Economic Contributions of Wood-based Biomass Power Generation Industries in Georgia: 2017 Version

Prepared for
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Executive Summary

Decarbonization of the electricity sector calls for a greater reliance on renewable energy sources including biomass for generating electricity. In 2024, approximately, 41% of the total electricity generated in Georgia came from natural gas, 34% from nuclear power, 13% from coal and the remaining 12% came from renewable energy sources including solar power, biomass, and hydropower. Of the total renewable energy generated, biomass accounted for about three-tenths with most of it coming from wood and wood-derived fuel (U.S. Energy Information Administration, 2023a). Georgia ranks first across the nation in the amount of electricity generated from biomass resources. Woody biomass is unique in that it is one of the few renewable energy sources that can provide 24/7 baseload power. Wood-based biomass for energy reduces greenhouse gas emissions over traditional fossil fuels, generates income and employment opportunities in rural forest-dependent communities, provides the market outlet for unwanted materials, reduces the amount of garbage ending up in landfill sites, and has positive effects on forests' health if done sustainably.

This report provides an overview of electric power generation industries in Georgia and estimates the economic contributions of wood-based biomass power generation industries on the state's economy. It is one of the multiple coordinated and comparable state reports produced across the country. The forest statistics information used in the report comes from the U.S. Forest Service's Forest Inventory and Analysis data, and the economic data come from the 2017 Impact Analysis for Planning (IMPLAN), a commercially available economic input-output (IO) model.

To help quantify the economic effects of the wood-based biomass power generation industry on Georgia's economy, the economic contribution analysis was conducted using impact analysis for planning (IMPLAN), an input-output modeling software, and 2017 IMPLAN data using the Analysis-by-Parts (ABP) technique. IMPLAN does not have a separate sector to represent the wood-based biomass power generation industry and incorporates it as a part of electric power generation using the biomass sector (noted by IMPLAN sector 45 in cloud version of 2017 data). This sector also includes other sources of biomass such as agricultural byproducts, landfill gas, municipal solid waste, black liquor, and sludge waste. Hence, to estimate the economic contributions resulting from only the wood-based biomass portion of the total mix, the ABP method was used. APB allows the user to create a customized industry sector by using the information about that sector's budgetary spending pattern and labor income. The supplementary data for conducting the economic contribution analysis was obtained from the mail survey of biomass power generation industries located in the 20-state Northeast Midwest study region along with California, Georgia and Virginia conducted by the Michigan Department of Natural Resources in the Fall of 2022 and a review of the existing literature on wood-based biomass power generation in the U.S. The economic contribution estimates presented in this report are expressed in 2017 dollars.

The cost per MWh of electricity produced using wood and wood-derived fuel was obtained from the mail survey of biomass power plants located in the twenty-state Northeast Midwest region along with California, Georgia, and Virginia. It was estimated to be $63/MWh. In Georgia, the wood-based biomass power generation industry directly employed 304 people and generated $294 million in direct output to the state's economy in 2017. Including ripple effects, the industry created a total of 3,774 jobs and contributed $691 million in total output to the state's economy. In terms of tax contributions, the industry generated ~$42 million at the state and local levels and ~$50 million at the federal level in 2017. The social accounting matrix multipliers for the industry were found to be 12.4 for employment, 2.8 for labor income, 2.8 for value-added, and 2.4 for output. Output multiplier of 2.4 means that for every $1 million in output in the state's wood-based biopower industry, an additional $1.4 million in output was supported in the rest of the economy. In terms of output, the top three industries affected by the state's wood-based biomass power generation industry included biomass power generation industry itself, commercial logging industry, and forestry, forest products, and timber tract production industry. In terms of employment, commercial logging, support activities for agriculture and forestry, and electric power generation using biomass industry were affected the most.

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.

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

<u>**Economic Contribution Terms**</u>

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.

Introduction

There is a growing interest in generating a greater share of electric power using renewable energy sources in the United States. This interest stems from increasing concerns over the negative environmental, human health, and economic effects of continued reliance on non-renewable fossil fuels for energy. Further, the emphasis on renewable electricity generation is important for ensuring energy security and for creating opportunities for local and rural development.

The U.S. electricity consumption has risen over the years reaching a total of 4.07 trillion kilowatt hours in 2022 (US Energy Information Administration (EIA) 2023b) and the short-term forecast is for increasing energy consumption owing to demands from new semiconductor and battery manufacturing factories as well as data centers (US EIA 2025). To keep up with the increasing demand, the U.S. electricity generation has also increased substantially over the years. In 2023, the U.S. generated a total of 4.17 trillion kilowatt hours of electricity (US EIA 2023c). The U.S. electric power industry accounted for approximately 33% of the total U.S. energy-related CO_2 emissions in 2022 (US EIA 2023d). This is because most of the electricity produced in the country (60%) comes from fossil fuel sources such as coal, natural gas, and petroleum (US EIA 2023c). Approximately 19% of the electricity produced in 2023 was generated using nuclear energy and 21% using renewable energy sources (US EIA 2023c). Despite making considerable progress in transitioning to clean energy over the last two decades, the U.S. electricity sector still accounts for about a quarter of the U.S. climate pollution (Center for American Progress, 2023). Approximately 356 billion kilowatt hours of electricity were produced using renewable energy sources in the U.S. in 2000. By 2022, the amount of electricity produced using renewable energy sources increased to reach over 900 billion kilowatt hours (US EIA 2023e). This is an impressive increment. Nonetheless, for improved environmental outcomes associated with the electric power generation industry in the future, a greater share of electricity production in the country needs to come from renewable energy sources.

Over the years, state and local governments have played a pivotal role in promoting the use of renewable energy sources for producing electricity. This has been done through the implementation of focused sectoral strategies and incorporation of performance standards along with supporting policies (Center for American Progress, 2023). As of December 2023, 28 U.S. states along with the District of Columbia have established a renewable portfolio standard (RPS), seven states have set renewable portfolio goals, and eleven states have clean energy standards or goals identified moving forward (U.S. EIA 2023f). These can be requirements or goals for energy producers and providers to supply energy from low- or zero carbon emission sources (U.S. EIA 2023f).

In Georgia, approximately 12% of the total electricity generated in 2024 came from renewable energy sources, mostly solar energy. Of the total renewable energy generated, biomass contributed about three-tenths with most of it coming from wood and wood-derived fuel (US EIA 2023a). Biomass is an important source of renewable energy that is used for facility heating, electric power generation, and combined heat and power generation. It includes a variety of materials, including wood and wood processing wastes, agricultural crops and waste materials, biogenic materials in municipal solid waste as well as animal manure and human sewage (US EIA 2023g). Biomass can be converted into electric power and heat through several different methods, the most common being direct combustion. Other methods include gasification, pyrolysis, and anaerobic digestion (US EIA 2023g). One of the primary benefits of using biomass for power generation is that it can provide baseload or firm power, unlike other renewable energy sources such as solar and wind (Bracmort 2016).

The utilization of woody biomass for power generation offers numerous societal, economic, and environmental benefits. Wood-based biomass for energy reduces greenhouse gas emissions over traditional fossil fuels, generates income and employment opportunities in rural forest-dependent communities, reduces the amount of garbage ending up in landfill sites, and has positive effects on forests' health if extraction is done following sustainability standards (National renewable energy laboratory 2023, Gan and Smith 2007). Substantial volumes of woody biomass are removed annually by private, state, and federal forestland managers in the process of managing forests to protect it against wildfires, insects, diseases, and invasive species. Additionally, woody biomass can also result from natural disasters such as hurricanes and tornadoes as well as urban cleanup activities (USDA Forests and Rangelands 2023). Most of the materials resulting from these management activities can decay or be burned in place or hauled to landfills in the absence of market outlet such as biomass power generation (USDA Forests and Rangelands 2023). Biomass power generation, therefore, offers an important avenue for the disposal of woody biomass, thus contributing to improving air quality, visibility, and public health by reducing the smoke created by burning woody biomass. It also helps to offset the high costs of forest management activities, hazardous fuel treatment operations, restoration activities, and post-harvest cleanup operations by providing an economic value to nonmerchantable and low value wood (Page-Dumroese et al. 2022). Biomass power generation thus indirectly contributes to reduce wildfires and helps to preserve wildlife habitat and watersheds while creating economic opportunities for the communities (USDA Forests and Rangelands 2023). Additionally, when manufacturers of wood products make products such as lumber, furniture, pallets, and paper, they generate substantial amounts of residues that can be underutilized in absence of markets for such products. Less than 50% of the tree that is harvested ends up in the final product leaving a large volume of residues that can be used for energy generation (Abbuelh et al. 2004).

Since biomass-based electricity production requires a high initial investment and the facilities are likely to use local feedstock for energy production compared to electricity generation using fossil fuel sources, they are likely to have greater impacts on local income (Faaij et al. 1998). Besides, power generated from woody biomass, if managed sustainably, may qualify as carbon neutral, since CO_2 released during power generation is displacing CO_2 emissions from fossil fuels and can be sequestered through the production of additional trees (International Energy Agency 2022). However, to be considered truly carbon neutral, a full supply chain including all emissions associated with production, processing, transportation, and the use of biomass for energy production needs to be considered (International Energy Agency 2022).

Despite the above listed benefits of using biomass for energy generation, the use of woody biomass in electricity production in the U.S. has remained relatively stable over the past two decades, with a slight decline in recent years (Figure 1). In Georgia, however, the share of total electricity generated from woody biomass has increased over the years contributing 2.4%

of the total electricity generated in 2000 to 4.6% in 2020. In 2023, woody biomass contributed about 3.6% of the total electricity produced in the state (US EIA 2023h).

In 2017, there were a total of 247 power generation facilities using wood and wood-derived fuels across the county (US EIA 2023i). Out of these, 16 were located in Georgia (Figure 2).

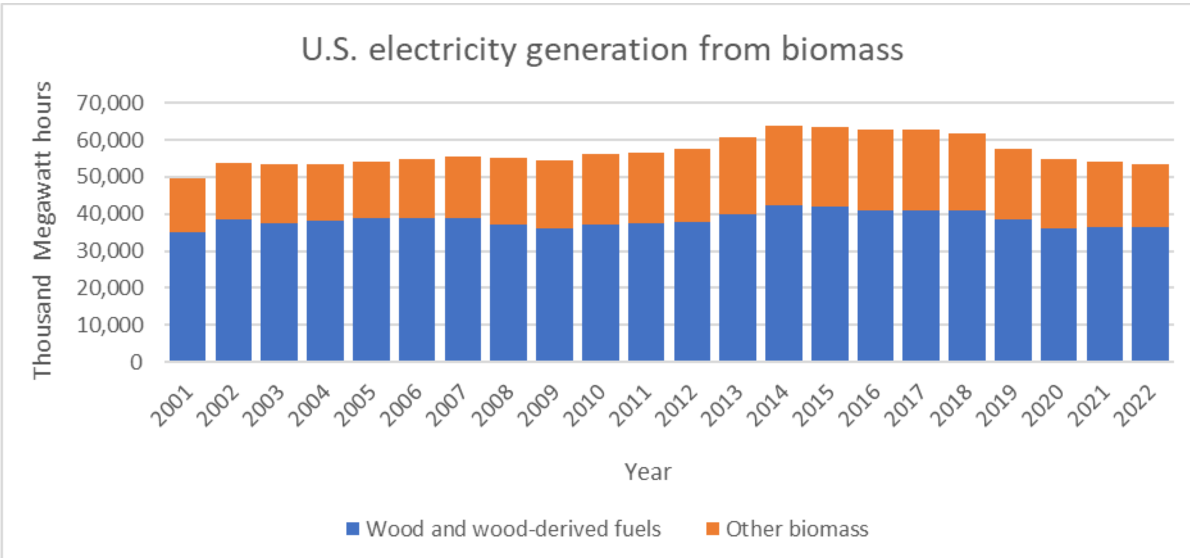

Figure 1. U.S. electricity generation from biomass, 2001 to 2022. (Source: U.S. Energy Information Administration 2023i).

Figure 2. Map depicting the locations of biomass power plants using wood and wood-derived fuels in Georgia in 2017 (Source: U.S. Energy Information Administration 2023i).

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 for calendar years 2017 and 2022 respectively.

As a part of this project, a 2017 regional report highlighting the economic contributions of wood-based biomass power generation industry to the regional economy of the Northeast and Midwest U.S. states has been developed. Accompanying this regional report, are individual state reports fourteen participating states summarizing the economic contributions of wood-based biomass power generation industry to the respective state's economy. Fourteen participating states include California, Connecticut, Georgia, Illinois, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Pennsylvania, Vermont, Virginia, and Wisconsin. This report is one of the individual state reports developed for the state of Georgia. Its purpose is to summarize the economic contributions of wood-based biomass power generation industry to Georgia's economy.

The next sections of the report shed light on the status of electric power generation industry in Georgia; briefly discuss the condition of forest resources within the state; outline the methods employed for conducting the economic contribution analysis of wood-based biomass power-generating industries in Georgia; and discuss the findings obtained from the analysis.

Electric power generation in Georgia in 2017

In 2017, the electric power industry in Georgia produced a total of ~127 million Megawatt hours of electricity. Natural gas was the major source of electricity generated across the state followed by nuclear power and coal respectively (Figure 3). Out of the total electricity generated, approximately 4% or 4.7 million Megawatt hours were produced using wood and wood-derived fuel (Figure 3) (US EIA 2023i).

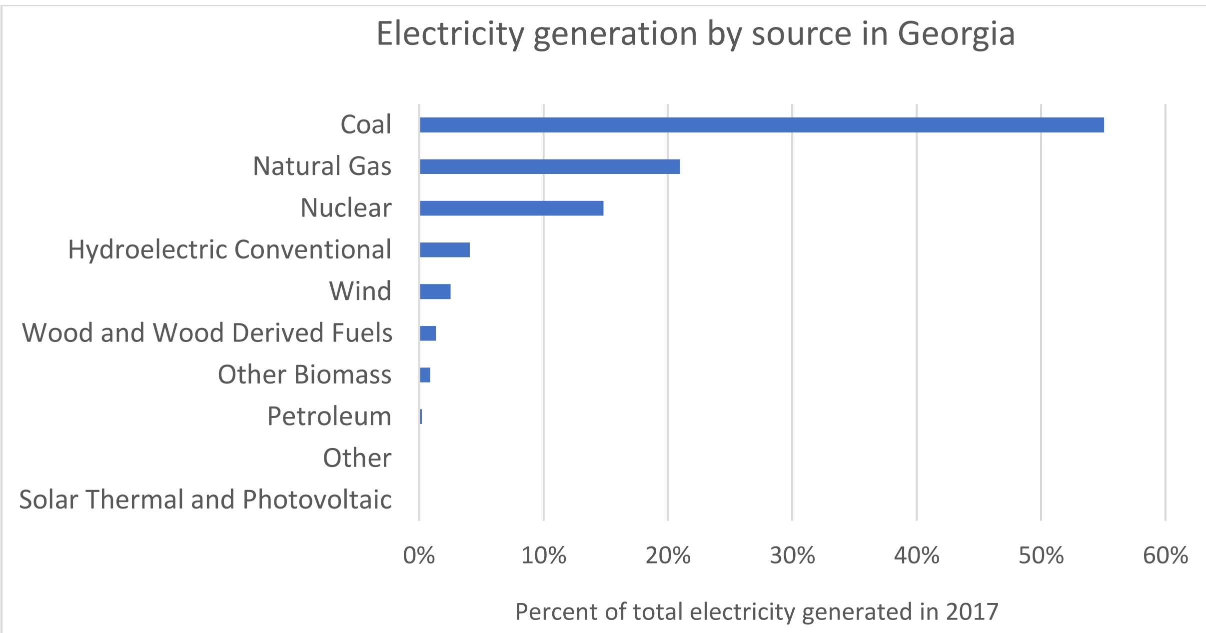

Figure 3. Percentage of total electricity generated in Georgia in 2017 by energy source (Source: U.S. Energy Information Administration 2023i).

Collectively the electric power generation industry employed 16,999 people in 2017 which is equivalent to 0.28% 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 1.

Table 1. The direct economic effects of power generating industries in Georgia based on 2017 IMPLAN data.

IMPLAN Sector Code (Electric Power Generation)	Energy Source	Employment	Labor Income	Value-Added	Output
			(Millions of 2017 dollars)		
39	Hydroelectric	62	9	27	50
40	Fossil fuel	2,211	334	1,298	3,104
41	Nuclear	1,822	323	819	1,746
42	Solar	233	85	96	152
43	Wind	-	-	-	-
44	Geothermal	-	-	-	-
45	Biomass	115	36	49	111
46	All other	3	1	(0)	1
47	Electric power transmission and distribution	12,553	1,709	6,681	17,519
	Total electric power generation, transmission and distribution	16,999	2,497	8,970	22,683
	Total All Sectors	**6,150,579**	**338,603**	**571,342**	**1,037,865**

Forest Resources of Georgia

Georgia is rich in forests. Forestlands cover approximately 64% of the total land area in Georgia (USDA Forest Service, Forest Inventory and Analysis 2025). Out of this, ~98% of the forestland can produce commercial timber and is identified as timberlands. Most of the forests in the state (88%) are under private ownership, followed by the federal government (4%), and the state and local government (4%) respectively (Figure 4). Loblolly/shortleaf pine and Oak/hickory are the major forest types in the state followed by Longleaf/slash pine and Oak/gum/cypress forest types (Table 2).

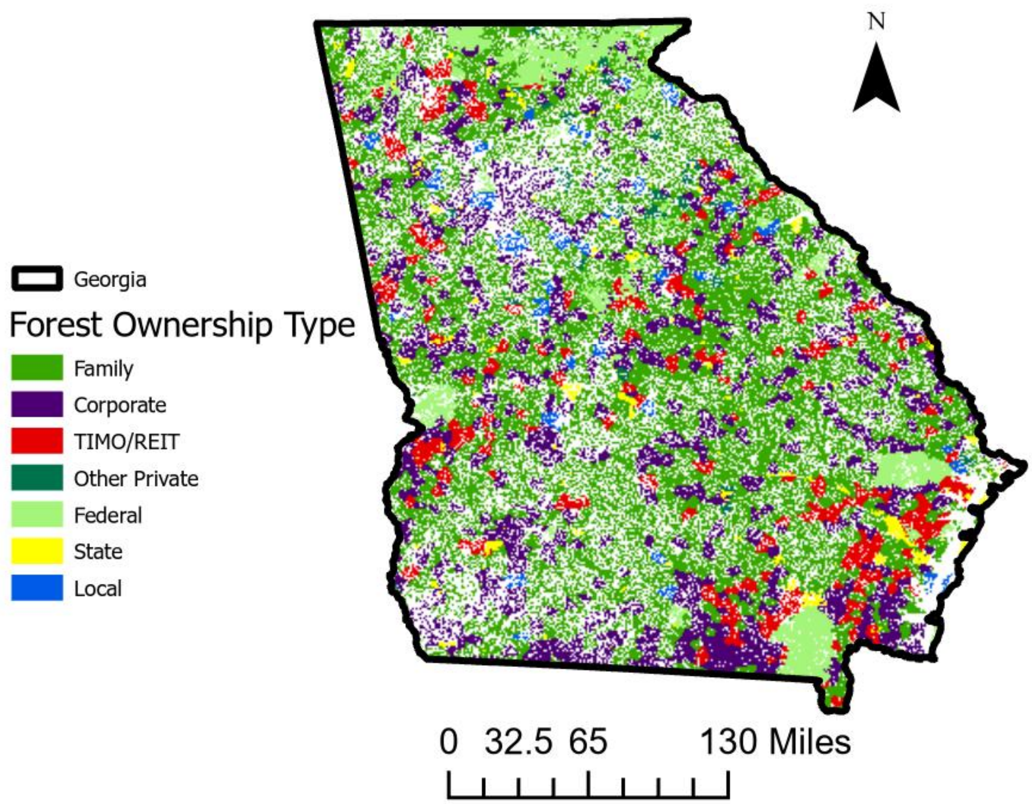

Figure 4. Forest ownership in Georgia (Data source: Sass et al. 2020).

Table 2. Forestland area in Georgia by forest type (Source: USDA Forest Service, Forest Inventory and Analysis 2025).

Forest Type Group	Acres	Percentage
Loblolly / shortleaf pine group	7,664,604	32%
Oak / hickory group	6,191,565	26%
Longleaf / slash pine group	3,253,932	13%
Oak / gum / cypress group	3,236,239	13%
Oak / pine group	2,741,962	11%
Elm / ash / cottonwood group	480,326	2%
Other	604,051	2%
Total	24,172,679	100%

The merchantable net bole volume of live trees in Georgia is estimated to be ~50 billion cubic feet (Table 3). The average annual net growth is 2,021 million cubic feet, annual removals are 1,402 million cubic feet, and annual mortality is 453 million cubic feet. Annual growth in the timberlands exceeded the removals by a ratio of 1.4, meaning that for each cubic foot of timber harvested in the region, about 1.4 cubic feet of timber grew in the timberlands. However, this ratio varies by ownership type. The growth to removals ratio in national forests is 8.8. In private forests, it is 1.5, 2.8 in the case of forests under state and local government, and 0.9 in forests under other federal ownership (Table 3). This suggests variation in management focus on timberlands owned by different forest ownership types. Across the state, the annual removals are close to 3% of the standing volume (Table 3).

Table 3. Characteristics of state growing stock in Georgia 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	49,706	2,021	1,402	453	1.4
National Forest	2,548	44	5	24	8.8
Other federal	1,481	31	35	13	0.9
State and local	2,373	70	25	24	2.8
Private	43,304	1,865	1,208	392	1.5

Methods

The analysis was conducted using impact analysis for planning (IMPLAN) software and 2017 cloud version of IMPLAN data using the Analysis-by-Parts (ABP) technique. 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, 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. Overall, 11 responses were obtained (9.2% response rate), out of which nine responses were from the Northeast-Midwest region. 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 4.

The survey also asked respondents to indicate the total amount of electricity produced in 2017 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 $63/MWh on average when weighed by the size of production. 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 2017 was obtained from US EIA (2023i). In Georgia, ~4.7 million Megawatt hours of electricity were generated using wood and wood-derived fuel in 2017. At the rate of $63/MWh of electricity produced, this translated into a direct output of $293.9 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 2017 IMPLAN data for Georgia. According to it, approximately 56.0% of the output of the biomass power generation industry was comprised of intermediate inputs and 44.0% was value-added. Value added was further broken down into employee compensation (3.5%), proprietor income (28.9%), other property type income (4.2%), and taxes on production and imports (7.4%) following IMPLAN sector 45's percentage breakdown for Georgia in the cloud version of IMPLAN data. Direct employment in wood-based biomass power generation industry was estimated using total output data and output per employee information obtained from IMPLAN 2017 model for Georgia. Based on this, we estimated direct employment in wood-based biomass power generation industry in Georgia to be 304 in 2017.

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 $5.4 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 4. Average operation and maintenance expenditures in 2017 US$ for the wood-based biomass power generating industry (as per Dahal et al. 2020 and supplemented with information collected from a mail survey of the wood-based power generating industry in the Northeast and Midwest U.S. states).

IMPLAN Sector	**Cost category (sector)**	**MM US$ per year**	**%**
16	Biomass	7.94	58.6%
20	Natural Gas	0.01	0.05%
39	Utilities	0.38	2.8%
49	Water	0.22	1.6%
60	Building expenses	0.06	0.4%
154	Oil and diesel	0.11	0.8%
162	Chemical	0.17	1.3%
167	Supplies (consumable, urea, ammonia)	0.26	1.9%
384	Office supplies and expenses	0.03	0.2%
408	Gasoline (retail)	0.02	0.1%
433	Communication	0.03	0.2%
444	Insurance	0.21	1.6%
453	Equipment rental	0.01	0.1%
457	Outside support services (water treatment, vendor services)	0.08	0.6%
462	Consulting fees	0.05	0.4%
470	Office administrative service	0.14	1.0%
474	Travel and entertainment	0.02	0.1%
476	Janitorial	0.04	0.3%
479	Ash freight and waste management	0.4	3.0%
512	Vehicle repair	0.02	0.1%
515	Maintenance	0.98	7.2%
50001	Employee compensation	2.12	15.6%
	Total taxes (including emission fee)	0.25	1.8%
	Total operation and maintenance cost	13.55	100.0 %

Results

The results obtained from the economic contribution analysis indicated that in Georgia, the wood-based biomass power generation industry directly employed 304 individuals in 2017 with a labor income of $95 million, value-added of $129 million, and an output or sales of $294 million in 2017 US dollars (Table 5). Including ripple effects, the industry supported a total of 3,774 jobs with $270 million in labor income. The industry contributed a total of $363 million in value-added and $691 million in total output to the economy of Georgia (Table 5). 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 industry (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 biomass power generation industry itself saw the largest effects (Table 6).

SAM multipliers for employment, labor income, value-added, and output across the region were estimated to be 12.4, 2.8, and 2.4 respectively. Output multiplier of 2.4 means that every $1 million in output in the region's wood-based biopower industry supported an additional $1.4 million in output to the rest of the economy. 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 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 close to $42 million in annual state and local taxes and ~$50 million in federal taxes in 2017 (Table 7).

Table 5. Economic contributions of wood-based biomass power generation industry in Georgia in 2017 US dollars using IMPLAN software and 2017 IMPLAN data.

	Economic Contributions of Wood-based Biomass Power Generation Industry				
States Included		**Employment (Jobs)**	**Labor Income ($MM 2017)**	**Value-added**	**Output**
Georgia	Direct	304	95	129	294
	Indirect	2,130	116	123	208
	Induced	1,339	59	110	189
	Total Contribution	3,774	270	363	691
	SAM Multiplier	12.4	2.8	2.8	2.4

Table 6. The top five industries affected in terms of employment by wood-based biomass power generation industry in Georgia in 2017

		Impact			
	Industry affected (IMPLAN Sector)	**Direct**	**Indirect**	**Induced**	**Total**
1	Commercial logging (16)	0	1252	0	1252
2	Support activities for agriculture and forestry (19)	0	341	1	342
3	Electric power generation – Biomass (45)	304	0	0	305
4	Commercial and industrial machinery and equipment repair and maintenance (515)	0	116	2	118
5	Full-service restaurants (509)	0	7	72	78

Table 7. Total tax contributions of wood-based biomass power generation industry in Georgia in 2017 US dollars ($MM) using 2017 IMPLAN data.

Impact Type	Sub-county general	Sub-county special districts	County	State	Federal	Total
Direct	$1.88	$5.99	$4.95	$10.41	$15.97	$39.20
Indirect	$0.52	$1.67	$1.37	$4.96	$20.72	$29.25
Induced	$0.78	$2.49	$2.05	$4.82	$13.08	$23.22
Total	$3.17	$10.15	$8.38	$20.19	$49.77	$91.66

Summary

This study assessed the economic contributions of wood-based biomass power generation industry in Georgia using IMPLAN, an input-output analysis software and 2017 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 Georgia was found to directly support 304 jobs and contribute $294 million in output to the state's economy. Including direct, indirect, and induced effects, the industry contributed a total of 3,774 jobs and $691 million in output in Georgia.

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