Capacity, Production, and Consumption Assessment of the U.S. South Atlantic Wood Pellet Industry

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The wood pellet industry has been in a growing trend worldwide. The Southern U.S. has been proposed as a good location to further develop wood pellet industries geared toward the supply of international markets. This research looks into the current status of the wood pellet industry of the region in terms of consumption of biomass, installed capacity, and production levels of wood pellets. It assesses the known future developments for the region (Virginia, North Carolina, South Carolina, Georgia, and Florida). The study also includes an analysis of major ports within the region. Currently, companies within the region have a total production capacity of over 4.7 million tons of pellets, while the current production levels are estimated at 3.1 million tons. Research indicates that at least 20 facilities within the region will be opening their operations, and the expected capacity of the wood pellet industry will then be over 5 million tons of pellets per year. The biomass requirement for the production of these pellets was determined, and the current production level requires over 11 million tons of green biomass (55% moisture content). Future developments may require over 13 million tons, making the industry total over 24 million tons in coming years.

Keywords: Pellets; Market trends; Southern USA; Ports; Future production levels; Biomass utilization

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INTRODUCTION

Biomass is the most prevalent source of energy, mainly used for heat generation (Hohenstein and Wright 1994; Fritsche *et al*. 2006; EarthTalk 2009), and is currently one of the promising replacements for fossil fuels. If properly managed, biomass can be a renewable and sustainable energy source.

Recent interest in biomass is mainly due to rising fossil fuel costs and concerns over carbon emissions. This interest has driven a worldwide search for alternative energy sources (Evans and Perschel 2009; Kim *et al*. 2009). The increase of biomass utilization is also driven in countries such as the Netherlands, India, China, Thailand, New Zealand, Canada, and the U.S. (Gonzalez *et al*. 2011). The lure of biomass is that it uses a sustainable cycle to produce energy, having carbon dioxide drawn from the atmosphere, and when the biomass is converted to energy, this carbon dioxide is released and becomes available for the production of new biomass, producing little or no net addition of carbon to the atmosphere (Oak Ridge National Laboratory 2011).

The Wood Institute for the Environment (2007) argues that biomass has one of the highest potentials for providing clean energy while reducing dependence on petroleum and strengthening agricultural economies (Phipps *et al*. 2007). Several authors indicate that the interest generated by bioenergy will further increase in the near future (Demirbas 2009; Wopienka *et al*. 2009; Wopienka 2011).

In general, woody biomass contains, in descending order, varying amounts of cellulose, hemicelluloses, lignin, and small amounts of extractives. The relative proportion of cellulose and lignin is one of the key factors in determining the suitability of plant species for conversion into energy. The high concentration of cellulose gives woody plants the "cellulosic biomass" denomination. Woody plants, in particular, are typically characterized by slow growth and are composed of tightly bound fibers, giving the material its typical hard surface (McKendry 2002).

Biomass production can also generate local benefits, such as sources of employment; McKendry (2002) and Domac *et al*. (2005) indicate that positive socio-economic impacts of biomass utilization are the main drivers for implementing bioenergy projects. In the U.S. specifically, local reasons for the recent interest and development of biomass production for bioenergy have been the following:

- Forest industries' need for residue disposal and increased utilization of tree resources;
- A desire to find and use alternative energy sources to reduce dependence on fossil fuels;
- Solid waste disposal issues related to resource utilization, recycling, and reduction of solid waste landfills;
- Concerns with global environmental issues related to climate change (Frank and Smith 1993; Schroeder 2000).

Wood Pellets

Wood pellets are defined as compressed cylindrical particles of biomass, with a diameter ranging from 6 to 12 mm, a length of approximately four times the diameter, and moisture content lower than 8% (The Swedish Association of Pellet Producers 2006). The process of pelletizing produces a fuel that has a volumetric density between 800 and 1200 kg/m^3, resulting in an energy density of around 0.05 GJ/m^3. Pelletizing involves a particle reduction of the biomass to less than 3 mm, and the drying of the material (often an obligatory step). The biomass is then densified using (typically) the natural waxes and extractives of the biomass in order to bind the material together in a high pressure system of dies, and with a high mass and energy production efficiency (over 95%, Overend 2004). Pelletized biomass has an enhanced volumetric density and calorific value per unit of volume, improving transportation, material handling, and combustion efficiency (Moran *et al*. 2004).

This form of solid biofuel has several applications for commercial, industrial, and domestic heating and power generation, making use of many high-efficiency stoves and boilers on the market and providing a competitive heating source as compared to oil or natural gas (Overend 2004). Specifically, pelletization has become a proven technology for the conversion of biomass into heat and power, becoming an increasing, mature energy market in several European Union countries as well as Canada and the U.S. The main reason for the increase in pellets utilization resides in being an attractive fuel for power stations, since pellets are composed of small particles that can be readily crushed and used in fuel burners in the same sense as coal (Hoque *et al*. 2006).

The Pellet Fuel Institute (PFI 2013) cites some of the main reasons and benefits for the continuous development of the wood pellets industry:

- Typical U.S. homeowners use 3 tons of pellets per heating season at a cost of about $825. With an average retail price of $250/ton, pellets offer a fuel cost per

million BTU of $19.05. To offer a fuel cost of $19.05 per million BTU, #2 fuel oil and propane would have to be priced at $2.05/gal and $1.36/gal, respectively.

- Direct thermal conversion of 3 million tons of wood pellets, at an efficiency level of approximately 80%, displaces the equivalent of almost 8.5 million barrels of #2 fuel oil—that is 356 million gallons.
- Pellet stoves have extremely low particulate emissions due to their high burn efficiency and the density of the fuel (<1 gm/hr).
- Every ton of pellets used *vs.* oil reduces CO_2 emissions by about 1.5 tons. Total emissions offset in the year 2011 were nearly 4.5 million tons of CO_2.
- Pellet distribution costs less than the cost of distributing wood chips.
- Wood pellets have a fossil energy ratio (net energy output/fossil energy used) of 12:1.
- Spelter and Toth (2009) indicated that as of 2009, pellet manufacturing directly employs approximately 2,300 people in the U.S. and supports thousands of industry-related jobs in fields such as transportation and logging.
- Location of ports, better road infrastructure, and year-round harvesting makes the U.S. a more ideal exporter for European countries versus Canada (Pirraglia *et al*. 2010).

The Market

The wood pellet market has been drastically increasing in Europe during the last 10 years. The EU 2020 policy targets for renewable energy sources and greenhouse gas (GHG) emission reduction are among the main encouragements (Sikkema *et al*. 2011). During 2009 around 650 pellet plants produced more than 11 million tons of pellets in Europe, representing an increase of about 2.0 million tons compared to an earlier study of production in 2008.

Total European consumption in 2009 was about 10.8 million tons, of which some 10.1 million tons was within the EU-27 (27 countries composing the European Union since 2007), representing a modest 0.2% of the Gross Energy Consumption (Sikkema *et al*. 2011). While most markets of non-industrial pellets are largely self-sufficient, industrial pellet markets depend on wood pellets imported from outside the EU-27, mainly from North America and the Russian Federation (Aguilar *et al*. 2011).

According to the National Renewable Energy Action Plans of the EU-27, as of December 2010, all member states have submitted their biomass needs for a renewable energy production in 2020: a total of 150 MTOE (Million Ton of Oil Equivalent). This indicates that the biomass needed for the final production of electricity, heating and cooling, and transportation fuels will grow by about 242 million tons of pellets (equivalent), compared to the 2010 use of biomass for renewable energy production (Sikkema *et al*. 2011).

In addition, the projected demand in 2020 for woody biomass varies from 116 million tons, based on market forecasts for pellets in the energy sector and a reference growth of the forest sector, to 226 million tons, based on maximum demand in energy and transport sectors and a rapid growth of the forest sector (Sikkema *et al*. 2011). Research suggests that extra demand for woody biomass triggered by the EU 2020 targets could reach 336 million tons of wood (Aguilar *et al*. 2011).

The Russian market has been described as a volatile and uncertain market due to many considerations; however it is still relevant for the European market. There are

almost 200 pellet producing companies in the Russian Federation, two of which produce more than 110,000 tons per year (Aguilar *et al*. 2011). Pellet production capacity in the Russian Federation continues to grow; however, less than one-third is utilized in the internal market. Estimated annual production is 826,000 tons of which 661,000 tons are exported (Aguilar *et al*. 2011).

After Europe, North America has the largest pellet production facilities and capacity. North American production capacity has increased from 1.2 million tons in 2003 to 4.6 million tons in 2008, and 6.8 million tons in 2009 (Sikkema *et al*. 2011).

Wood pellet production in Canada is continuing to grow and, in 2010, almost 1.6 million tons of wood pellets went to overseas markets (Aguilar *et al*. 2011). In Canada, the estimated production was 1.5 million tons, about 81% of capacity (Sikkema *et al*. 2011).

Between 2005 and 2007, pellet fuel production increased by 25% in the United States (Bowyer 2008), and currently, the United States ranks in the top three, along with Sweden and Canada, in annual pellet production (Penksa-Blanchard *et al*. 2007).

Even more noticeable is the increase from 2002 to 2007, in which U.S. production increased more than 200% (Pirraglia *et al*. 2010). This increase in production is due to the opening of many new facilities, especially in the Southern U.S., expanding the capacity of the U.S. for exports, mainly to European countries. Wood pellet production in the United States in 2008 amounted to 2.0 million tons, which was 66% of capacity (Sikkema *et al*. 2011).

The objective of this research was to describe the current and future status of the wood pellet industry in the U.S. South Atlantic Region. The description includes the total number of facilities operating in the region, installed capacity and production levels, as well as future developments in the region. The information included in this document is referenced to the end of 2012.

Additionally, a review of the geographic location of current and future facilities was included. The main deep sea ports of the region were included to study possible changes to the supply chain infrastructure.

METHODOLOGY

This section comprises the methodology followed to describe and assess the emerging market trends for wood pellets in the Southern United States. The research was started by gathering basic and current market data of the wood pellet industry and the most relevant information previously presented. Databases with key contacts within the industry were developed and different sources of information available for the sector were also identified. The research team traveled to the International Pellet Conference as well as the International Biomass Conference and Expo to meet with different parties within the industry and to develop agreements of mutual collaboration.

Questionnaires were developed and interviews to stakeholders took place during the first 4 months of this study (some took place during the conferences). Additional information was also gathered and consolidated with the rest of the information available. Confidentiality agreements were also signed to keep private some of the information gathered in the study. Quantification and analyses of the information was performed in the following 4 months of the study. The final 2 months of the study were used to geographically analyze the results and include the study of major ports of the region.

The data analyzed here represents up-to-date information (December 2012) for each of the facilities located within the scope of study. The level of detail varied from one facility to another and, in many cases, some assumptions were made. The information from some facilities did not include capacity or production levels (actual manufacturing levels lower than capacity); for the purpose of the study, these were assumed at a fixed value.

The utilization of softwood or hardwood was not specified in some cases and different scenarios were studied covering all softwood and all hardwood production. The study divided facilities by state but also analyzed facilities regionally. The analyses of this study are measured in tons (short tons) of pellets or biomass.

RESULTS AND DISCUSSION

A total of 132 responses were obtained from this study including duplicates for the same facilities. Results covers the South Atlantic region of the U.S., which includes the states of Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

There are currently 34 companies manufacturing wood pellets in the region and this report contains detailed information (production capacity and type of biomass) for 21 companies. Some assumptions were made for the remaining companies based on current trends and published research.

Regarding the type of biomass, the study included all the information available for most companies. For those without enough detail, scenarios were developed ranging from all softwood to all hardwood. In terms of capacity, for those facilities where information was not provided, a set value of 100,000 tons/year was used, which represents the most common value in our database and is not considered as an outlier in terms of capacity.

Current Facilities

The total current capacity known for the region totals 3,433,500 tons of pellets per year, and with the additional companies (according to our assumptions), the capacity of the region adds up to 4,733,500 tons of pellets per year. The distribution per state is shown in Fig. 1.

The base portion contains all the facilities with known production capacities and the assumed capacity only includes those facilities with unknown capacities which were assumed to be 100,000 tons/year. The total capacity of the region will be the sum of the base capacity and the assumed capacity.

As seen in Fig. 1, the distribution of tons of pellets produced per state is uneven with Georgia being the top producer and Maryland and West Virginia producing the lowest quantity of the region. This distribution is not correlated to the number of companies per state, having cases of few companies with large production rates, and many companies with small production rates; therefore the distribution of companies per state is shown in Fig. 2.

Fig. 1. Current tons of pellets per state

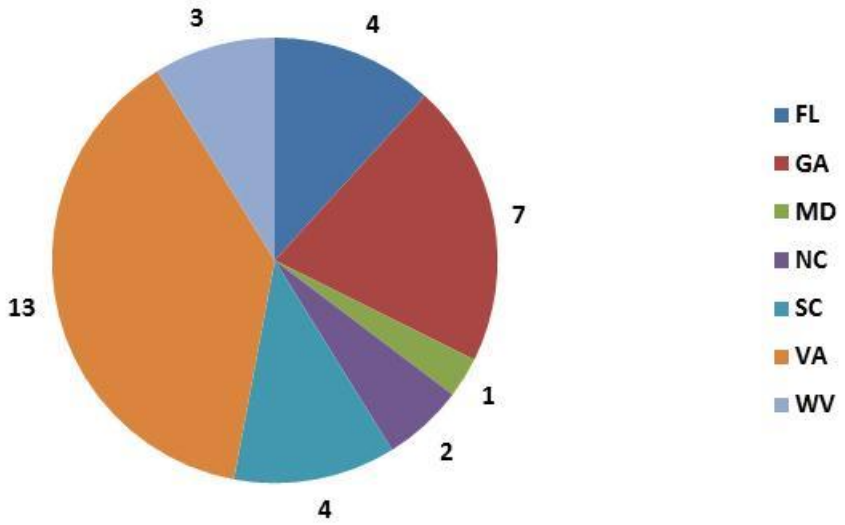

Fig. 2. Current number of companies per state

Virginia is the state with the largest number of pellet facilities within the region, but their pellet capacity is not the largest. Out of the 13 companies within the state, there are 4 of which the capacity is unknown, which could shift the production capacity of Virginia, depending on the accuracy of our assumptions.

The state with the largest capacity is Georgia, totaling a capacity of 1,399,500 tons (including assumptions) with only 7 companies within the state. Currently, the largest facility in the state is Georgia Biomass with a capacity of 827,000 tons per year; this company puts the state at the top production capacity within the region.

Production was studied in relation to installed capacity, but in every case it was determined as a ratio of production/capacity. According to the literature presented, the average production level for the U.S. was 66%; this value was therefore used to

determine the production/capacity ratio of the region. The total production of the region is 3,124,110 tons of pellets and it is distributed as shown in Table 1. The total production level is the sum of the base production level and the assumed production.

Table 1. Current Production Levels by State

Current Production (tons/year)			
State	**Base**	**Assumed**	**Total**
FL	369,600	198,000	**567,600**
GA	791,670	132,000	**923,670**
MD	-	66,000	**66,000**
NC	344,520	-	**344,520**
SC	330,000	132,000	**462,000**
VA	351,780	264,000	**615,780**
WV	78,540	66,000	**144,540**
Total	**2,266,110**	**858,000**	**3,124,110**

From the total amount of pellets produced in the region, information suggests that at least 542,355 tons of pellets per year are made from softwood, while 612,975 tons/year are made from hardwood (considering the assumptions). The production level, for which the raw material was not known, was analyzed using different scenarios and the production varies from the values shown above to over 2,500,000 tons. The different scenarios are shown in Fig. 3.

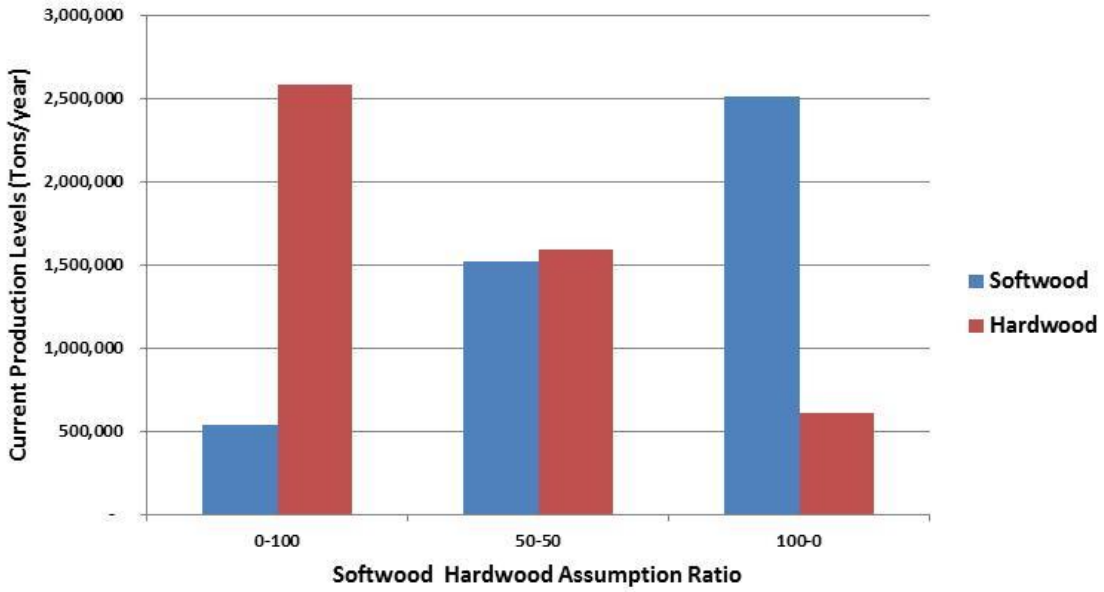

Fig. 3. Analysis of current hardwood, softwood production levels

In the first part (0-100) of Fig. 3, the assumption used was to produce all the unknown pellets with hardwood and the resulting utilization in this scenario is ~540,000 tons of pellets per year of softwood and over 2,500,000 tons of pellets of hardwood per year. The opposite scenario (100-0) where all the unknown production is fulfilled with softwood resulted in a utilization of ~2,500,000 tons of pellets per year of softwood and over 600 tons of pellets of hardwood per year. Additional information from the hardwood-softwood ratio is shown in Table 2.

Table 2. Current Hardwood-Softwood Ratio by State (tons/year)

	Known		0	100	50	50	100	0
State	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.
FL	184,800	184,800	184,800	382,800	283,000	283,800	382,800	184,800
GA	72,765	72,765	72,765	850,905	461,835	461,835	850,905	72,765
MD	-	-	-	66,000	33,000	33,000	66,000	-
NC	172,260	172,260	172,260	172,260	172,260	172,260	172,260	172,260
SC	-	-	-	462,000	231,000	231,000	462,000	-
VA	112,530	143,550	112,530	503,250	292,380	323,400	472,230	143,550
WV	-	39,600	-	144,540	52,470	92,070	104,940	39,600
Total	542,355	612,975	542,355	2,581,755	1,597,365	1,597,365	2,511,135	612,975

The first part (known columns) of Table 2 shows the known production levels distributed in softwood and hardwood for each state followed by the different assumptions for the total production in each state. The different scenarios presented here (0% softwood-100% hardwood, 50-50, 100-0) shows the total production for each case including the known production and the unknown.

Most of the known information for each state showed a utilization of both hardwood and softwood in the manufacturing of wood pellets. The ratio of how much preference is given to one over another is uncertain and therefore it was assumed as an equal percentage (50%). The numbers shown in the known section for each state presents an estimation of the total count.

Future Developments

Future developments and projects under construction were also considered in this study. The region is expected to increase the number of manufacturers by at least 20 companies during the next few years (with more projects being announced each week as this report is being written). These companies are set to begin operations in a span that ranges from 2012 to 2015.

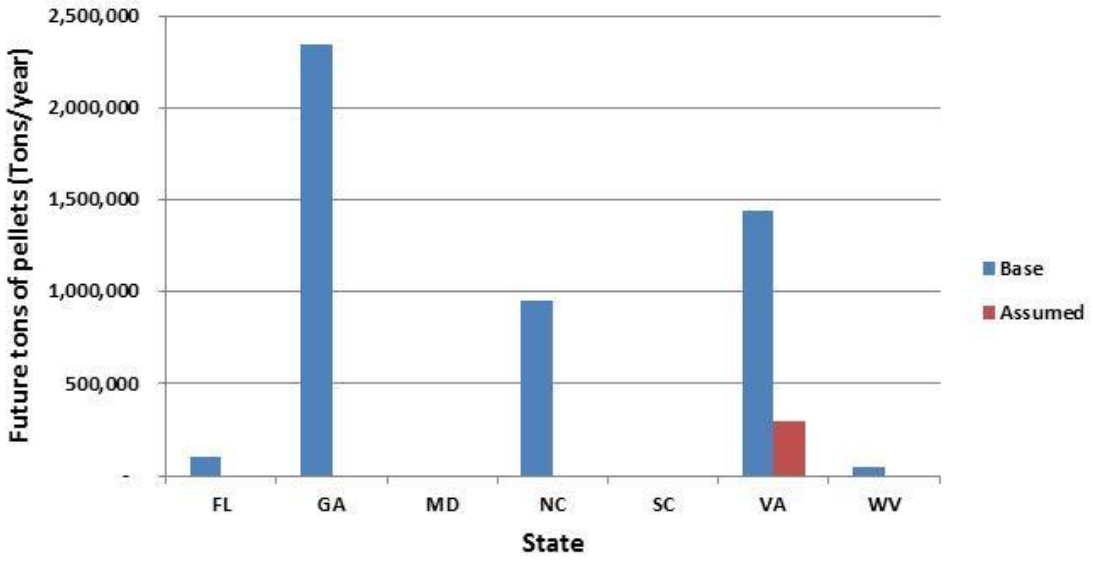

Fig. 4. Future capacity of new facilities by state

The state of Georgia is the leader in new developments with a total of 8 companies, followed by Virginia with 7. North Carolina is expected to increase its presence by 3 new companies, and 1 facility is expected to open in Florida and West Virginia. Out of the 20 new companies, there is information available for the expected capacity of 17 of them, and the remaining 3 were estimated in the same sense as current companies based on published documents. The distribution of future capacity by state is shown in Fig. 4.

The base portion of the Fig. 4 represents those companies for which the capacity is known and the assumed are those for which the capacity was assumed. The total capacity of future developments within the region is expected to be 5,187,300 tons of pellets, exceeding the current capacity of 4,773,500 tons. Assumptions were also made with future capacity to obtain production estimates. The same percentage of 66% was used to determine future production levels. The estimated yearly production of future developments totals 3,423,618 tons of pellets and comparison by state is shown in Fig. 5.

Figure 5 highlights that the states of Georgia, North Carolina, and Virginia will handle more future production than their current rate. This future production was also studied in terms of ratios of hardwood and softwood utilized. Some projects specified what species they intend to use, but in other cases, similar assumptions and analyses were considered as with current production rates. Amounts of hardwood and softwood utilization per state are shown in Table 3.

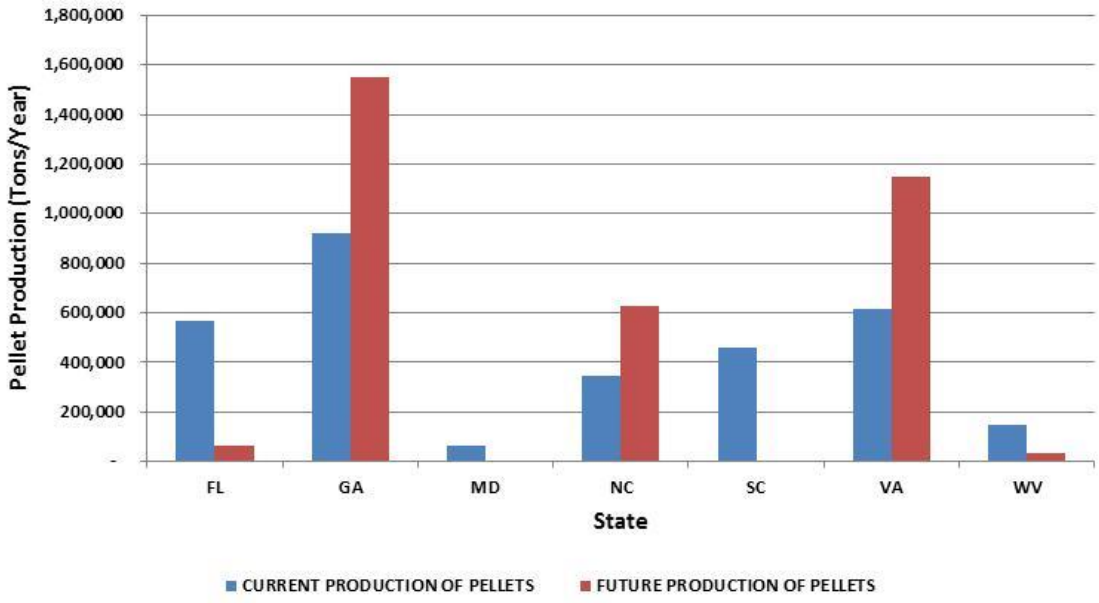

Fig. 5. Current and new production levels by state

Table 3 shows the distribution of each State in the total future production of the region. In the first part (known columns), the known distribution is shown between hardwood and softwood from the information obtained, following the different scenarios for the total future production of the region. It is shown that just in future developments, Georgia and Virginia will be the states with the most significant contribution to the pellet market. The results indicate that there is a likelihood of an increase in production of pellets of over 1,000,000 tons of hardwood and softwood per year; some scenarios show an increase in over 2,000,000 tons per year depending upon the species used.

Table 3. Future Hardwood and Softwood Mix by State (tons/year)

	Known		0	100	50	50	100	0
State	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.
FL	-	-	-	66,000	33,000	33,000	66,000	-
GA	486,849	120,549	486,849	1,061,049	957,099	590,799	1,427,349	120,549
MD	-	-	-	-	-	-	-	-
NC	198,330	198,330	198,330	429,330	313,830	313,830	429,330	198,330
SC	-	-	-	-	-	-	-	-
VA	346,830	346,830	346,830	802,230	574,530	574,530	802,230	346,830
WV	-	33,000	-	33,000	-	33,000	-	33,000
Total	1,032,009	698,709	1,032,009	2,391,609	1,878,459	1,545,159	2,724,909	698,709

Current and Future Facilities

To further understand the size of the future pellet market of the region, a combined analysis was performed with current production facilities and future developments. The region is expected to have a total of 54 companies manufacturing pellets with an installed capacity of 9,920,800 tons/year. This capacity, under current utilization values (66%), would be producing 6,547,728 tons/year. Additional analyses were performed to determine different production estimates based on different utilization percentages of total production capacity of the region. Figure 6 shows the different values of capacity, 90, 80, 70 percent utilization rates, and 66 percent (current utilization).

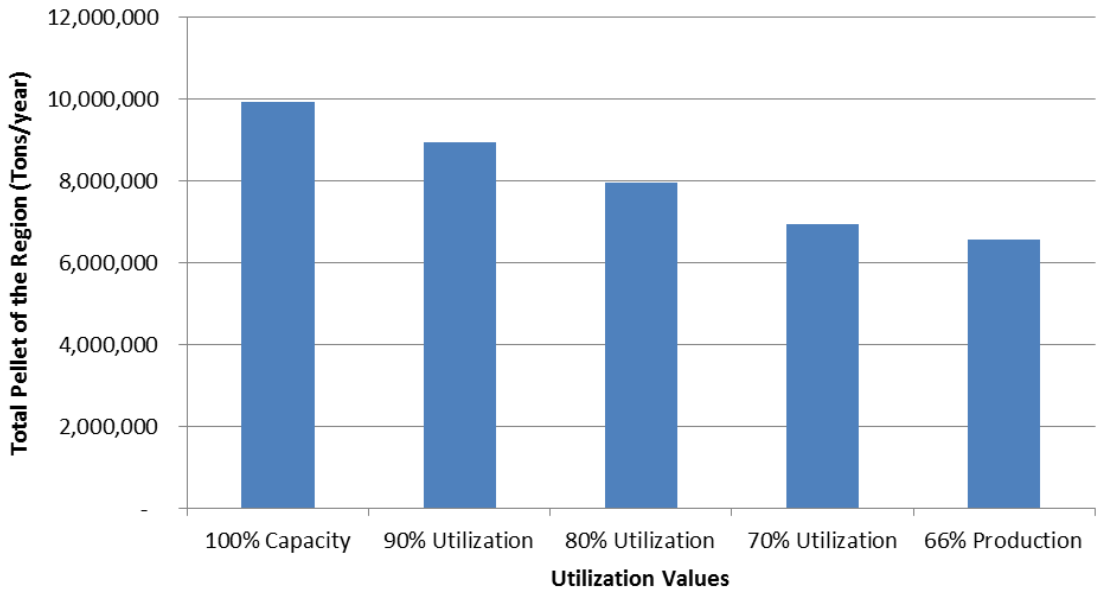

Fig. 6. Different utilization values for the installed capacity of the region

These pellets will be manufactured either with hardwood, softwood, or a mix, and the amounts required of each to achieve this production level (66 percent) are shown in Table 4. The table shows total number of current and future companies and which of those have some information missing about their operations. The known portion of the table is the combination of current and future production of pellets from hardwood and softwood. The total requirement of softwood and hardwood (according to the scenario) needed in the region can also be observed in Table 4.

Table 4. Total Future Hardwood and Softwood Distribution for the Region (tons/year)

	Companies		Known		0	100	50	50	100	0
	#	Uncertain	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.
Current	34	13	542,355	612,975	542,355	2,581,755	1,526,745	1,597,365	2,511,135	612,975
Future	20	3	1,032,009	698,709	1,032,009	2,391,609	1,878,459	1,545,159	2,724,909	698,709
Total	54	16	1,574,354	1,311,684	1,574,364	4,973,364	3,405,204	3,142,524	5,236,044	1,311,684

The combined pellet production of the region is projected to be at least 1 million tons of pellets per year of each type of wood biomass, and up to almost 5 million of each per year. These values represent a considerable increase from current production values; thus, the total production is expected to increase by 110% by 2015.

As previously discussed, the pelletizing process modifies the physical characteristics of the biomass by means of a drying and densification process to obtain a product with enhanced volumetric density and calorific value per unit of volume. This fact is a key element in understanding how much wood is required to manufacture a determined amount of pellets. According to Pirraglia *et al*. (2010), there is a ratio of about 2.5 to 1 (weight/weight) of green wood input (at 55% moisture content) and pellets.

This ratio was used to determine the amount of biomass needed to manufacture the total volume of pellets to be produced in the region. The total green biomass requirements needed to achieve the total production levels (current and future) of the regions totals 16,418,821 tons of green wood (55% moisture content). Table 5 shows the distribution of green biomass requirements of hardwood and softwood as a function of the projected and current production rates.

Table 5. Green Biomass Requirements

Tons of Green Wood (55% MC)								
	Known		0	100	50	50	100	0
	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.
Current	1,359,988	1,537,072	1,359,988	6,473,906	3,828,405	4,005,489	6,296,822	1,537,072
Future	2,587,824	1,752,055	2,587,824	5,997,103	4,710,349	3,874,579	6,832,873	1,752,055
Total	3,947,812	3,289,126	3,947,812	12,471,009	8,538,753	7,880,067	13,129,694	3,289,126

As can be seen in Table 5, the requirements per type of biomass would vary between over 3,000,000 green tons, with the potential to reach over 13,000,000 green tons required per year (depending on the scenarios). These calculations were determined with current levels of utilization of the manufacturing facilities; however, these levels are likely to increase substantially in the near future. To give the full perspective of biomass needs, Table 6 shows the total future capacity of the region (current and future), presenting the potential of how much the region could require.

Table 6. Total Future Capacity of the Region

	Tons of Green Wood (55% MC)				
	Companies		Capacity		
	#	Uncertain	Base	Assumed	Total
Current	34	13	8,609,707	3,259,828	11,869,535
Future	20	3	12,255,198	752,268	13,007,466
Total	54	16	20,864,905	4,012,096	24,877,001

An analysis of different utilization scenarios was also performed in terms of green biomass. In this case, the same 100 percent capacity, 90, 80, 70 percent utilization, and current utilization (66%) were included. The results of the different cases are shown in Fig. 7.

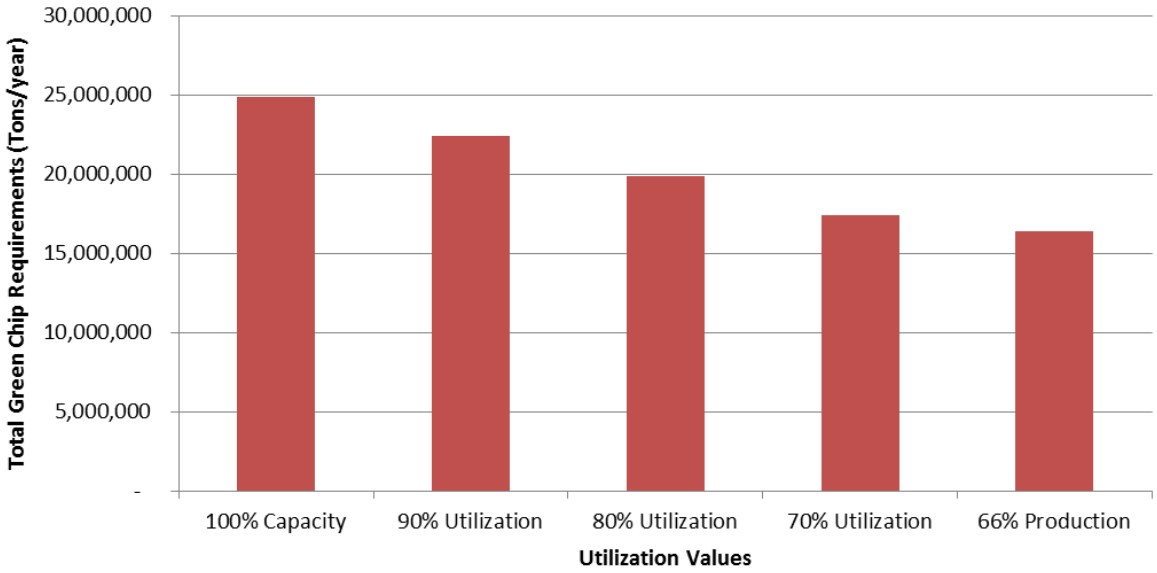

Fig. 7. Different utilization values for green chip requirements

The total future requirements of the region in terms of green biomass would likely be 24,877,001 tons per year, considering current projections on future capacity. This might be the maximum amount of biomass required within the region to manufacture wood pellets at full capacity. The challenge will now reside on the sourcing of the biomass for each company. It is likely that the biomass used to produce pellets within the region will come from within and outside of the South Atlantic states (staying in close proximity to the facilities).

In order to provide additional information, the same analysis was made by state. Table 7 shows the total capacity by state for the region. The totals are the same as the ones shown in Table 6. These values have a certain degree of uncertainty due to the assumption made for capacity of those facilities without information available. The base values are very likely to occur and the uncertainty resides on the assumed column.

Table 7. Total Future Capacity by State

Tons of Green Wood (55%MC)					
	Companies		Capacity		
State	#	Uncertain	Base	Assumed	Total
FL	5	3	1,654,990	752,268	2,407,258
GA	15	2	8,888,799	501,512	9,390,311
MD	1	1	-	250,756	250,756
NC	5	0	3,693,636	-	3,693,636
SC	4	2	1,253,780	501,512	1,755,292
VA	20	7	4,949,923	1,755,292	6,705,215
WV	4	1	423,778	250,756	674,534
Total	54	16	20,864,905	4,012,096	24,877,001

The total future capacity can also be analyzed in terms of hardwood and softwood but with an additional level of uncertainty. The same scenarios as in the previous cases were analyzed, and the results showed requirements between over 3,000,000 tons/year and over 21,000,000 tons/year depending on the scenario that is evaluated. These results are shown in Table 8.

Table 8. Total Future Capacity Distribution by Type of Material

Tons of Green Wood (55%MC)						
	0	100	50	50	100	0
State	Soft.	Hard.	Soft.	Hard.	Soft.	Hard.
FL	463,397	1,943,861	1,203,629	1,203,629	1,943,861	463,397
GA	1,403,266	7,987,045	5,154,415	4,235,896	8,905,564	484,746
MD	-	250,756	125,378	125,378	250,756	-
NC	929,277	2,764,359	1,846,818	1,846,818	2,764,359	929,277
SC	-	1,755,292	877,646	877,646	1,755,292	-
VA	1,151,873	5,553,343	3,313,715	3,391,500	5,475,558	1,229,657
WV	-	674,534	246,242	428,291	492,484	182,049
Total	3,947,812	12,767,844	12,767,844	12,109,158	21,587,875	3,289,126

The total requirements for the region in every scenario are the sum of softwood and hardwood requirements and it equals the same amount from the previous results of 24,877,001 tons/year of green biomass.

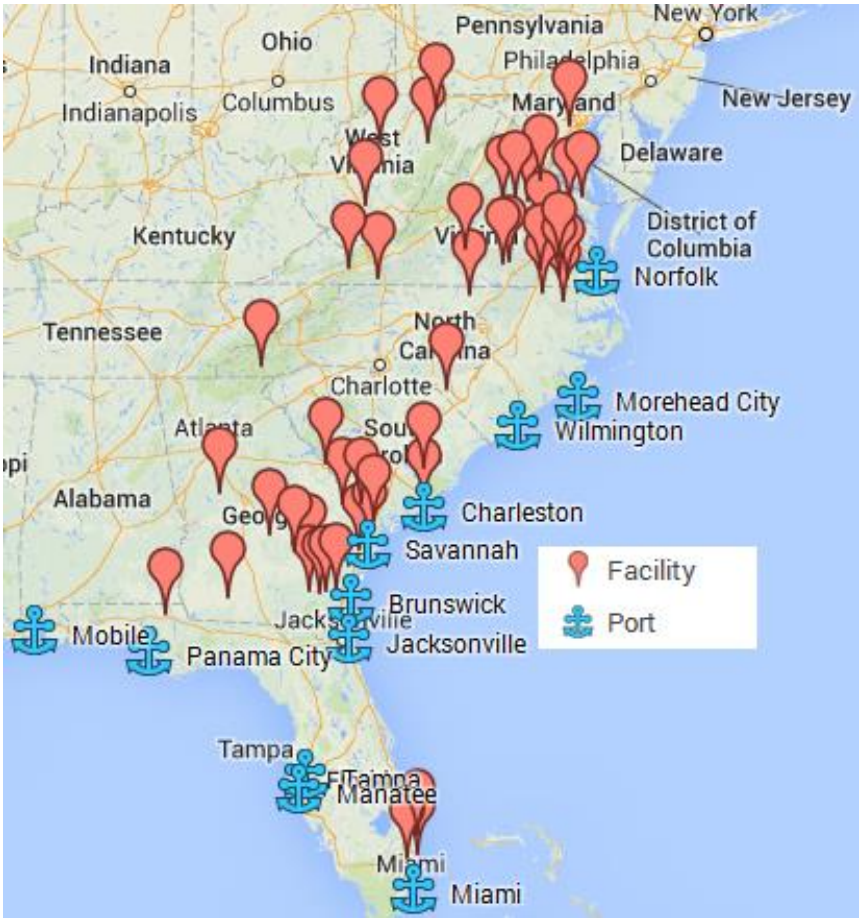

Fig. 8. Location of facilities and ports

Location of Facilities and Ports

An additional analysis was performed to describe the impact on major deep-sea ports in the region. Figure 8 shows the approximate location of all the facilities included in this study as well as the major ports of the region.

Figure 8 shows a group of facilities toward the north of the region that might use the port of Norfolk for oceanic transportation. The facilities near this port will have a total production capacity of over 3.8 million tons/year of pellet, representing 39% of the region in terms of capacity. The facilities located near the ports of Savannah and Brunswick will have a total production capacity of over 3 million tons/year of pellet, representing 30% of the region. The ports of Charleston, Miami and Panama City could potentially handle 5% each of the production capacity of the region.

The analysis presented here was based on the assumption that those facilities will export their products. The remaining 15% capacity of the region will either be incorporated in these ports, use others or remain in the US for the internal market.

CONCLUSIONS

1. Research indicates the potential of solid woody biofuels and the gathered data shows the addition of Southern U.S. industries in this market. The region seems to be a strategic location for pellet production facilities looking to supply the domestic and international markets.
2. This study indicates that the Southern U.S. pellet industry will continue to grow in terms of capacity during the next couple of years. There is still some uncertainty in the projections but the growth is very likely to occur.
3. The demand of woody biomass within the Southern U.S. for the pellet industry is expected to double in the next couple of years to almost 25 million tons of biomass by 2015. It is likely that new facilities have established suppliers to fulfill their demand, but competition for woody biomass could potentially increase in the next years.
4. A higher degree of uncertainty is tied to the type of biomass to be used by companies, but results indicate a future demand of at least 3 million tons to up to 21 million of each (softwood and hardwood). These results will vary depending on the different sources for biomass once the new facilities open.
5. There is an uneven distribution of the pellet facilities throughout the region. This distribution could significantly increase the use of some ports over others when targeting international markets. The ports in Norfolk, Savannah, and Brunswick are the main pellet ports of the region.

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