WOOD to ENERGY

Community Economic Profile

Louisiana: Livingston Parish

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In the southern United States, communities with increasing populations and nearby forests may be able to consider using woody biomass to generate energy. A variety of other factors must also be considered, such as the price of existing energy sources, competing markets for wood, community acceptance, and the economic availability of wood resources. Many parishes in Louisiana have forests in close proximity to growing populations. To gain a better understanding of the range of possibilities for economic availability and the local economic impacts of using wood for energy, Livingston Parish was selected for analysis in this community economic profile.

Almost 50 percent, or 13.8 million acres, of Louisiana is covered with forests. All except for five of the state's 64 parishes contain ample forestland for providing environmental benefits, recreational opportunities, and sufficient timber to support forest industry-related activities. Approximately 62 percent of the state's forestlands are under private ownership and another 9 percent are under public management (Louisiana Department of Agriculture and Forestry 2005). Cane River Creole National Historical Park and Kisatchie National Forest are two popular destinations in central Louisiana that provide residents and tourists with the opportunity to enjoy the state's natural beauty and abundant resources. The remaining 29 percent of forested land is owned by over 900 forest industry firms (Louisiana Department of Agriculture and Forestry 2005). Prime species harvested for timber operations in Louisiana include yellow pine, slash pine, and red oak, which are used to produce forest products such as furniture, paper, and building materials. The multi-billion-dollar industry is the state's second largest manufacturing employer, providing nearly 33,000 jobs (Frey 2005).

Livingston Parish is located just east of Baton Rouge in southeast Louisiana. Forest types found within the parish include cypress-tupelo swamps, bottom hardwood forests, and mixed pine-hardwood forests. Under the shelter of these forests, Tickfaw State Park and Denham Springs offer residents and tourists an array of opportunities to enjoy recreational experiences. Postsecondary education provides a major source of economic vitality for the parish. Southeastern Louisiana University, located in Hammond, offers 71 degree programs to over 17,000 students each year. The university is also home to one of the National Science Foundation's two gravitational wave observatories, which is dedicated to detecting and harnessing cosmic gravitational waves for scientific research. Other area attractions include a living history Civil War reenactment, a jazz and bluegrass concert series, antique shopping, and the annual "krewe of wrecks" Mardi Gras boat parade.

According to the U.S. Census Bureau (2007), Livingston Parish experienced heavy population growth of 25 percent between 2000 and 2006. Such growth increases the demand for reliable sources of energy. A great potential exists for public and private forest managers in and around Livingston Parish to utilize wood resources for energy production. Biomass research is currently being conducted at nearby Louisiana State University, where scientists are assessing the benefits of the forest industry's use of mill residues to generate electricity. The combination of increasing populations and existing forested areas may provide Livingston Parish the opportunity to consider using wood to produce energy, whether for a utility or a smaller facility, such as a school or hospital.

Woody biomass from urban wood waste, logging residues, and forest thinnings, for example, can be used to generate energy. Using wood to generate electricity provides many potential benefits such as reduced greenhouse gas emissions, healthier forests, and local jobs and other economic impacts. For more information on these topics see the *Climate Change and Carbon*, *Sustainable Forest Management*, and *Environmental Impacts* fact sheets. All of our materials are available at http://www.interfacesouth.org/woodybiomass.

To estimate the amount of wood that could be available in a community, we include three sources: urban wood waste, logging residues, and pulpwood. While other woody biomass resources exist and could be added to the resource assessments, we include only these resources, for which cost and supply data are available. Urban wood waste is generated from tree and yard trimmings, the commercial tree care industry, utility line clearings, and greenspace maintenance. Logging residue is composed of the leftovers from forest harvesting, such as tree tops and limbs, and poorly formed trees. Pulpwood refers to small diameter trees (3.6 to 6.5 inches diameter at breast height) that are harvested for manufacturing paper, purified cellulose products (including absorbents, filters, rayon, and acetate), and oleoresin products (including pine oils, fragrances, cosmetics, and thinners). This profile excludes secondary woody waste from sawmills and furniture makers, which is available but may already be used within the industry to produce energy. See the fact sheet, *Sources and Supply,* for more information.

Cost Calculations

Economic factors, including fuels costs and the creation of local jobs, are major determinants of the feasibility of bioenergy projects. Assessing the economic availability of biomass requires learning about the delivered cost of wood, the quantity available wood, and its geographic distribution. This information is then used to create biomass resource supply curves, which express price per unit of biomass at a range of potential quantities of consumption. The following summary uses these methods to assess the economic availability of wood resources for Livingston Parish in Louisiana. More information about the development of this supply curve can be found on the Web site in *Assessing the Economic Availability of Woody Biomass*.

The delivered cost of woody biomass to a facility is the sum of the amount paid to buy the wood from the original owner (procurement), the harvest cost, and the transportation cost. Although rail transportation could be used in some cases, woody biomass is typically transported by truck. The cost of transportation depends on the time it takes a truck to travel from the harvest site to the facility. Haul times to the central delivery point in the parish are calculated using a software program called ArcGIS Network Analyst Extension (Figure 1).

Assuming that haulers drive the speed limit on the quickest route available to them, we calculate total transportation times for the forested areas around the delivery point, and then increase haul times (and thus costs) by 25 percent to account for delays, such as traffic and stops. These haul-time areas delineate potential "woodsheds" or areas that can provide wood for a specific community or biomass user. If demand is established in more than one area in proximity, woodsheds can overlap, causing competing demand for biomass.

The total delivered cost is derived from the sum of the procurement, harvest, and transportation costs for

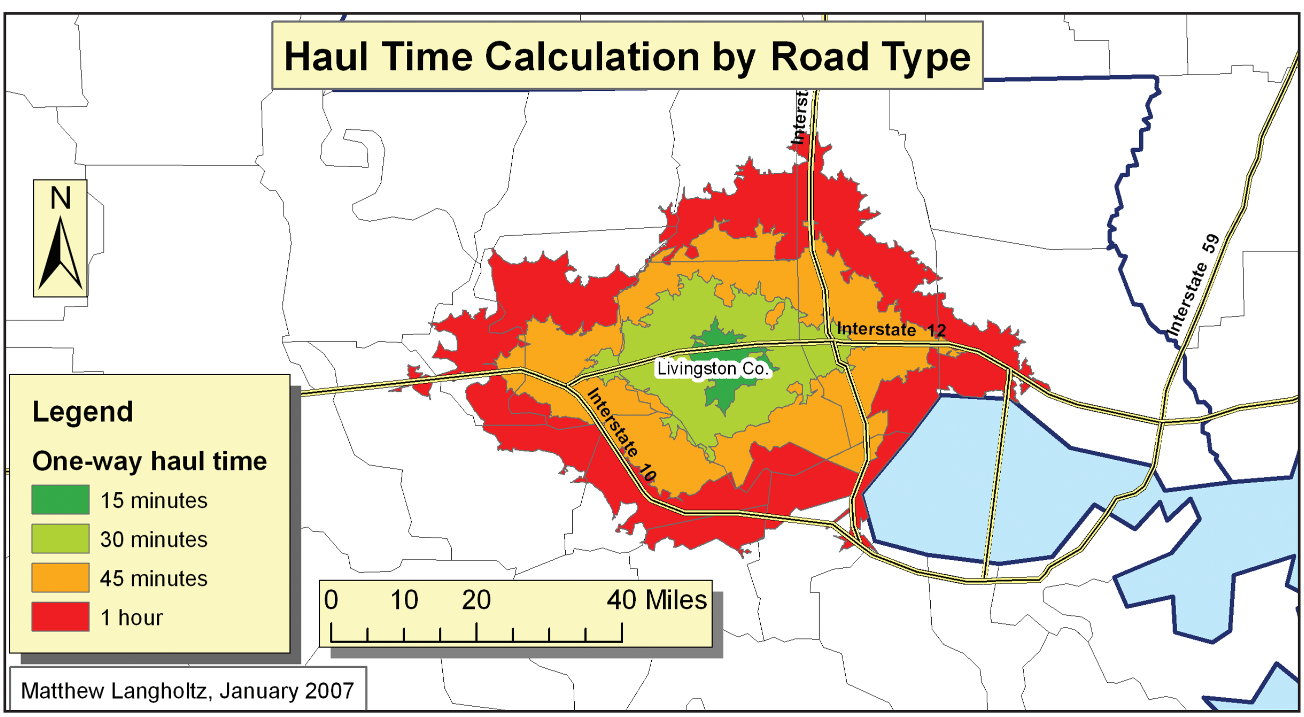

Figure 1. *Wood harvested within each colored band can be transported to the center of the parish in 15-minute increments.*

urban wood waste, logging residues, and pulpwood. This is calculated at 15-minute increments up to one hour from the delivery point. Delivered costs allow us to see the progression of the most- to least-expensive woody biomass resources. For example, if urban waste wood were delivered within the one-hour limit, the total delivered cost would be $19.46 per dry ton, or $1.25 per million British thermal units (MMBtu). However, if pulpwood were delivered from the same distance, the delivered cost would increase to $49.14 per dry ton, or $3.04 per MMBtu, primarily because pulpwood is more expensive than urban wood waste.

Physical Availability

In addition to the delivered cost of wood, knowing how much of each type of woody biomass is available is necessary to construct supply curves. Annually harvested pulpwood and annually available urban wood waste and logging residues within Livingston Parish are shown in Table 1.

For urban wood waste, it is assumed that 0.203 green tons (40 percent moisture content) of urban wood waste is generated per person per year (Wiltsee 1998). This includes municipal solid waste wood from yard waste and tree trimming but excludes industrial wood (e.g., cabinet and pallet production) and construction and demolition debris. This average yield was multiplied by parish population estimates and reduced by 40 percent to estimate total annual parish yield of urban wood waste. For example, this results in 13,300 green tons of urban wood waste per year from Livingston Parish.

The amount of logging residue and pulpwood for all parishes in Louisiana was obtained from the USDA Forest Service (2003) Timber Product Output Reports. This database provides forest inventory and harvest information, including annual yields of forest residues and pulpwood. We reduced the figure for logging residues by 30 percent to exclude stumps. For example, in Livingston Parish, there are 72,800 green tons (37 percent moisture) of logging residues available annually from existing forestry operations. There are also 105,000 green tons (50 percent moisture) of pulpwood harvested annually. Because the pulpwood harvest is currently used to produce pulp and paper products, not all of this resource is economically available for bioenergy. However, additional biomass is available from forest thinning, particularly those conducted for ecosystem restoration, which is not included in this assessment (Condon and Putz 2007).

Table 1. *Three Sources of Available Wood*

Available urban wood waste	Available logging residues	Harvested pulpwood
13,300	72,800	105,000

Moisture content refers to the amount of moisture remaining in wood and is an important consideration in the quality of biomass resources. Moisture content is 0 percent in oven-dried biomass, about 20 percent for air-dried biomass, and about 50 percent for fresh or "green" biomass. As the moisture content of wood increases, the energy content per unit mass of wood decreases. Thus, wood with low moisture content will combust more efficiently than wood with high moisture content. Moisture content in this document is reported on a green-weight basis.

Supply Curve Construction

Given information regarding cost, quantity, and distribution of all three types of woody biomass, a supply curve can be generated for Livingston Parish. Figure 2 shows the price of wood at different quantities needed. The y-axis represents price per MMBtu of energy and the x-axis represents the total amount of wood available in 15-minute increments. The width of each bar signifies the quantity of wood available. The height of each bar estimates the price one would pay for delivered wood. The first 0.01 trillion Btu of urban wood waste from 0-15 minutes is too small to appear as a bar in the graph. Several scales are provided to translate the quantity of wood into tons, energy content, and houses electrified. Biomass sources include urban wood waste, logging residues, and pulpwood within a one-hour haul radius of the center of Livingston Parish.

Supply Analysis Results

Energy resources and costs for each resource-haul time category for Livingston Parish are shown in Table 2 (resources are ranked from cheapest to most expensive based on delivered cost of energy). These values were used to construct the supply curve shown in Figure 2. The supply curve suggests that 3.2 trillion Btu, or 28 megawatts (MW) of electricity, which is enough to power 11,000 households in the South (Bellemar 2003), are available for less than $2.60 per MMBtu. Energy at this

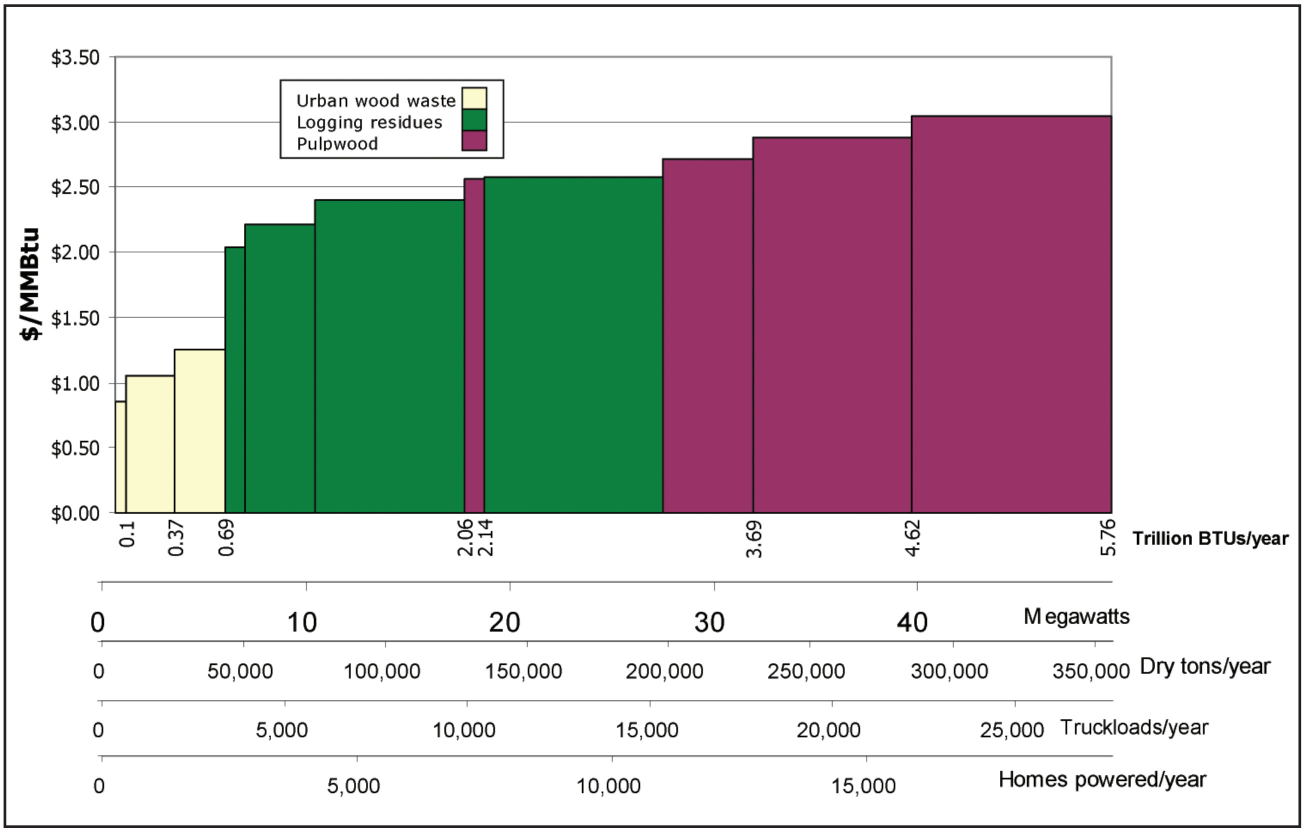

Figure 2. *Four bars for each source represent the wood available within 15-minute haul time intervals.*

cost is competitive with the current costs of coal. Within a one-hour haul radius, up to 0.7 trillion Btu can be provided from urban wood waste alone. With the addition of logging residues, 3.1 trillion Btu can be produced. Other types of wood may be available from thinnings to improve forest health, although estimates of this wood are not available. As the cost of oil increases, all price estimates increase (with petroleum inputs for harvesting and transportation), but so do the costs of coal and natural gas. In other words, as fossil fuels become more expensive, the delivered cost of wood will increase but will become increasingly competitive with nonrenewable fuels.

Economic Impact Analysis

The potential economic impacts of developing a wood-fueled power plant are an important consideration for both public and private interests in a community. In this economic analysis, two sizes of power plant were considered: 20 or 40 MW. The construction of the plant would be a one-time impact event that is assumed to occur within a year, while the impacts of plant operations continue annually over the life of the plant, for 20 years or more. Wood fuel costs were calculated from the regional supply curves discussed previously in this report.

Economic impacts were estimated using IMPLAN software and databases for each parish. These estimates included not only the direct impacts of plant construction and operation but also the indirect impacts from local purchases and local spending by employee households. Further information on the methods of analysis and interpretation of economic impact results is available in the fact sheet, *Economic Impacts of Generating Electricity*.

Economic impacts were evaluated for Livingston Parish in Louisiana. Fuel typically represented the largest operating cost for a wood-fired power plant. Wood fuel costs were estimated at $3.6 million and $9.1 million for the 20 MW and 40 MW plants, respectively (Table 3). The economic impacts of annual operations for the 20 MW plant were $9.6 million in output (revenue), 158 jobs, and $5.7 in value added (income). For the 40 MW plant, operating impacts were $20.4 million in output, 349 jobs, and $12.2 million in value added. The first year impacts for plant operations are representative of the ongoing annual impacts; however, future impacts could change due to prices of inputs such as fuel, unexpected maintenance activities, and general economic inflation.

Total construction costs were valued at $48.7 million for the 20 MW plant and $86.8 million for the 40 MW

Table 2. *Delivered Cost of Available Wood*

Delivered cost ($/MMBtu)	Resource/Haul time category	Trillion Btu available per year
$0.65	Urban wood: 0-15 minutes	0.01
$0.85	Urban wood:15-30 minutes	0.08
$1.05	Urban wood: 30-45 minutes	0.27
$1.25	Urban wood: 45-60 minutes	0.32
$2.03	Logging residues: 0-15 minutes	0.07
$2.21	Logging residues: 15-30 minutes	0.43
$2.39	Logging residues: 30-45 minutes	0.87
$2.56	Pulpwood: 0-15 minutes	0.09
$2.57	Logging residues: 45-60 minutes	1.05
$2.72	Pulpwood: 15-30 minutes	0.50
$2.88	Pulpwood: 30-45 minutes	0.93
$3.04	Pulpwood: 45-60 minutes	1.14

Table 3. *Economic Impacts of 20 and 40 MW Power Plants*

		Annual Operations Impacts (first year)			Plant Construction Impacts		
Plant Size (MW)	Wood Fuel Cost ($Mn)	Output ($Mn)	Employment (Jobs)	Value Added ($Mn)	Output ($Mn)	Employment (Jobs)	Value Added ($Mn)
20	3.62	9.64	158	5.73	34.97	328	17.19
40	9.10	20.38	349	12.19	61.17	504	29.87

plant, including land, site work, construction, plant equipment, and engineering fees. The economic impacts of construction expenditures for a 20 MW plant were estimated at $35 million in output, 328 jobs, and $17.2 million in value added. Construction impacts for the 40 MW plant were estimated to be $61.2 million in output, 504 jobs and $29.9 million in value added. These construction impacts were relatively high compared to most other southern counties that were examined. This was due to the presence of the manufacturing sector for turbines and boilers, key components of a power plant, in Livingston Parish.

Often it is helpful to predict the distribution of economic impacts across various sectors of the local economy. More than 60 percent of all jobs from operations would occur in the agriculture and forestry sector, which supplies wood fuel to these facilities. However, there would also be significant employment impacts in the sectors for professional services, retail trade, and government, reflecting the indirect effects on the local economy associated with purchased supplies and employee household spending.

Conclusions

Economic concerns are important to discussions of using wood for energy in the South. For many communities, the conversation begins with the recognition that there might be enough wood at an affordable cost. Our supply analysis suggests that, indeed, enough wood at a reasonable cost is available in the Livingston Parish woodshed to make a continued conversation possible. Up to 3.2 trillion Btu (i.e., 28 MW or energy to power 11,000 homes annually) of woody biomass are available at less than $2.60 per MMBtu. These general estimates could be improved with more site-specific analysis and information.

Additional assessments of local conditions, population density, distribution of wood, competition from pulp mills, restoration activities, and other factors would improve the accuracy of these biomass resource assessments. The following caveats should be considered when interpreting the results presented in this profile:

- The supply considered in this profile includes only urban wood waste, logging residues, and pulpwood. It excludes stumps and waste from wood industries.

- Because the data are available at the parish level, homogeneous distribution of resources within parishes is assumed. Resource distribution within parishes and location of bioenergy generating facilities will influence the actual economic availability of woody biomass for energy generation. More detailed local analysis might consider the distribution of biomass resources within parishes, especially for site selection of bioenergy facilities.
- The inclusion of other resources such as mill wastes or thinnings for forest management and habitat restoration would increase available resources.
- This analysis is not intended to be a definitive resource assessment but is rather meant to provide a starting point for discussions about the feasibility of using wood for energy. Resources can be excluded or added as more information becomes available, and prices can be modified to reflect local conditions.
- A rise in the price of petroleum would increase the cost of the resources shown here, as well as costs of conventional energy sources like coal.
- Some assumptions made in this analysis are subject to change. For example, large-scale bioenergy development in the area could increase competing demand for wood resources.
- Rail transportation was not considered in this analysis, which could reduce transportation costs and make biomass resources from other areas more available.
- Construction and operation of wood-fueled power plants may have significant local economic impacts. These impacts vary widely among selected parishes, depending upon the makeup of the local economy.
- Wood fuel represents one of the largest expenditures for a power plant, and gives rise to large impacts in the local forestry and forestry services sectors. Other sectors of the local economy are also impacted through the indirect effects associated with purchased supplies and employee household spending.
- Economic impacts of a 40 MW power plant are greater than for a 20 MW plant, although not in proportion to the power output, due to economies of scale.

For more information about using wood to produce energy, visit http://www.interfacesouth.org/woodybiomass and read other fact sheets, community economic profiles, and case studies from this program, or www.forestbioenergy.net to access a number of other resources.

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