis for Planning (IMPLAN) data via the cloud-based platform.

To isolate the economic effects of wood-based biomass power generation specifically, the study applied IMPLAN's detailed impact analysis activity type which is analogous to its Analysis-by-Parts (ABP) technique. IMPLAN does not provide a dedicated sector for wood-based biomass power; instead, these activities are included under the broader "electric power generation—biomass" sector (Sector 45 in cloud version of IMPLAN data). This sector also encompasses electricity generation from other biomass sources, including agricultural

byproducts, landfill gas, municipal solid waste, black liquor, and sludge waste. Using the detailed impact analysis activity type, we developed a customized sector profile based on budgetary spending patterns and labor income specific to wood-based biomass power generation. Supplementary data for the analysis came from the Michigan Department of Natural Resources' 2022 and 2024 mail survey of biomass power producers across a 20-state Northeast-Midwest region, alongside a review of recent literature on biomass energy in the United States.

The economic contribution estimates presented in this report are expressed in constant 2022 dollars. In 2022, Vermont generated approximately 0.37 million megawatt-hours (MWh) of electricity using wood and wood-derived fuels, about sixteen percent less than the amount generated in 2017. The estimated cost of producing electricity from wood and wood-derived fuels was $87 per MWh in 2022, based on data obtained from a 2024 mail survey of biomass power facilities located in the twenty-state Northeast and Midwest regions.

In 2022, the wood-based biomass power generation industry in Vermont directly supported 26 jobs and generated ~$32 million in direct economic output. When accounting for indirect and induced effects throughout the economy, the industry supported a total of 389 jobs and contributed $64 million in total economic output. State and local tax revenues generated by industry were approximately $4.7 million, with an additional $3.6 million in federal tax contributions. The social accounting matrix (SAM) multiplier for industry output was estimated at 2.0, indicating that every $1 million of output from Vermont's wood-based biomass power generation industry supported an additional $1 million in economic activity elsewhere in the state's economy. In terms of employment, industries most affected by the sector's activities included commercial logging, support services for agriculture and forestry, and all other crop farming.

In comparison, the biomass power generation industry directly employed 36 individuals and generated $30 million (in 2022 dollars) in direct output in 2017. Between 2017 and 2022, direct employment decreased by approximately 28% while direct output grew by 5%. Total

employment, including direct, indirect, and induced jobs, declined by 25% over the same period, and total economic output declined by 6%.

Glossary

Biomass: Renewable organic material that comes from plants and animals. It contains stored chemical energy from the sun. Sources of biomass for energy include wood and wood processing wastes, agricultural crops and waste materials, biogenic materials in municipal solid waste, animal manure, and human sewage.

Woody Biomass: It encompasses biomass obtained from the trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management.

Biopower: Biopower technologies convert biomass fuels into heat and electricity. There are three main methods of releasing the energy stored in biomass to produce biopower: burning, bacterial decay, and conversion to gas/liquid fuel.

Net Electric Power Generation: Generation is a measure of electricity produced over time. Some portion of the electricity produced by the power plants is used internally to operate these plants. Net generation excludes electricity use for power plant operations.

Renewable Portfolio Standard (RPS): It is a regulatory requirement that electricity providers must supply a specified minimum share of their total electricity sales from eligible renewable energy sources.

Power Plant Capacity: It is the maximum level of electricity that a power plant can supply at a specific point in time under certain conditions.

Nameplate Capacity: Nameplate generator capacity is determined by the generator's manufacturer and indicates the maximum output of electricity a generator can produce without exceeding design thermal limits.

Kilowatt (kW): A standard unit for measuring electricity. 1 kW is equivalent to 1,000 Watts.

Kilowatt-hour (kWh): One kW of electricity generated or used for one hour.

Megawatt (MW): 1,000 kW

Megawatt hour (MWh): 1,000 kWh

Economic Contribution Terms

Direct effects/contributions: The economic activities (e.g., output, employment, labor income, and value-added) associated with an industry or sector in the study area. These can describe the current economic sectors or changes to those sectors.

Employment: The number of full- and part-time jobs associated with an industry plus self-employed individual.

Indirect effects/contributions: The impact of local industries purchasing goods and services from other industries, leading to others' outputs, employment, and labor income.

Induced effects/contributions: The impact of labor income (employee compensation and proprietor income) via goods and services purchased due to the direct and indirect spending by industries.

Labor income: The dollar total of employee compensation and proprietor income; the latter is associated with self-employed individuals.

Output: The dollar measure of production within an area; it is also viewed as sales.

Type I multiplier: These multipliers are derived by dividing the sum of direct and indirect effects by the direct effects.

Social Accounting Matrix (SAM) multipliers: These multipliers are derived by dividing the sum of direct, indirect, and induced effects by the direct effects. The social accounts include payments made between households, households, and government and more. These are available for output, employment, labor income, and value-added and are used to assess the effects of changes in industry activity (i.e., "ripple effects").

Total effects/contributions: The sum of direct, indirect, and induced effects.

Value-added (also known as gross state product, or GSP): The sum of labor income, other property income (e.g., rents and profits), and indirect business taxes (e.g., excise and sales taxes). It is the difference between an industry's total output and the cost of its intermediate inputs. The sum of value-added for all economic sectors within the state equals the total GSP.

Forest Inventory and Analysis Terms

Forestland: It is a land that has at least 10 percent canopy cover of trees of any size or has had at least 10 percent canopy cover of trees in the past that will be naturally or artificially regenerated. To qualify as forest land, an area must be at least 1 acre in size and have a minimum width of 120 feet to ensure continuity of forest conditions.

Merchantable net bole volume: It is the volume of sound wood in the merchantable bole (from the 1-foot stump to merchantable top), after deductions for rot, missing sections, or other defects.

Annual net growth: It is the average annual increase in net volume of live or growing-stock trees on forest land during the inventory period.

Annual removals: It is the average annual net volume of trees removed from forest land during the inventory period due to harvest, land-clearing, or other land-use changes.

Annual mortality: It is the average annual net volume of live trees that died from natural causes during the inventory period.

Introduction

Renewable energy plays an increasingly important role in the U.S. electricity sector, driven by concerns over greenhouse gas emissions from fossil fuels, energy security, and the potential for local and rural economic development. In 2023, the United States generated 4.18 trillion kilowatt-hours (kWh) of electricity, with approximately 60% produced from fossil fuels, 19% from nuclear energy, and 21% from renewable sources (U.S. Energy Information Administration [EIA], 2025a). Renewable electricity generation more than doubled over the past two decades, increasing from 357 billion kWh in 2000 to over 900 billion kWh in 2022 (EIA, 2025b). Despite this growth, the electricity sector remains a major contributor to national greenhouse gas emissions, accounting for roughly 25% of total U.S. emissions in 2022 (U.S. Environmental Protection Agency [EPA], 2025).

This expansion of renewable energy has been strongly supported by state and local policies, including renewable portfolio standards (RPS) and voluntary renewable energy goals. These policies aim to increase the share of renewable energy in electricity generation, reduce emissions, and stimulate local investment. In addition, some states have adopted clean energy standards (CES), which often encompass RPS requirements while also including broader low-emission technologies (National Conference of State Legislatures, 2025). As of 2025, 28 states, along with the District of Columbia, have enacted RPS mandates (Lawrence Berkeley National Laboratory, 2025). Three additional states and one U.S. territory (Guam) have adopted voluntary renewable energy targets, further reinforcing the nationwide momentum toward cleaner energy systems (National Conference of State Legislatures 2025). Additionally, sixteen states have established a broader 100% CES in combination with RPS (Lawrence Berkeley National Laboratory, 2025). Figure 1 highlights the states with 100% CES commitments and the range of RPS targets currently in place.

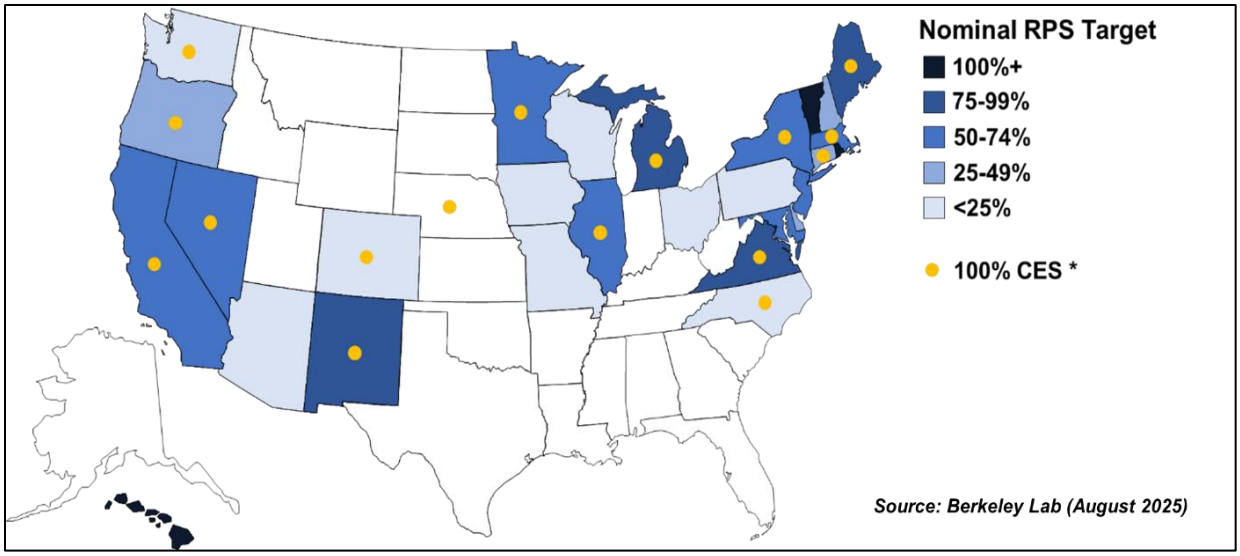

Figure1. Map of US depicting states with 100% Clean Energy Standards (CES) and associated Renewable Portfolio Standard targets (Source: Lawrence Berkeley National Laboratory, 2025).

In Vermont renewable energy standard (RES) was enacted in 2015, which was later updated in 2024. The RES requires the state's retail electricity suppliers to obtain 63% of their annual electricity sales from renewable sources by 2025, increasing the percentage by at least 4% every three years until reaching 100% by 2030 (US EIA 2025c). Vermont is also a member of the 11-state Regional Greenhouse Gas Initiative (RIGGI), that was established to cap and reduce greenhouse gas emissions from power generation. In 2023, almost all of Vermont's in-state electricity generation came from renewable energy sources. However, the state imports more than 80% of its electricity supply from out of state, mostly hydropower from Canada. Of the total renewable electricity generated in-state, biomass contributed about 15% with most of it coming from wood and wood-derived fuel (US EIA 2025c). Woody biomass offers unique benefits. It provides baseload power, reduces greenhouse gas emissions, supports rural economies, and creates a market for forest residues and byproducts from forest management, wildfire reduction, and wood product manufacturing (National renewable energy laboratory 2023, USDA Forests and Rangelands 2023, Gan and Smith 2007). Biomass power can also help offset the costs of forest restoration and hazardous fuel treatments (Page-Dumroese et al. 2022).

Despite its benefits, electricity generation from woody biomass in the U.S. has remained relatively stable over the past two decades, with a slight decline in recent years (Figure 2). In Vermont, woody biomass contributed about 6.8% of the total electricity produced in the state in 2001. By 2022, it increased to 16.8% and again declined slightly to 14.7% of the total in-state electricity produced in 2024 (US EIA 2025d). Nationwide, the number of power plants utilizing wood and wood-derived fuels declined from 247 in 2017 to 219 in 2022, and further to 197 in 2024 (U.S. EIA 2025d). In Vermont, there were three biopower facilities in 2017 that have remained operational in 2024 (U.S. EIA 2025d). Table 1 provides the names, locations, sector classifications, and full fuel portfolios of Vermont's biopower facilities using wood and wood-derived fuels in 2022.

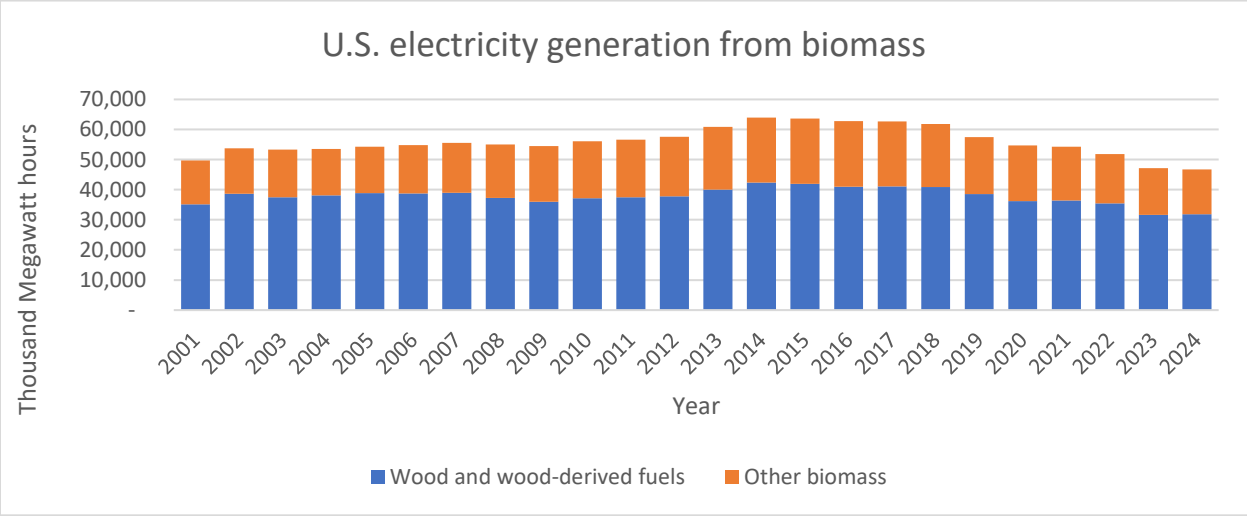

Figure 2. U.S. electricity generation from biomass, 2001 to 2024. (Source: U.S. Energy Information Administration 2025d).

Figure 3. Locations of biomass power plants using wood and wood-derived fuels in Vermont in 2022. (Source: U.S. Energy Information Administration, 2025d).

Table 1: List of Vermont's power generation facilities using wood-based fuels in 2022.

Plant Name	Street Address	City	County	Sector Name	Fuel Type Used*
J C McNeil	111 Intervale Road	Burlington	Chittenden	Electric Utility	NG,WDS
Ryegate Associates, LLC	247 Weesner Drive	East Ryegate	Caledonia	IPP Non-CHP	WDS
Middlebury College	84 South Service Road	Middlebury	Addison	Commercial CHP	NG,DFO,WDS

*Fuel Type Codes: NG = Natural Gas; WDS = Wood and Wood-Derived Solids; DFO = Distillate Fuel Oil.

Estimating the economic contributions of wood-based biomass power generation industry in a region can help emphasize the ripple effects of this industry to the regional economy and help to advocate for its sustenance and expansion in the future. Realizing this, in 2022, Michigan Department of Natural Resources (MI DNR) Forest Resources Division contracted with a research team at Michigan State University, Department of Forestry along with its collaborators (from North Carolina State University, Oklahoma State University, University of Idaho, SUNY College of Environmental Sciences and Forestry, and the Michigan Biopower) to conduct the economic contribution analysis of wood-based biomass power generation industry to the regional economy of the twenty-state Northeast and Midwest U.S. states along with California, Georgia and Virginia for calendar years 2017 and 2022 respectively.

As part of this project, the research team developed a 2022 regional report analyzing the economic contributions of the wood-based biomass power generation industry across a 20-state Northeast and Midwest regions. In addition to the regional analysis, individual state reports are prepared for the participating states which include California, Connecticut, Georgia, Illinois, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Pennsylvania, Vermont, Virginia, and Wisconsin. These reports summarize the industry's economic contributions within each state.

This report presents the results for Vermont, focusing on the industry's economic role in the state's economy. The sections that follow provide an overview of California's electric power generation industry, a brief description of the state's forest resources, an explanation of the methods used in this analysis, and a summary of the findings from the 2022 study.

Electric power generation in Vermont in 2022

In 2022, the electric power industry in Vermont produced a total of 2.2 million Megawatt hours of electricity. Most of it was generated from hydroelectric power followed by biomass, solar, and wind energy respectively (Figure 4). Out of the total electricity generated, approximately 17% or 0.37 million Megawatt hours were produced using wood and wood-derived fuel (Figure 4) (US EIA 2025d).

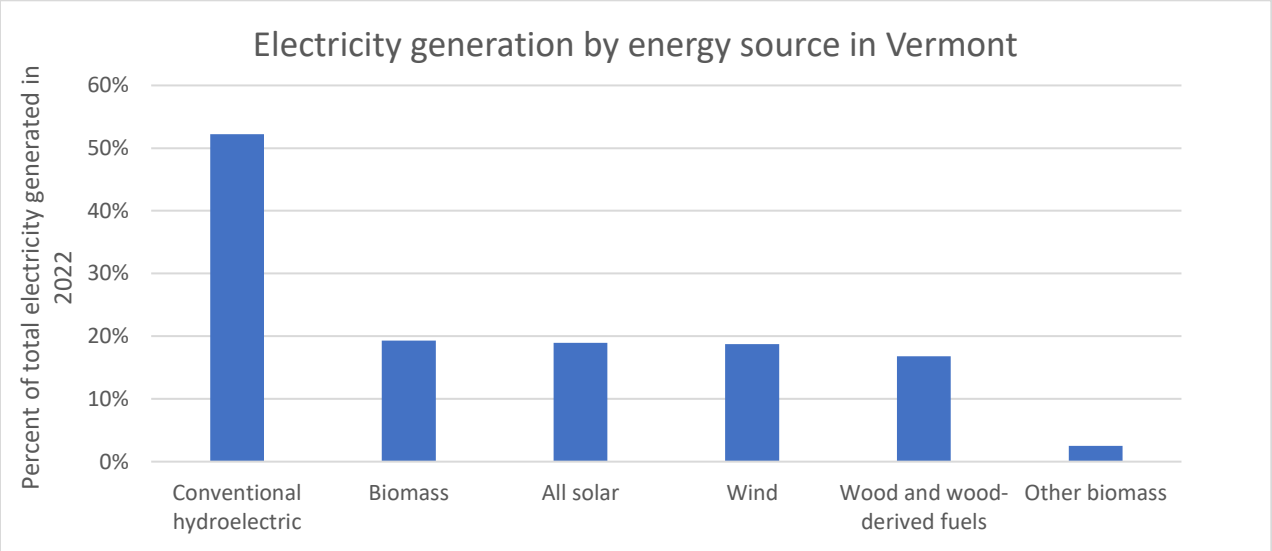

Figure 4. Percentage of total electricity generated in Vermont in 2022 by energy source (Source: U.S. Energy Information Administration 2023i).

Collectively the electric power generation, transmission, and distribution industry employed 1,411 people in 2022 which is equivalent to 0.33% of total jobs in the state the same year (IMPLAN 2017). The direct economic effects resulting from various power-generating industries within the state including biomass are listed in Table 2.

Table 2. The direct economic effects of power generating industries in Vermont based on 2022 IMPLAN data.

IMPLAN Sector Code (Electric Power Generation)	Energy Source	Employment	Labor Income (Millions of 2022 dollars)	Value-Added	Output
41	Hydroelectric	53	$7	$17	$36
42	Fossil fuel	-	$-	$-	$-
43	Nuclear	110	$19	$42	$97
44	Solar	65	$4	$14	$37
45	Wind	23	$3	$29	$59
46	Geothermal	-	$-	$-	$-
47	Biomass	9	$1	$4	$11
48	All other	-	$-	$-	$-
49	Electric power transmission and distribution	1,150	$202	$688	$1,673
	Total electric power generation, transmission, and distribution	1,411	$237	$792	$1,913
	Total All Sectors	**428,677**	**26,518**	**42,618**	**79,383**

Forest Resources of Vermont

Forestlands cover approximately 4.5 million acres which is 74% of the total land area in Vermont (USDA Forest Service, Forest Inventory and Analysis 2023). Most of the forests in the state (78.8%) are under private ownership, followed by the federal government (10.7%), and state and local governments (10.5%) respectively (Figure 5). Maple/beech/birch are the major forest types in the state followed by White/red/jack pine and Spruce/fir forest types (Table 3).

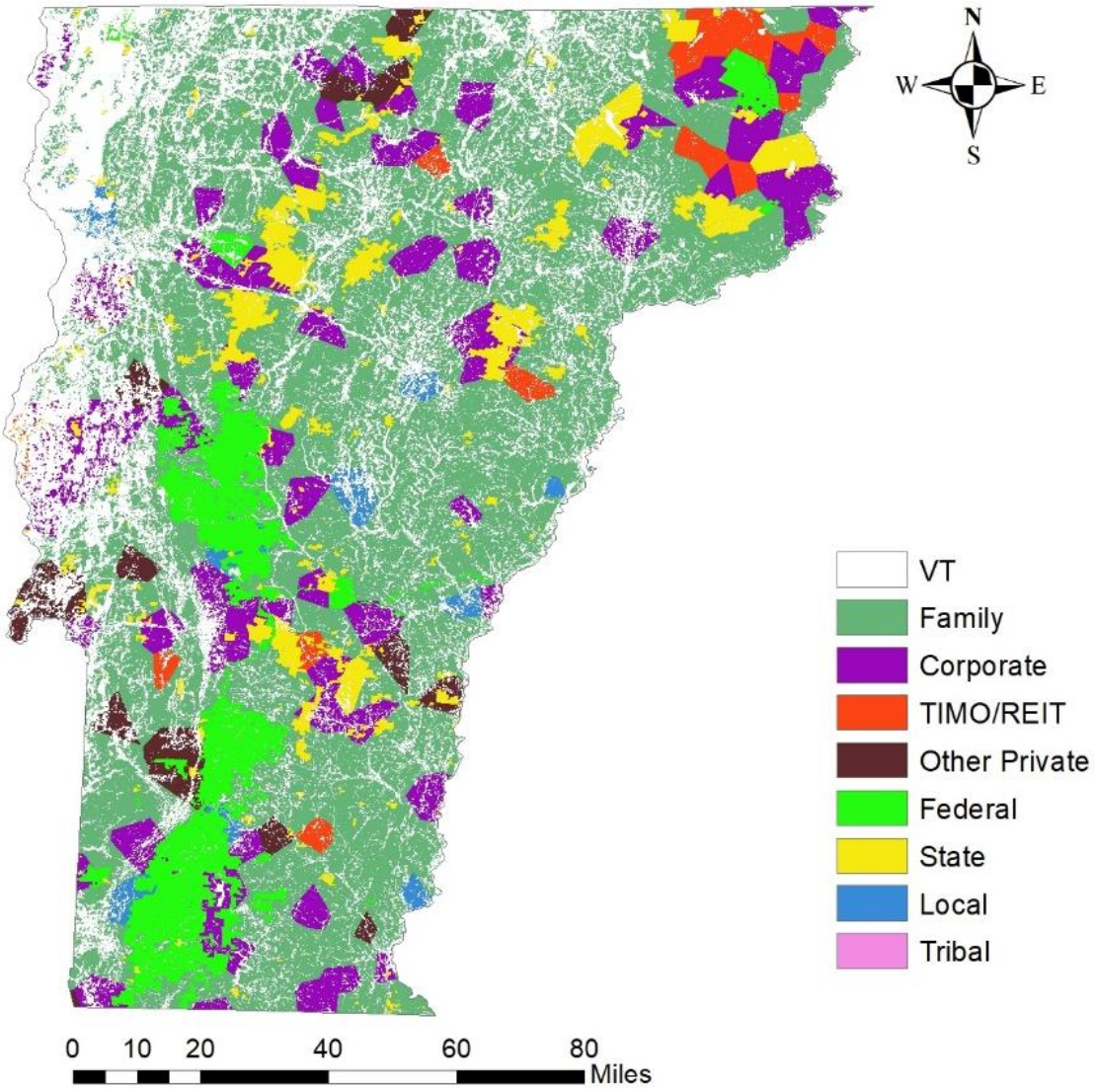

Figure 5. Forest ownership in Vermont (Data source: Sass et al. 2020).

Table 3. Forestland area in Vermont by forest type (Source: USDA Forest Service, Forest Inventory and Analysis 2025).

Forest Type Group	Acres	Percentage
Maple / beech / birch group	3,256,781	72%
White / red / jack pine group	399,658	9%
Spruce / fir group	291,204	6%
Aspen / birch group	173,339	4%
Oak / hickory group	159,180	4%
Others	245,609	5%
Total	4,525,771	100%

The merchantable net bole volume of live trees in Vermont is estimated to be ~10.3 billion cubic feet (Table 4). The average annual net growth is 155 million cubic feet, annual removals are 68 million cubic feet, and annual mortality is 76 million cubic feet. Annual growth in the timberlands exceeded the removals by a ratio of 2.3, meaning that for each cubic foot of timber harvested in the state, about 2.3 cubic feet of timber grew in the timberlands. However, this ratio varies by ownership type. The growth to removals ratio in national forests is 7.8. In private forests, it is 2.6, and 7.2 in the case of forests under state and local government (Table 4). This suggests variation in management focus on timberlands owned by different forest ownership types. Across the state, the annual removals are close to 0.7% of the standing volume and annual mortality in the timberlands is higher than annual removals (Table 4).

Table 4. Characteristics of state growing stock in Vermont in 2025 (million cubic feet) (Source: USDA Forest Service, Forest Inventory and Analysis 2025).

Ownership	Net Volume	Annual Net Growth	Annual Removals	Annual Mortality	Growth/Removals
Total	10,266	155	68	76	2.3
National Forest	700	7	1	5	7.8
Other federal	34	0	3	0	0.0
State and local	959	10	1	8	7.2
Private	8,573	137	52	62	2.6

Methods

The analysis was conducted using impact analysis for planning (IMPLAN) software and 2022 IMPLAN data using the Analysis-by-Parts (ABP) technique accomplished through detailed industry impact analysis activity type in IMPLAN. The ABP technique was chosen because it allows the user to create a customized industry sector by using the information about that sector's budgetary spending pattern and labor income (Lucas 2022). So far IMPLAN does not have a separate sector to represent wood-based biomass power generation. Instead, it is incorporated as a part of the electric power generation using the biomass industry. This means that it includes power generation from all sources of biomass including agricultural byproducts, landfill gas, municipal solid waste, woody biomass, black liquor, and sludge waste. To separate the economic contributions associated with wood-based power generation from power generation using all forms of biomass, the analysis-by-parts (ABP) technique was used. The resulting economic contributions are measured in terms of full- and part-time employment, industry output, value-added, labor income, other property income, and business taxes.

The information about industry spending patterns for the biomass power generation industry using woody biomass was obtained from Dahal et al. (2020) and corroborated or supplemented (where applicable) with the information collected through the mail survey of biomass power generation plants located in the twenty state Northeast-Midwest region. In fall 2022 and 2024, Michigan Department of Natural Resources conducted a mail survey of 120 biomass power industries located in the 20-state Northeast-Midwest region along with California, Georgia, and Virginia to collect the financial and resources utilization data for the year 2017 and 2022 respectively. Overall, 11 responses were obtained in the 2022 survey (9.2% response rate), and five responses were obtained in the 2024 survey (4.2% response rate). The data obtained from these responses were used to inform and supplement the industry spending pattern for wood-based biomass power generation industries for regional and state level reports for participating states. The average operation and maintenance expenditure for the wood-based biomass power generation industry used for the economic contribution analysis is listed in Table 5.

The 2024 survey asked respondents to indicate the total amount of electricity produced in 2022 using wood and wood-derived fuel along with the total cost of production. This information was used to estimate the cost per megawatt hour of electricity produced. It was estimated to be $87/MWh on average when weighed by the size of production for respondents who responded to the survey. This cost falls within the range of levelized cost of electricity generation from biomass ($77.16 to $95.16) as listed by the US energy information administration in the Annual Energy Outlook (2023). Hence, we used $87/MWh of electricity production as the cost of generating biopower from woody biomass for our 2022 analysis. The details of the survey method along with the information collected are included in the twenty-state Northeast-Midwest biopower economic contribution analysis report.

The per unit cost of electricity produced using wood and wood-derived fuel was multiplied by the total electricity produced using wood and wood-derived fuel within a state to obtain the direct output from the wood-based biomass power-generating industry in that state. Information about the total electricity produced by the electric power generation industry using wood and wood-derived fuels in 2022 was obtained from US EIA (2025d).

In Vermont, 0.37 million Megawatt hours of electricity were generated using wood and wood-derived fuel in 2022. At the rate of $87/MWh of electricity produced, this translated into a direct output of $31.9 million for the wood-based biomass power generation industry in the state. The direct output was then allocated into intermediate inputs and value-added following the percentage breakdown of output into its component parts for IMPLAN sector 45 (electricity generation using biopower industry) using 2022 IMPLAN data for Vermont. According to it, approximately 66.8% of the output of the biomass power generation industry was comprised of intermediate inputs and 33.2% was value-added. Value added was further broken down into employee compensation (8.1%), proprietor income (2.5%), other property type income (13.6%), and taxes on production and imports (9.1%) following IMPLAN sector 45's percentage breakdown for Vermont for 2022. To estimate the direct employment for wood-based biomass power generation industry, the industry's total output was divided by the output per worker value for IMPLAN sector 45 (from Vermont's 2022 dataset). Based on this, we estimated direct employment in wood-based power generation industry in Vermont to be 26 in 2022.

When estimating the economic contribution of the biomass power generation industry in IMPLAN using the ABP technique, the local purchase percentage (LPP) for all other items in the industry spending pattern except woody biomass, was set to default SAM value. For woody biomass, LPP was set to 100%. This is because all wood used by the biomass power generation industry is sourced locally as per the findings obtained from the mail survey (within 60 miles radius). Since it is not possible to precisely identify the location of production, transport, and purchase of other items included in the industry spending pattern for the wood-based biomass power generation industry, LPP was set to default SAM values for those items. Like Dahal et al. (2020), we estimated total taxes (including emission fee) to be 1.85% of total operation and maintenance cost, which amounted to $0.6 million. This was modeled separately, and the resulting indirect and induced effects obtained from tax contributions were added to the total economic contribution summary for the state.

Table 5. Percentage distribution of annual operation and maintenance expenditures for the wood-based biomass power generation industry. Percentages are based on Dahal et al. (2020) and supplemented with data collected from a mail survey of wood-based power generation facilities in the Northeast and Midwest United States.

IMPLAN Sector	Cost category (sector)	Percentage
16	Biomass	58.6%
20	Natural Gas	0.05%
39	Utilities	2.8%
49	Water	1.6%
60	Building expenses	0.4%
154	Oil and diesel	0.8%
162	Chemical	1.3%
167	Supplies (consumable, urea, ammonia)	1.9%
384	Office supplies and expenses	0.2%
408	Gasoline (retail)	0.1%
433	Communication	0.2%
444	Insurance	1.6%
453	Equipment rental	0.1%
457	Outside support services (water treatment, vendor services)	0.6%
462	Consulting fees	0.4%
470	Office administrative service	1.0%
474	Travel and entertainment	0.1%
476	Janitorial	0.3%
479	Ash freight and waste management	3.0%
512	Vehicle repair	0.1%
515	Maintenance	7.2%
50001	Employee compensation	15.6%
	Total taxes (including emission fee)	1.8%
	Total operation and maintenance cost	100.0%

Results

The results obtained from the economic contribution analysis indicated that in Vermont, the wood-based biomass power generation industry directly employed 26 people in 2022 with a labor income of $3.4 million, value-added of $10.6 million, and an output or sales of $31.9 million in 2022 US dollars (Table 6). Including ripple effects, the industry supported a total of 389 jobs with $16.3 million in labor income. The industry contributed a total of $28.3 million in value-added and $64.5 million in total output to the economy of Vermont (Table 6). The top three industries affected in terms of output by wood-based biomass power generation industry in the state include biomass power generation industry itself, commercial logging (IMPLAN sector 16), and forestry, forest products and timber tract production industry (IMPLAN sector 15). In terms of employment, commercial logging, support activities for agriculture and forestry and all other crop farming were affected the most.

SAM multipliers for employment, labor income, value-added, and output were estimated to be 14.9, 4.8, 2.7, and 2.0 respectively. Output multiplier of 2.0 means that every $1 million in output in the region's wood-based biopower industry supported an additional $1 million in output to the rest of the economy. The Social Accounting Matrix (SAM) multiplier for industry output in the region was estimated at 2.3, indicating that every $1 million in output from the wood-based biopower industry supported an additional $1.3 million in economic activity across the broader regional economy. The SAM multiplier for employment, labor income and value added were found to be 12.4, 4.9, and 2.8 respectively. The relatively high employment multiplier compared to output, labor income, and value-added multipliers, reflect the biomass power industry's supply chain and spending patterns. It reflects the wood-based biomass power sector's dependence on labor-intensive upstream industries, especially commercial logging and forestry support services. These industries generate many jobs per dollar of spending, but with relatively modest wages and value added per worker. Additional induced effects in service industries such as hospitals, restaurants, and retail further increase job counts. Consequently, employment multipliers are substantially higher than output, labor income, or value-added multipliers. It should be noted that IMPLAN employment is jobs including part-time, seasonal

workers and proprietors head count, hence sectors that add lots of part-time, low-hour service jobs tend to increase the employment count though labor income and output remain modest.

The industry also contributed approximately $4.7 million in federal and $3.6 million in annual state and local taxes in 2022 (Table 7).

Table 6. Economic contributions of wood-based biomass power generation industry in Vermont in 2022 US dollars using IMPLAN software version and 2022 IMPLAN data.

States Included	Economic Contributions of Wood-based Biomass Power Generation Industry				
		Employment	Labor Income	Value-added	Output
		(Jobs)	($MM 2022)		
Vermont	Direct Contributions	26	$3.4	$10.6	$31.9
	Indirect Contributions	304	$9.6	$11.5	$22.3
	Induced Contributions	59	$3.3	$6.2	$10.3
	Total Contribution	389	$16.3	$28.3	$64.5
	SAM Multiplier	14.9	4.8	2.7	2.0

Table 7. Total tax contributions of wood-based biomass power generation industry in Vermont in 2022 US dollars ($MM) using 2022 IMPLAN data.

Impact	Sub County General	Sub County Special Districts	County	State	Federal	Total
Direct	$0.54	$0.01	$0.00	$2.42	$0.96	$3.93
Indirect	$0.13	$0.00	$0.00	$0.86	$1.86	$2.85
Induced	$0.12	$0.00	$0.00	$0.62	$0.79	$1.53
Total	$0.79	$0.02	$0.01	$3.90	$3.61	$8.32

Table 8. The top five industries affected in terms of employment by wood-based biomass power generation industry in Wisconsin in 2022

		Impact			
	Industry affected (IMPLAN Sector)	**Direct**	**Indirect**	**Induced**	**Total**
1	Commercial logging (16)	0	168	0	168
2	Support activities for agriculture and forestry (19)	0	67	0	67
3	All other crop farming (10)	0	29	0	29
4	Electric power generation – Biomass (45)	26	0	0	26
5	Commercial and industrial machinery and equipment repair and maintenance (515)	0	8	0	8

Summary

This study assessed the economic contributions of wood-based biomass power generation industry in Vermont using IMPLAN, an input-output analysis software and 2022 IMPLAN data. It provides a snapshot of the economic effects of wood-based biomass power generation industry in terms of employment generated, value-added contributed and output produced using analysis by parts technique. The ABP technique was used to separate the economic contributions of wood-based biomass power generation from the contributions of biomass power generation in general, which also includes biomass sources other than wood and wood-derived fuel. The wood-based biomass power generation industry in Vermont was found to directly support 26 jobs and contribute $31.9 million in output to the state's economy. Including direct, indirect, and induced effects, the industry contributed a total of 389 jobs and $64.5 million in output in Vermont.

Compared to 2017, in 2022, direct employment in wood-based biomass power generation industry in Vermont declined by 28% (from 36 employees in 2017 to 26 employees in 2022) while direct output increased by 5% (from $30.5 million in 2017 to $31.9 million in 2022). Similarly, total employment declined by 16% and total output declined by 6% in 2022 compared to 2017.

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