
# Biomass Resources: The Southeastern United States and the Renewable Electricity Standard Debate

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May 4, 2009

**Congressional Research Service**
7-....
www.crs.gov
R40565

**CRS Report for Congress**
*Prepared for Members and Committees of Congress*

# Summary

Congress has been debating establishment of a Renewable Electricity Standard (RES) to encourage increased use of all forms of renewable energy including generating electricity from biomass sources (H.R. 890, S. 433). Concerns over the potential impacts of a federal RES seem to revolve largely around the issue of whether, nationwide, sufficient renewable energy resources exist and are economically viable. States and electricity suppliers in the southeastern United States have been most vocal in their concern that they may be unfairly burdened by an RES. They contend there is a lack of wind or solar resources that can be delivered economically.

Today, biomass is the largest source of renewable energy in the United States. Approximately 53% of all renewable energy comes from biomass sources, represented by biofuels, landfill gas, municipal solid waste, wood and wood-derived fuels, and other biomass feedstocks. All renewable energy sources combined account for about 10% of the U.S. total energy production. The definition of what constitutes biomass has varied over time with changes in law and regulations, reflecting policy goals and evolution of potential uses.

A principal argument made by supporters of an RES is that it would provide benefits to the environmental goals. Carbon dioxide ($CO_2$) emissions from biomass sources are considered practically neutral, as biomass sources take in $CO_2$ during their growing cycle and release it when burned. Renewable energy is seen as a way to reduce fossil fuel use and, with growing awareness of the potential impacts of climate change, the role of renewable energy in reducing $CO_2$ emissions from energy production has garnered increasing public support.

Biomass has been characterized by advocates for an RES in the Southeast (i.e., Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia) as the region's main renewable resource which could be used to meet a standard. However, the region's major user of woody biomass and producer of wood wastes is the forest products industry. It is concerned that competition for biomass resources from new power generation facilities and from transportation fuel uses could drive up prices to the economic detriment of forest product companies.

If biomass from forest residues and forest product industry wastes do not prove sufficient to meet RES goals, new resources such as dedicated bioenergy crops or other biomass resources, such as municipal solid waste, may need to be used. The definition of which types of biomass are eligible under an RES would determine which resources, technologies and processes will be available to meet a possible federal RES mandate. Goals for biofuels production to meet a Renewable Fuels Standard (RFS) may also mean that increased amounts of biomass would be dedicated to that use. Diversity of biomass resources seems likely to be key to the economic production of biomass-fired power generation. Sustainable management of forest resources is likely to be both a basic consideration and a possible constraint. The issue of whether there is enough biomass to meet both an RES and RFS is beyond the scope of this report.

The terms RES and RPS (Renewable Portfolio Standard) are often used interchangeably as no material difference exists in program goals.

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# Introduction

Renewable energy currently accounts for about 10% of U.S. total energy production according to the U.S. Department of Energy.[1] Biomass is the largest source of renewable energy[2] in the United States. Approximately 53% of all domestic renewable energy comes from biomass sources[3] represented by biofuels, landfill gas, biogenic[4] municipal solid waste, wood and wood-derived fuels, and other biomass such as switchgrass.

Much of the impetus for the contribution of biomass sources and technologies to the national energy picture originated in a federal law[5] originally viewed as a natural gas conservation measure, the Public Utility Regulatory Policies Act of 1978 (PURPA). A market was created for firms outside of the electric utility industry with a preference or opportunity for producing energy from alternative fuels, especially for qualifying small power facilities that could use biomass, waste, or other renewable resources (including wind, solar energy, and water).[6] Investments and advances in combustion turbine technology preceded the growth of cogeneration.[7] Nowadays, combined heat and power turbine-generator sets are a mainstay of several industries and industrial applications. The pulp and paper industry dominates the cogeneration sector today fueled largely by biomass from wood wastes.

State governments have generally led the way in deploying other renewable energy technologies. Picking up where federal research and development dollars left off, states are using the concept of a Renewable Portfolio Standard[8] (RPS) to create a market for renewable energy via mandatory goals. RPS requirements oblige electric utilities to provide electricity from renewable energy sources in increasing amounts over a specified period of years. Through February 2009, RPS requirements or goals have been established in 29 states plus the District of Columbia.[9]

A major argument that has been advanced for a national renewable energy (or electricity) standard is that it would encourage increased use of renewable energy. Thus far, two bills have been introduced in the 111th Congress that would amend PURPA. The American Renewable Energy Act, H.R. 890, would establish a renewable electricity standard (RES).[10] In the Senate, a

[1] EIA, Monthly Energy Review, September 2008.

[2] Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action. http://www.eia.doe.gov/glossary/glossary_r.htm.

[3] Energy Information Administration (EIA). U.S. Energy Consumption by Energy Source. May 2008. http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.html.

[4] Produced by biological processes of living organisms. http://www.eia.doe.gov/glossary/glossary_b.htm.

[5] National Museum of American History, *The Public Utility Regulatory Policies Act - Government Involvement to Remedy Energy Crisis: PURPA*, http://americanhistory.si.edu/powering/past/history4.htm.

[6] Public Utility Regulatory Policies Act of 1978 at 16 U.S.C. §796 (17)(E)].

[7] Cogeneration is the production of electrical energy and another form of useful energy (such as heat or steam) through the sequential use of energy. Also called "combined heat and power." http://www.eia.doe.gov/glossary/glossary_c.htm.

[8] The terms RPS and RES (renewable electricity standard) are often used interchangeably, as no material difference exists in program goals.

[9] Renewable Portfolio Standards. http://www.ferc.gov/market-oversight/mkt-electric/overview/elec-ovr-rps.pdf.

[10] The American Clean Energy & Security Act of 2009 "discussion draft" introduced by Representatives Waxman and Markey draws upon H.R. 890 (111th Congress) § 101, the Federal Renewable Electricity Standard.

renewable electricity standard was introduced in S. 433.[11] Senator Bingaman had previously released a draft bill to discuss a federal renewable portfolio standard on February 11, 2009.[12]

With biomass representing the most widely used (and ostensibly the least expensive) renewable energy resource in the United States, its potential use in meeting RES requirements is key to the success of any RES that may be enacted.

# Background

Much of the debate over an RES revolves around whether there is a need for a federal requirement for renewable energy use by electric providers and whether the momentum in the states is truly moving the use of renewable energy forward. The Production Tax Credit[13] and the Investment Tax Credit[14] have been used by the federal government to support renewable energy.[15] Recent consideration has also been given to implementing a federal "Feed-in Tariff" (FIT) law. Feed-in Tariffs are incentive structures for generating renewable electricity usually at above-market rates for a set number of years, reducing the payback period and adding certainty to the return on the investment. The successful deployment of renewable energy in Europe is often credited to FIT provisions.[16]

Arguments in favor of an RES usually involve impacts on the environment, and reducing dependence on fossil fuels. Historically, most electric power has come from base-load generation in large, central station plants using fossil fuels (principally coal) as the source of energy. When burned, fossil fuels emit pollutants such as sulfur dioxide and nitrogen oxides which are subject to environmental controls to limit their release to the air. Combustion of fossil fuels also produces the greenhouse gas carbon dioxide. Generating electricity from renewable resources emits far less of such pollutants. Many consider carbon dioxide emissions from biomass sources as practically neutral, because biomass sources take in carbon dioxide during their growing cycle and release it when burned.[17] Renewable energy is seen as a way to reduce fossil fuel use, and with growing awareness of the potential impacts of climate change, the role of renewable energy in reducing carbon emissions has garnered increasing public support. But renewable energy technologies (with the exception of basic biomass combustion) are relatively newly developed and costlier than fossil fuels to produce electricity. Federal support for research and development is believed by many policymakers to be crucial in making renewable energy technologies more cost-competitive. A federal RES mandate and consistent, long-term financial incentives are also seen

[11] Introduced by Senators Udall and Udall on February 12, 2009.

[12] Senator Bingaman discussion draft, Title VIII, Renewable Portfolio Standard, 111th Congress.

[13] 26 USC § 45. The production tax credit is an incentive to business developers of renewable energy projects producing electricity whereby a developer can apply for a credit against taxes for each kilowatt-hour of renewable energy produced.

[14] 26 USC § 48. The investment tax credit is an incentive for domestic investment in renewable energy plant and equipment. For additional information, see the discussion of the investment tax credit and the production tax credit in the federal incentives section of the Database of State Incentives for Renewable Energy website at http://www.dsireusa.org/.

[15] For additional information, see the discussion of these tax credits in the federal incentives section of the Database of State Incentives for Renewable Energy website at http://www.dsireusa.org/.

[16] http://www.guardian.co.uk/business/2007/jul/23/germany.greenbusiness.

[17] CRS Report RL34059, *The Carbon Cycle: Implications for Climate Change and Congress*, by (name redacted).

by supporters as necessary to increase renewable electricity generation to attain the goals of cleaner energy and greater energy security.

Arguments against the need for a national RES have been made in the past that this is a matter for state or regional self-determination. Some states have moved forward with their own RES programs envisioning either an economic benefit or environmental imperative, or both.[18] States may argue that a federal mandate could override existing state programs which may have involved years of negotiations among local interests to set goals and timetables. Grants, guaranteed loans and tax incentives from the federal government may be viewed by such parties as the best ways for the federal government to encourage renewable energy growth. In regions where the quality or availability of renewable resources may be in question, as for example, in the Southeast,[19] some states are concerned that the current RES proposals would subject them to federal penalties. A "Renewable Electricity Deployment Fund," proposed in H.R. 890, would return amounts collected from penalties for noncompliance or alternative compliance payments to retail electricity suppliers that have submitted renewable energy credits[20] (REC) for compliance. Unless some balancing mechanism is in place, such as the Bingaman discussion draft proposal to return federal penalties to those states with less renewable energy resources to specifically develop such resources, southeastern states and electric utilities fear that they will become net purchasers of RECs, which will result in a "transfer of wealth" to the sunny and wind-rich states of the Southwest and Midwest, respectively.[21] Given the identified concerns over biomass supplies in the southeastern states and the pivotal role the region will likely have in a federal RES debate, issues in this region will be used as the focus of this report.

# Renewable Energy Resources in the Southeast

Investments in energy production in the southeastern United States have long favored base load technologies due to increasing economies of scale from large generation units. The electricity industry in the region is still largely subject to traditional rate regulation, and power generation projects historically have been approved by state regulatory commissions which have endeavored to maintain a favorable, low cost business climate. Relatively low electricity prices have thus resulted in the region.[22] New, renewable energy technologies have not been adopted to the extent seen in other regions of the United States thus far, largely because of cost and operational variability.[23] When considered from a regional perspective, the southeastern United States does

[18] Virginia and North Carolina are the only two southeastern states to have enacted RPS requirements, but at levels below current federal RPS proposals. Virginia has a 12% RPS requirement by 2022. North Carolina has enacted a 12.5% requirement by 2021 for electric utilities and a 10% requirement for municipal and cooperative utilities. See http://www.ferc.gov/market-oversight/mkt-electric/overview/2009/03-2009-elec-ovr-archive.pdf#xml=http://search.atomz.com/search/pdfhelper.tk?sp_o=4,100000,0.

[19] For the purposes of this discussion, southeastern states include Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

[20] Under RES proposals, most producers of renewable electricity will receive renewable energy credits or certificates to prove that a certain amount of renewable electricity was produced (usually 1 Megawatt-hour). http://www.dsireusa.org/glossary/glossary.cfm?CurrentPageID=8&EE=1&RE=1#con.

[21] Daniel Cusick, "Southern utilities led effort to squash Senate RPS proposal," *Earth News*, June 26, 2007.

[22] Energy Information Administration, *How is my electricity generated, delivered, and priced?*, July 10, 2008, http://tonto.eia.doe.gov/energy_in_brief/electricity.cfm.

[23] Discussion with Southern Company, March 31, 2009.

not have the high quality wind and solar resources which exist in other regions of the country.[24] Although offshore wind in the region may have promise for southeastern coastal states, there are no commercially operating offshore wind farms anywhere in the United States.

However, renewable energy from biomass is the exception. The region is home to 44% of the nation's total energy from woody biomass and a significant portion of other biomass types.[25] Not all biomass is recognized as "eligible" to meet federal RES requirements due to differences in federal legislation and tax provisions defining biomass.[26] These definitions have varied over time with changes in the law and regulations, reflecting policy goals and technological change. The definition of biomass would be critical to determining which technologies and processes would be available to meet possible RES requirements. The next section discusses current and future possible sources of biomass and technologies for renewable energy.

[24] National Renewable Energy Laboratory, *Renewable Resource Data Center*, http://www.nrel.gov/rredc/.

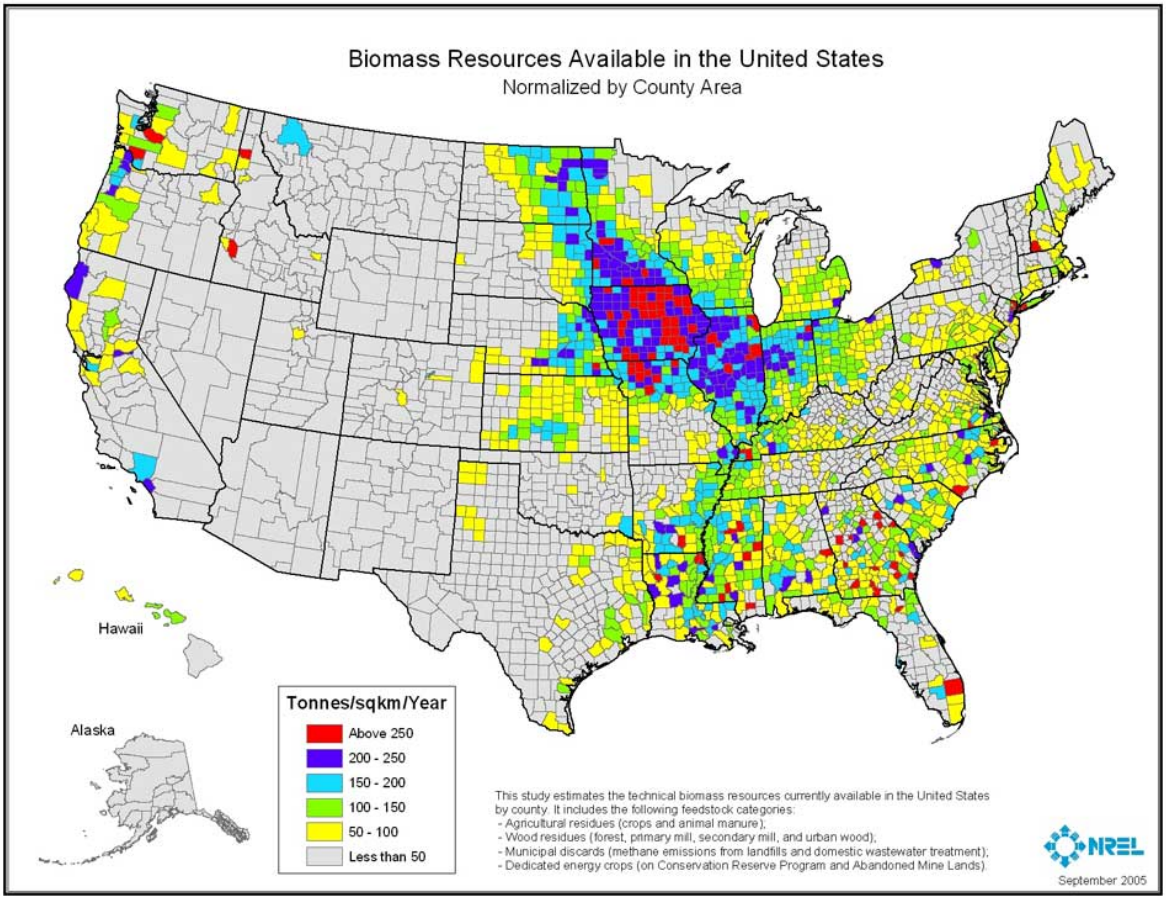
[25] Southeast Agriculture & Forestry Energy Alliance, *Southern Bioenergy Roadmap*, 2009, p. 5, http://www.saferalliance.net/projects/bioenergy_roadmap.pdf.

[26] CRS Report R40529, *Biomass: Comparison of Definitions in Legislation*, by Kelsi S. Bracmort and (name redacted).

# Biomass Resources for Power Generation

**Figure 1** shows various types of biomass resources in the United States by annual tonnage per square kilometer available in individual counties. The agricultural resources of the Midwest and the forest-based resources of the Southeast feature prominently.

**Figure 1. Biomass Resources Available per Square Kilometer in the United States**




**Source:** National Renewable Energy Laboratory. See http://www.nrel.gov/gis/images/map_biomass_sqkm.jpg

## Forest-Based Resources: Wood Wastes and Black Liquor

Biomass is possibly mankind's oldest source of energy. Since the time of the first nomadic hunter-gatherer societies, wood has been collected for cooking fires and heating. The use of cellulosic fiber from trees to make paper is a primary use of wood, rivaling other forest product uses such as lumber for buildings and furniture products. Today, most wood used as fuel for thermal processes or power generation actually is waste from the harvesting and processing of trees by the forest products industry (i.e., tree bark, branches and stumps, wood chips, sawdust,

and lignin).[27] Thus, wood waste may be burned in biomass boilers specifically for "hog fuel" (basically wood waste other than lignin) to produce steam for process uses and electricity generation.[28]

The pulp and paper industry has another wood waste fuel source in "black liquor," a by-product of the pulping process.[29] Inorganic chemicals are used to dissolve the lignin holding together wood fibers, thus making the cellulosic fibers available for the manufacture of paper products. The inorganic chemicals are recovered in a "recovery boiler" and reconstituted for reuse, while the organic lignin is burned, generating heat for steam production. These recovery and biomass boilers are responsible for most of the energy generated by the forest products (biomass) sector, either as steam heat for process uses, or electricity generated for on-site use. Electricity not used on-site to power equipment may be made available for sale on the grid.

## Agricultural Sources

The harvest of food and other crops often leaves behind a mass of stover (i.e., stalks, leaves and other plant remnants). In past years, much of this material was either plowed under to reconstitute the soil, left for livestock forage, or was gathered to make straw. But nowadays, possibilities for use include collection of a portion of this material for burning in a biomass boiler, producing steam for electricity, or processing into biofuels (see below) such as cellulosic ethanol, as technologies and new processes are developed.

Crops grown specifically for energy production are sometimes called "bioenergy crops" or "biomass crops." Biocrops are fast-growing (sometimes hybridized) species dedicated to producing energy (electricity or liquid fuels) from all or part of the resulting plant.[30] These are mostly perennials such as switchgrass or mixed prairie perennials, or trees like willow or poplar, but any other plant material could be used for biocrops. The need for agricultural chemicals is often lower for perennial biocrops which can mean less pollution from runoff into rivers and streams.

## Co-Firing with Biomass

Today, coal is the most widely used fuel for electric power generation in the United States. By blending suitable biomass into coal boilers for steam generation, "co-firing" with biomass can reduce the amounts of coal used by as much as 20%. The efficiency of boilers at these levels of biomass input is not affected and resulting overall air emissions are reduced.[31] In the future, much of the biomass co-fired in coal plants may come from biocrops. Biomass grown for energy is commonly seen as carbon neutral and most biomass sources are low in sulfur content, so sulfur

[27] Lignin is the "glue-like" substance which holds woody plant fibers together.

[28] "Hog fuel" is a mixture of wood and bark, usually reduced to 50-75 millimeter-size chips and produced by a "wood hog" (i.e., grinder), from which it derives its name. http://bioenergy.ornl.gov/pdfs/ornltm-2002199.pdf.

[29] The alkaline spent liquor from the digesters in the production of sulfate or soda pulp during the manufacture of paper. http://www.fao.org/docrep/w7407e/W7407e05.htm.

[30] Oak Ridge National Laboratory. *Bioenergy and Biomass Frequently Asked Questions. What are Energy Crops?* http://bioenergy.ornl.gov/faqs/index.html#overview4.

[31] US Department of Energy, *Biomass Cofiring in Coal-Fired Boilers*, http://www1.eere.energy.gov/femp/pdfs/fta_biomass_cofiring.pdf.

dioxide emissions are reduced. Further, biomass combustion typically does not produce nitrogen oxides.[32]

## Other Potential Sources of Biomass Energy

### Livestock Wastes

The intensive raising of livestock for food often results in significant amounts of manure and other wastes from the animals.[33] Some livestock wastes may be bound up with sawdust or wood shavings used in animal stalls and thus (when prepared) can be used as fuel in a biomass power boiler. In addition, methane[34] can be captured from the livestock wastes and burned to produce steam for electricity. [35]

### Landfill Gas and Municipal Solid Waste [Waste-to-Energy]

Landfill gas from decomposing organic matter in landfills can be collected and used to generate electricity, if it is present in suitable quantities and is of a high enough quality in its energy content.[36] As such, landfill gas is usually a mixture of methane and carbon dioxide, and may contain other contaminants requiring treatment or removal before the gas can be used as fuel to produce steam for power generation.[37]

As an alternative to burying the volumes of trash collected by cities and towns, waste-to-energy facilities can use municipal solid waste directly as a fuel source to generate electricity. After the municipal solid waste is sorted and separated, much of the remaining material is biogenic and can be prepared for burning in a steam boiler. Waste-to-energy facilities in operation today are typically able to meet clean air standards and requirements.[38]

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[32] Environmental and Energy Study Institute, *Biomass Cofiring: A Transition to a Low-Carbon Future*, March 2009, http://www.eesi.org/030409_cofiring.

[33] In fact, estimates are that livestock production may be responsible for 18% of greenhouse gas emissions (as measured in carbon dioxide equivalents) including 37% of all anthropogenic methane, and up to 64% of ammonia in the environment which also contributes to acid rain and acidification of ecosystems. Henning Steinfeld, Pierre Gerber, and Tom Wassenaar, et al., *Livestock's Long Shadow - Environmental Issues and Options*, Food and Agriculture Organization of the United Nations, 2006, ftp://ftp.fao.org/docrep/fao/010/a0701e/a0701e03.pdf.

[34] Methane is the primary component of natural gas which is used in cooking, heating, chemicals production, and electric power generation. Methane is a more powerful greenhouse gas than carbon dioxide, being 21 times more potent at trapping heat in the atmosphere over a 100 year period. See http://www.pnl.gov/aisu/pubs/14660.pdf.

[35] Methane released from manure management systems can be captured and used as clean energy to produce electricity. See http://methanetomarkets.org/ag/index.htm.

[36] Municipal solid waste contains significant portions of organic materials that produce a variety of gaseous products when dumped, compacted, and covered in landfills. Anaerobic bacteria thrive in the oxygen-free environment, resulting in the decomposition of the organic materials and the production of primarily carbon dioxide and methane. See http://www.eia.doe.gov/cneaf/solar.renewables/page/landfillgas/landfillgas.html.

[37] Mike Ewall, *Primer on Landfill Gas as "Green" Energy*, Energy Justice Network, July 29, 1999, http://www.energyjustice.net/lfg/.

[38] Danielle Jackson, *EPA Report Applauds Waste-to-Energy Plants*, Waste Age magazine, June 25, 2002, http://wasteage.com/news/waste_epa_report_applauds/.

### Emerging Biomass Power Technologies

Gasification technology holds promise for increased efficiency and usefulness of biomass combustion and waste-to-energy technologies. By converting biomass, waste materials, or other carbon-containing materials into a synthesized gas (synthesis gas or syngas) comprised mostly of carbon monoxide, hydrogen, and carbon dioxide, the syngas can be burned directly to generate electricity.[39] Further processing via Fischer-Tropsch methods[40] or other forms of catalysis can convert the syngas into higher value chemicals or transportation biofuels such as ethanol, methanol, or a form of biodiesel called di-methyl ether.

Plasma-arc gasification is an incineration technology which uses an oxygen-starved environment to reduce the organic components in municipal solid waste (or other biomass) into its constituent elements. The resultant gas is then used to provide heat for electric power generation. Inorganic wastes are reduced to low volume, inert solids.[41] The technology is being used commercially in several installations around the world, with the first U.S. facility scheduled to be operational in 2011.[42]

# Potential Biomass Use in the Southeast for RES Requirements

A potential national renewable electricity standard would rely on biomass as one of the nation's most widely available resources that could be used to meet requirements.[43] With many states already moving forward on advancing renewable energy goals, the acceptability of an RES may come down to regional views on the availability and suitability of renewable energy resources for meeting RES requirements. Nowhere is the debate on biomass resources more pronounced than in the southeastern United States where biomass has been described as the region's best hope to meet RES requirements.[44]

The key determinants of success related to fuel for a biomass power plant include the availability of biomass resources, prices of the feedstock, and the cost of collection and delivery of these resources. These factors will help determine whether further biomass development can help the region economically meet projected requirements of an RES.

## Availability of Biomass

Proponents of an RES assert that the Southeast has ample biomass resources to meet renewable energy requirements of an RES. The Southern Alliance for Clean Energy (SACE) states:

[39] Gasification. http://www.eia.doe.gov/glossary/glossary_g.htm.

[40] For more on Fischer-Tropsch technologies, see CRS Report RL34133, *Fischer-Tropsch Fuels from Coal, Natural Gas, and Biomass: Background and Policy*, by (name redacted) and (name redacted).

[41] See Plasma Gasification at http://www.recoveredenergy.com/d_plasma.html.

[42] Peter Fairley, *Garbage In, Megawatts Out*, July 2, 2008, http://www.technologyreview.com/Energy/21029/?a=f.

[43] U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy , *Overview of Biomass Technologies*, http://www1.eere.energy.gov/ba/pba/pdfs/bio_overview.pdf.

[44] EIA. Analysis of RPS. June 2007.

> Biomass represents about two-thirds of the Southeast's near-term potential for expanding renewable energy…. Today, biomass [electric power] generation is mainly associated with the use of mill and agricultural wastes. Tomorrow's opportunities for using biomass to generate electricity in the Southeast include a diverse assortment of options, particularly energy crops and wood resources. [45]

According to SACE's analysis, biomass is potentially seen as meeting 60% of a near-term RES goal of 15% of all generation in the Southeast (by the year 2015). The majority of that capacity is expected to come from new energy crops.[46]

Opponents of an RES say goals for new renewable energy generation are unfair and cannot be easily met in the timeframes under discussion. Southern Company, a major electric utility in the Southeast, asserts it could not meet a 15% requirement by 2015, adding that it may be able to raise only 800 megawatts (MW) of an estimated 6,000 MW of new renewable energy capacity required for compliance.[47] Southern Company doubts that currently discussed RES requirements of 20% or 25% (by the year 2025) can be achieved using biomass or other renewable energy sources, and the region may have to purchase renewable electricity credits[48] (RECs) from other states.[49] In the meantime, Southern Company's subsidiary, Georgia Power, has gained approval from the Georgia Public Service Commission to convert Plant Mitchell, a small coal-fired facility near Albany, Georgia, to woody biomass[50] with work beginning in 2011 (and ending in 2012) resulting in 96 megawatts of renewable electricity. Burning approximately one million tons of biomass annually, Plant Mitchell would be one of the largest biomass power plants in the United States.[51]

Collection of waste wood for biomass power plants may require a coordinated effort with forestry companies. Wood wastes from saw mills is a primary source of energy used by the biopower industry in its power plants, but if sufficient numbers of these mills go out of business, then the economics of biopower operations could change.[52] There is little doubt that logging operations leave behind considerable waste wood in the forests, but going into the forest specifically to collect wood wastes may not be cost effective for biopower companies.[53]

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[45] Southern Alliance for Clean Energy (SACE). *Yes We Can: Southern Solutions for a National Renewable Energy Standard.* Presentation on behalf of CleanEnergy.org. February 23, 2009.

[46] Ibid. Near-term potential for renewable energy resources: energy crops (22%); forest residues (18%); crop residues (11%); urban wood residues (6%); biogas (landfills—2%; livestock manure—1%).

[47] Capitol Hill Publishing Corp, *Southern Co. takes aim at renewable-energy bill*, May 8, 2007, http://thehill.com/business--lobby/southern-co.-takes-aim-at-renewable-energy-bill-2007-05-08.html.

[48] For more information on Tradable Credits, see CRS Report RL34116, *Renewable Energy Portfolio Standard (RPS): Background and Debate Over a National Requirement*, by (name redacted).

[49] E-mail from Southern Company, March 30, 2009.

[50] Georgia Power Company, *Georgia Power Seeks Approval for Coal Plant Conversion to Biomass*, August 22, 2008, http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/08-22-2008/0004871944&EDATE=.

[51] Tom Darin Liskey, *Georgia Power seeks to convert coal plant to biomass*, ReCharge News, February 3, 2009, http://www.rechargenews.com/energy/biofuels/article171226.ece.

[52] Approximately 16 mills have closed in the Southeast between 2004 and 2007. Pulp & Paperworkers Resource Council, *Mill Closures Chart*, 2007, http://www.pprc.info/html/millclosures.htm.

[53] Justine Hunter, *Forestry decline threatens B.C.'s biomass plants*, Globe and Mail, March 25, 2009, http://www.theglobeandmail.com/servlet/story/RTGAM.20090325.wforestry0325/BNStory/National/.

## Potential Impacts on Biomass Prices

When examined from a regional perspective, a number of questions have been raised as to the potential impacts on the supply and demand of biomass resources under a renewable energy standard. The provisions of such a law—including definition of eligible biomass resources, price incentives for renewable electricity, and tax treatment—would all affect the economic viability of possible projects and could affect demand for biomass resources.

Much of the Southeast region's biomass electricity capacity comes from existing forest products cogeneration facilities which would not qualify for tradable RECs under the RPS proposal floated by Senator Bingaman.[54] The American Forest & Paper Association (AF&PA) is concerned that if this option is followed, a financial advantage could be given to new biomass energy generators at the expense of its member companies because of the added value of tradable RECs.[55] Forest products companies are the primary users of biomass for manufacturing purposes. AF&PA contends that additional income from trading in RECs by biopower companies could lead to increased demand and higher prices for biomass, thus forcing forest products companies nationwide to pay more for its raw materials. Conversely, this situation could potentially benefit landowners in the region who have seen prices for wood fall with the economic decline of the forest products industry.

AF&PA points to a study of the effects of a 20% RPS by their counterparts in Europe, which concluded that simple power generation from biomass (i.e., wood and recovered paper) should only be considered when recycling is no longer feasible to maximize economic and environmental benefits.[56]

In contrast, the Biomass Power Association says that its members cannot profitably compete with the pulp and paper industry for supplies of woody biomass at existing prices of $60 per bone dry ton (BDT), and must seek alternative supplies in the $40 per BDT range, or lower.[57] Thus, other sources of biomass are targeted. Considering fuel cost inputs in this range and continuation of the Production Tax Credit[58] and RECs producing power valued around $0.08 per kilowatt-hour, biomass power plants could be built in the 25 megawatt size range and produce power economically, according to the Biomass Power Association.[59]

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[54] Generators of existing renewable energy facilities (placed in service before January 1, 2006) would receive non-tradable credits for the power they generate under the proposal in Senator Bingaman's RPS discussion draft.

[55] Press release, National Journal, February 12, 2009 at http://www.afandpa.org/Template.cfm?Section=Press_Releases1&template=/PressRelease/PressReleaseDisplay.cfm&PressReleaseID=936&PressReleaseCategoryID=10&ShowArchives=0.

[56] Confederation of European Paper Industries, *Bio-energy and the European Pulp and Paper Industry*. http://www.cepi.org/content/default.asp?pageid=10.

[57] Biomass Power Association (BPA). Forest Biomass and its Role in a National Renewable Electricity Standard. See page 4 of presentation at http://files.eesi.org/cleaves_030409.pdf.

[58] Companies that generate wind, geothermal, and "closed-loop" bioenergy (which is powered by dedicated energy crops) are eligible for the production tax credit, which provides a variable cent per kilowatt-hour benefit for the first years of a renewable energy facility's operation. Other technologies, such as "open-loop" biomass, incremental hydropower, small irrigation systems, landfill gas, and municipal solid waste (MSW), receive a lesser value tax credit. See http://www.house.gov/jct/x-39-08.pdf.

[59] BPA. See note 59.

Demand for woody biomass could also be affected by requirements for biofuels production under the Renewable Fuel Standard[60] specified by Congress in the Energy Policy Act of 2005, especially as cellulosic methods for ethanol production are improved. Cellulosic ethanol can be produced from the same types of biomass feedstock as could be used for biomass electric power generation. Recent technological developments are improving yields from cellulosic production and bringing down production costs[61] which, when coupled with incentives for ethanol production, may further increase demand and possibly prices for biomass.

## Cost of Delivery of Biomass

Transportation costs associated with biomass will bear strongly on the decision to site a biomass power facility. Access to the resource is critical to a facility's economic feasibility. The total delivered cost of woody biomass can be calculated as the sum of the costs of procurement (i.e., the amount paid to gain ownership of a biomass resource), collection or harvest costs, and transportation costs. Different types of biomass have different procurement and collection costs, and transportation cost varies as a function of haul time and distance.

In 1991, a study[62]of the availability of biomass in the Southeast identified 27 counties with high potential to generate power from woody biomass. More recently, a study released in 2006 assessed the economic feasibility of bringing in biomass resources for bioenergy projects. The latter study used geographic information system (GIS) techniques to examine the theoretical effects of transportation infrastructure, distance, and biomass types on potential bioenergy projects in the 27 counties. The locations selected were bounded by a 280-mile radius to allow for a four-hour maximum one-way haul, and trucks offloading biomass every 15 minutes. [63] Based on a demand of 2 to 4 trillion British Thermal Units (BTUs) for a biomass power facility generating between 20 and 40 megawatts of electricity, the study concluded that sufficient biomass supplies potentially existed in the 27 counties. The costs of delivered biomass fell into an estimated range of $1.66 to $2.01 per thousand BTUs, which was seen as competitive with coal energy costs for power generation. However, biomass would have to be utilized from a variety of sources, with forestry residues and stumps within a 45-minute haul range, and urban wood residues within a 135-minute haul.[64]

In comparison, Georgia Power's biomass conversion at the former Mitchell coal plant is expected to draw upon waste wood from a 100-mile radius around the facility. Georgia Power estimates it will require 160 to 180 truckload deliveries per day to supply the 1 million tons of biomass needed for the 96 MW facility. [65]

[60] The Renewable Fuels Program requires increased use of renewable fuels every year through 2012. By 2012, at least 7.5 billion gallons of renewable fuel must be blended into motor-vehicle fuel sold in America. After 2012, renewable fuel use is required to grow in volume as gasoline demand grows. See http://www.epa.gov/oms/renewablefuels/420f07062.htm.

[61] http://www.harvestcleanenergy.org/enews/enews_0505/enews_0505_Cellulosic_Ethanol.htm.

[62] "The Economic Availability of Biomass in the Southeastern United States," by T. Young, D. Ostermeier, J. Thomas, R. Brooks. See http://wood.tennessee.edu/NR/rdonlyres/70B5D4FC-FAAB-4DF3-A291-45E39CA5C99A/1310/EconomicAvailabilityofWoodyBiomass.pdf.

[63] Measuring the Economics of Biofuel Availability. See http://www.esri.com/library/fliers/pdfs/measuringbiofuel.pdf.

[64] The sensitivity of the estimates with regard to truck fuel prices is unknown.

[65] http://www.biomassmagazine.com/article.jsp?article_id=1975.

## Biomass Potential

Increasing electricity generated from biomass sources may be a viable route for compliance with RES requirements nationally, especially as biomass is already the largest source of renewable energy in the United States today. In the southeast region especially, biomass may be the most readily available opportunity for meeting RES goals, but compliance may still be a challenge. If a 15% RPS goal would require 6,000 MW of renewable energy in the Southeast, then developing even 4 biomass plants of 100 MW capacity[66] and all 27 GIS identified sites at 40 MW would result in 1,480 MW of capacity, less than one-third of the needed total. Another option may be to upgrade power production at some existing forest products industry mills solely for the purpose of power sales. Alternatively, new or existing power generation facilities at closed pulp and paper mills could be evaluated as options, and configured strictly for power generation.[67] Existing woody biomass stocks could be augmented by biocrops or other types of biomass to help fuel new power generation facilities. Making up some of this gap from market sources using procurement bids and new commercial solar or wind installations may be possible. The needs of other, possibly competing, uses for biomass are considerations if biomass resources are to be sustained while meeting projected uses.

# Summary of Barriers and Challenges to Greater Use of Biomass

DOE/EIA has stated that biomass has the potential to be a large part of the national solution toward meeting a prospective RES.[68] This is especially true for the southeastern region, at least in the initial years of compliance.[69] The definition for biomass could be chosen to expand the resource beyond the supply of woody materials to include livestock wastes, municipal solid wastes, and/or other non-traditional resources. Plans for increased use of waste wood from forests may require new forms of cooperation and coordination between forest products companies and biomass power generators to ensure access to the resource.

## Potential Supply Constraints

Biomass power plants are tied to a "geo-economic zone" in which it is cost-effective to collect and deliver the biomass feedstock to the boiler. This generally means that there could be only one large "industrial" user of biomass (whether forest product manufacturer or biomass power production) in a given geo-economic zone, and growth of renewable electricity from biomass to meet RES requirements will be bound by such zones.

Having a financially viable forest products sector producing wood wastes is important to the biomass power industry. New resources (such as dedicated biocrops) or other biomass sources

[66] Southern Company is considering converting three additional small coal plants to biomass, similar to Plant Mitchell. Personal communications with Southern Company. March 6, 2009.

[67] Map of pulp and paper mill closures. Pulp & Paper Workers Resource Council. See http://www.pprc.info/html/millclosures.htm.

[68] See http://energycommerce.house.gov/Press_111/20090226/testimony_gruenspecht.pdf.

[69] Ibid.

(such as municipal solid waste) may need to be used if biomass from forest residues and forest product industry wastes do not prove sufficient to meet RES goals.

Targets for biofuels production from a Renewable Fuels Standard may mean that increased amounts of biomass would be dedicated to meet the needs of that program, if the trend away from corn-based ethanol persists and gasoline demand increases. The effects of these new federal requirements added to existing uses on the price of woody biomass is uncertain, but increased demand without a commensurate increase in supply (or development of alternative supplies) usually leads to higher prices for a finite resource. Sustainable management of forest resources is a basic consideration.

## Environmental Aspects

Despite being "green" resources, renewable energy installations are not without aesthetic or environmental challenges of their own. Wind turbines have been called ugly and noisy, and the cooling needs of solar thermal facilities in desert locations may require the use of scarce water resources. Although biomass-fueled power plants are not immune to such challenges, they are capable of offering base-load capacity, and a viable clean energy alternative for utilities in the Southeast should climate change considerations officially become part of the rationale for a Renewable Electricity Standard. Climate change mitigation goals may have additional impacts on the value of renewable energy credits, and eventual impacts on biomass demand nationwide.

## Technological Challenges and Opportunities

Research and development initiatives may well increase the efficiency of biomass power generation, making it possible to increase power output from less biomass feedstock. Sustainable management of southeastern woody biomass supplies could help to meet any RES target. Diversity in biomass supplies will also be key if the resource is to meet competing demands. Planning for biomass resources that fails to consider competing uses, may have unintended economic, ecological and environmental consequences.

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