The
North Carolina

Biomass Roadmap:

Recommendations for Fossil Fuel Displacement through Biomass Utilization

North Carolina Biomass Council

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Acknowledgements: Thank you to the North Carolina State Energy Office for providing the funding for the North Carolina Biomass Council and specifically the roadmapping effort. Also, thank you to the many Biomass Council members who provided essential input into the formulation of the targets and recommendations. And finally, thank you to the North Carolina Biotechnology Center for adopting the Council as one of their Intellectual Exchange Groups and providing meeting space, travel money for speakers, and refreshments for meetings.

Dear Reader,

The North Carolina Biomass Council has developed this roadmap at the request of the North Carolina State Energy Office (SEO) as a tool to assist stakeholders in planning North Carolina's future biomass utilization. This document will provide a unified direction for North Carolina to reduce its dependence on petroleum, thus increasing energy security, spurring economic development, and improving environmental quality. The ultimate goal of the roadmap will be to guide the state toward increasing its utilization of biomass through such measures as research and development, public policy and financing mechanisms, and outreach and education. The Roadmap represents the collective assessment and expertise of the North Carolina Biomass Council and is a result of numerous facilitated discussions on issues regarding biofuels, biopower, and bioproducts development in North Carolina.

The Biomass Council represents experts from wide ranging backgrounds in the public, private, and academic sectors. Its members consist of representatives of the agricultural community, policy leaders, renewable energy advocates, and authorities in technology and biomass energy (a list of recognized Council members is included in Appendix I).

The Biomass Council was formed by the State Energy Office under the Office of Administration in March 2005. The mission of the Council is to promote economic development, a reduction in greenhouse gas and other emissions, and energy security through the utilization of biomass, and to produce both bioproducts and bioenergy in the state of North Carolina. The Council's specific responsibilities are to:

- Assist the State Energy Office with strategic planning for its biomass program and advise the SEO on specific biomass projects
- Conduct outreach and education to key stakeholders impacting the biomass industry
- Assist applicants in securing federal funds for biomass projects, such as grants arising from Title IX, Section 9006 of the 2002 Farm Bill
- Facilitate demonstration projects that utilize biomass for bioproducts or bioenergy

We hope you find this a useful tool as you move forward with biomass-related projects in North Carolina.

Sincerely,

Kurt Creamer
Director
North Carolina Biomass Council

Larry Shirley
Director
North Carolina State Energy Office

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Executive Summary

The North Carolina Biomass Council developed this Roadmap at the request of the State Energy Office to be used as a tool to assist stakeholders in planning North Carolina's future biomass utilization. The document provides direction for North Carolina to reduce its dependence on petroleum through the production of bio-based fuels, power and products, thus increasing energy security, spurring economic development, and improving environmental quality. The Roadmap represents the collective assessment and expertise of the North Carolina Biomass Council and is a result of numerous facilitated discussions.

For the purposes of this Roadmap, biomass is defined as "any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants (including aquatic plants), grasses, residues, fibers, animal wastes, and segregated municipal waste… Processing and conversion derivatives of organic matter are also biomass."[1] Biomass can be converted into bioproducts and biofuels through chemical and biological means or can be used to generate heat and/or electricity through direct combustion, co-firing, gasification, and pyrolysis.

Currently North Carolina already produces 4% of its energy using biomass, but it has the potential to produce another 10% with its existing biomass resources. Almost 60% of this additional biomass would come from North Carolina's enormous forest resource, and the rest would be derived from agricultural and "waste" resources, such as animal renderings, animal waste and more. These resources are produced annually in North Carolina, and utilizing them will inject money into this state's economy while averting money that leaves the state to purchase fossil energy resources. Furthermore, a single 90 million gallon per year ethanol plant would generate 3,200 direct and indirect jobs and use only 3% of North Carolina's available biomass resource.[2] There is enormous potential for biomass utilization in this state

Beginning on page 15, the Roadmap contains 17 main recommendations that should be carried out by 2017 to increase biomass utilization in North Carolina. A few key recommendations are: develop economically and agronomically viable biomass feedstocks suitable for North Carolina and create new incentives for farmers and timber growers to produce these feedstocks; fund in-state pilot plants that convert biomass to biofuels on a pre-commercial scale; create an in-state lab that will conduct efficient and inexpensive ASTM standard testing for all biodiesel producers; provide a credit to biofuel distributors that is equal to the state motor fuels tax; and offer state matching funds to leverage federal funds awarded in programs such as USDA's Section 9006 Renewable Energy and Energy Efficiency Program and the Value-added Producer Grant Program.

By 2017, North Carolina should displace 10% of its gasoline and diesel needs (*10 in 10)* and 7% of its power needs (*7x17)* using North Carolina bio-based fuels and power, along with becoming a leader in bioproducts research and development. These goals can be achieved using North Carolina's existing biomass resources and intellectual capital while producing new energy crops and new ideas.

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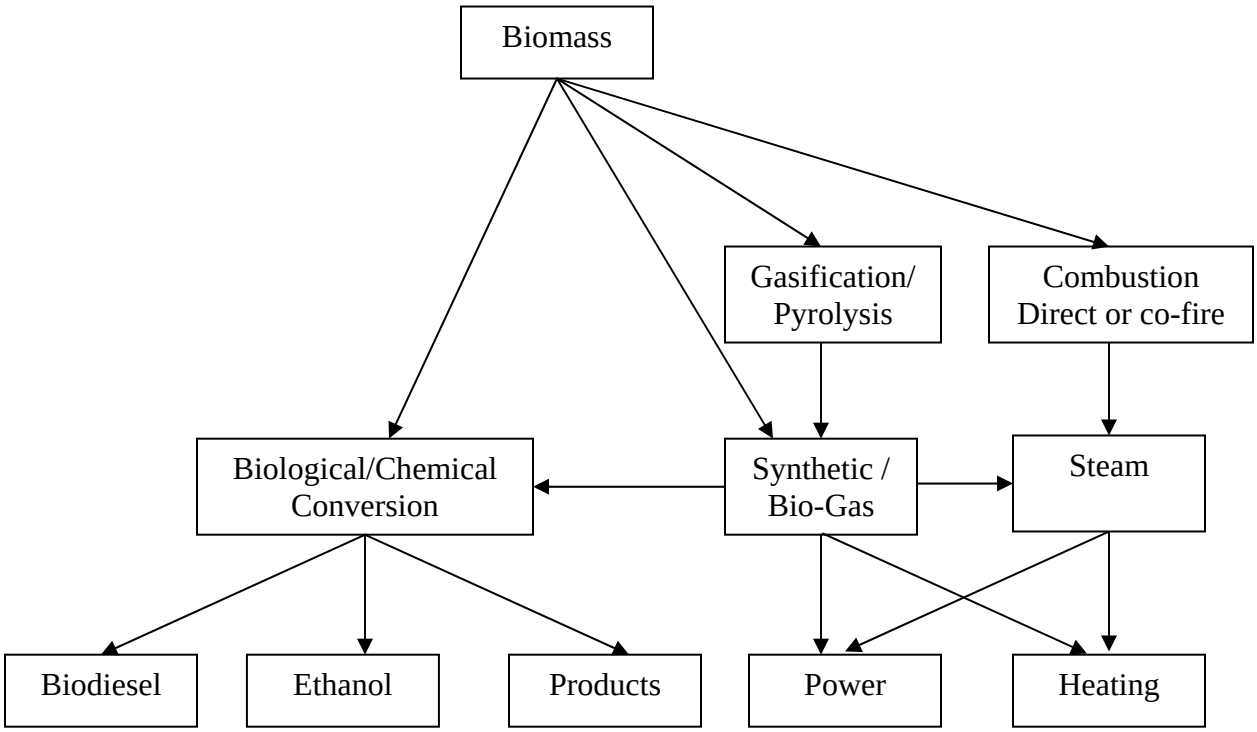
[1] *Roadmap for Biomass Technologies.* Biomass Research and Technical Advisory Committee. December, 2002.
[2] The Contribution of the Ethanol Industry to the American Economy in 2004, Ethanol Producers and Consumers, 2006, http://www.ethanolmt.org/contribution.html

I. Background

For the purposes of this Roadmap, biomass is defined as "any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants (including aquatic plants), grasses, residues, fibers, animal wastes, and segregated municipal waste… Processing and conversion derivatives of organic matter are also biomass."[3] This description was influenced by the definition created by the Biomass Research and Development Technical Advisory Committee, appointed by the U.S. Department of Energy (DOE) and Department of Agriculture (USDA), but it was adjusted to meet North Carolina's specific needs.[4]

Biomass can be converted into bioproducts and biofuels through chemical and biological means or can be used to generate heat and/or electricity through direct combustion, co-firing, gasification and pyrolysis. However, the synthetic gas created through gasification and pyrolysis, as well as the pyrolysis oils produced, can also be converted into biofuels and bioproducts. Furthermore, the biogas produced directly from biomass feedstocks such as decomposing landfills, animal waste, and municipal wastewater can be used in the same processes as the synthesis gas described above. Figure 1 (below) outlines the dynamic nature of biomass utilization; see Appendix II for a list of definitions.

Figure 1: Avenues for Biomass Utilization

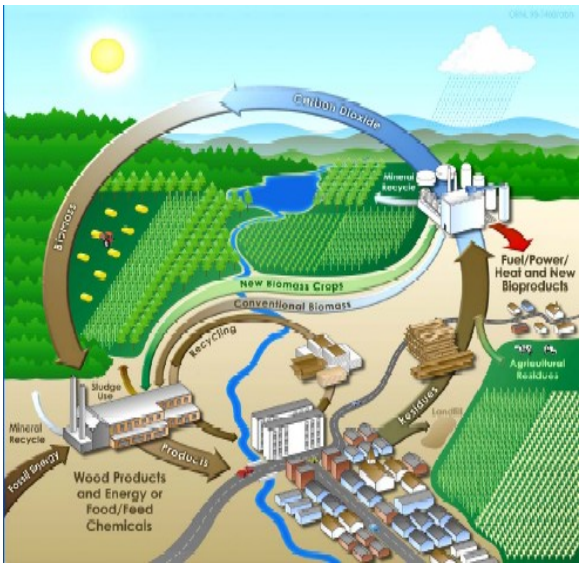


[3] *Roadmap for Biomass Technologies*. Biomass Research and Technical Advisory Committee. December, 2002.
[4] Originally the definition excluded "unsegregated wastes; painted, treated, or pressurized wood; wood contaminated with plastic or metals; and tires." It was determined by the North Carolina Biomass Council that the definition of biomass should be as inclusive as possible, and one should allow permit conditions and sampling requirements to ensure the necessary environmental protection.

Using North Carolina's biomass resources to produce fuels, products, and power will decrease the state's dependence on outside fossil fuels. Money currently used to purchase these fossil resources will not only stay within the country, thus providing energy independence from foreign powers, but will also remain in North Carolina sparking economic development. By growing, transporting, and processing biomass in North Carolina, monies will undergo an economic multiplier as they change hands within the financial system. This multiplier effect along with the jobs created by the new biomass infrastructure will provide a significant boost to North Carolina's economy. Furthermore, this bio-based economy will attract new businesses that specialize in areas such as biotechnology, thus bringing more revenue into the state. Finally, the majority of the biomass resource is located in North Carolina's poorest and most rural areas, which will focus economic development where it is most needed. Experts claim that biomass utilization could be a multi-billion dollar industry for North Carolina.

Displacing fossil fuels through the utilization of biomass also will create a healthier and more prosperous environment to live in.[5] Using biomass for energy decreases the emission of carbon dioxide, a harmful greenhouse gas that contributes to global warming. Carbon dioxide released into the air during biomass energy production is carbon dioxide that was recently sequestered by the biomass plant material during recent growing seasons (see Figure 2). Also, generating energy using biogas emitted from landfills or animal waste will further control greenhouse gas emissions through the destruction of methane, a greenhouse gas that is 21 times more potent than carbon dioxide. Finally, consuming biofuels will reduce harmful air emissions such as carbon monoxide and particulates and groundwater contaminants such as MTBE. This will not only provide health benefits, but also will help protect North Carolina's cities from being designated by the EPA as non-attainment areas for ozone, particulates and other pollutants, which in turn affects federal highway funding and dampens further industrial growth.

Figure 2: Biomass Energy Carbon Cycle



[5] Different biomass utilization technologies affect the environment in different ways. These statements are based on the use of the most optimal technologies.

Current Energy Mix in North Carolina

In 2002, North Carolina consumed an estimated 2,633.8 trillion British Thermal Units (BTUs) of energy, ranking twelfth nationally in energy consumption. Notice from Figure 3 that petroleum is the largest energy source consumed at 37%, requiring the state to import 12.1 million gallons of gasoline and 4.1 million gallons of diesel fuel *per day*. Also note that North Carolina already meets 4% of its energy needs using biomass, ranking eighth nationwide in biomass utilization.[6] The majority of this biomass energy comes from wood-fired boilers and landfill gas-to-energy projects, but a small and increasing amount is derived from biodiesel production. (A list of operating and proposed biomass energy plants in North Carolina is shown in Appendix III.)

Figure 3: North Carolina Energy Consumption in 2002 and Past Growth by Source[7]

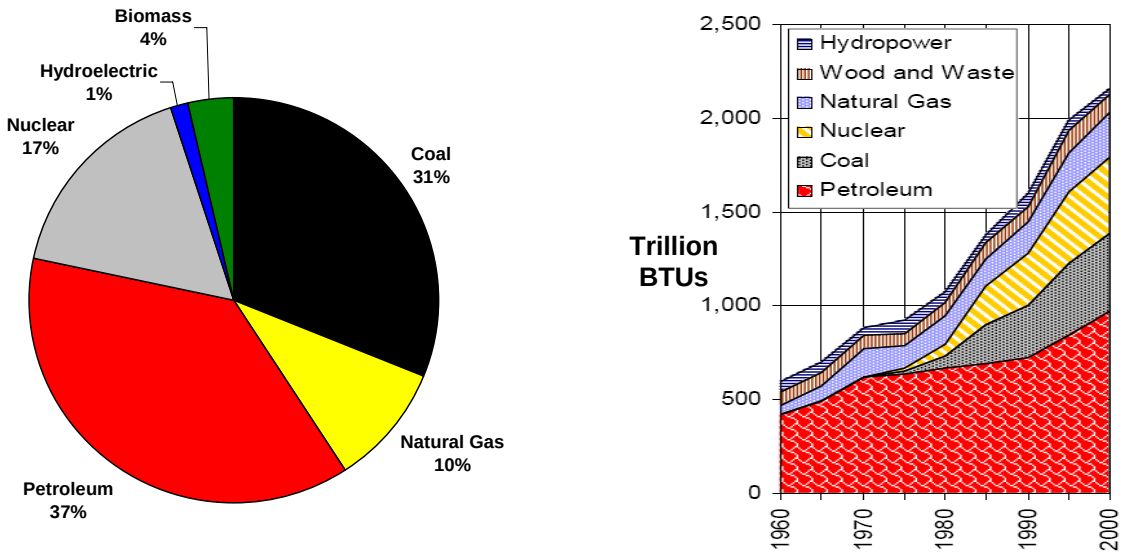


Figure 3 also shows that energy consumption in North Carolina has increased exponentially and most expect that it will continue to do so. The Integrated Resource Plan (IRP) developed by the North Carolina Utilities Commission predicts that electricity consumption will increase an average of 1.8% per year over the next 10 years (see figure 4).[8] The Energy Information Agency (EIA) predicts that national consumption of liquid fuels and other petroleum products will grow around 1% per year[9]. North Carolina most likely will mirror this growth rate, and since it has no in-state production, petroleum consumption will be a significant drain on the state's economy.

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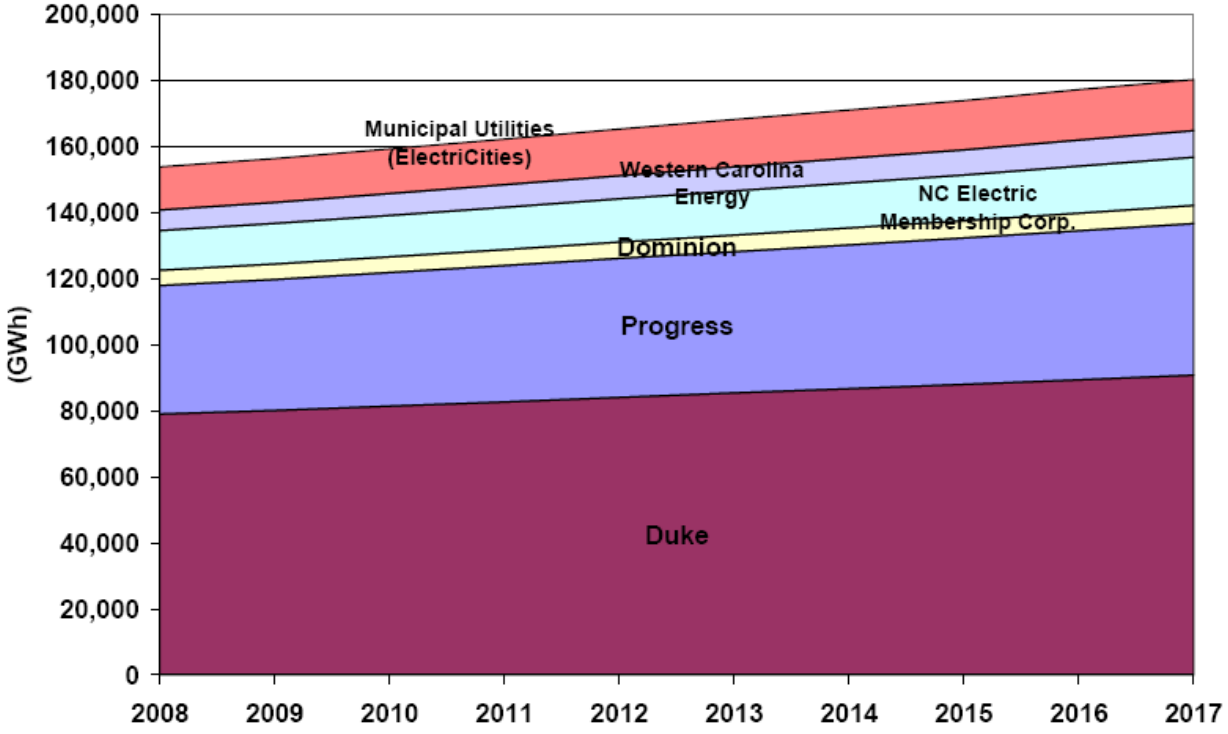
[6] Energy Information Administration. *Petroluem Profile: North Carolina.* Nov. 2006. http://tonto.eia.doe.gov/oog/info/state/nc.html

[7] *North Carolina State Energy Plan*. State Energy Office and ASU Energy Center. January 2005

[8] NC Utilities Commission. *Annual Report of the NC Utilities Commission Regarding Long Range Needs for Expansion of Electric Generation Facilities for Service in North Carolina.* Nov 2006. http://www.ncuc.commerce.state.nc.us/reports/lr2006.pdf

[9] Energy Information Administration. *Annual Energy Outlook: 2007*. Nov. 2006. *http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html*

Figure 4: Forecasted North Carolina State Energy Consumption[10]



Current Incentives, Policies, and Regulations Affecting Biomass Utilization

It is important to identify the incentives and regulations that currently exist before new policies and actions can be implemented. The following is a list of incentives, regulations, and laws that impact both production and consumption of electricity, fuels, and products derived from biomass. The list is drawn from two sources, the Database of State Incentives for Renewable Energy (www.dsireusa.org) and the U.S. Department of Energy's Alternative Fuels Data Center (www.eere.energy.gov/afdc/). Please click on these links or see Appendix IV and V for their full summaries.

- Energy Improvement Loan Program (EILP)

North Carolina businesses, local governments, public schools and nonprofit organizations can receive loans with an interest rate of 1% for certain renewable-energy projects and an interest rate of 3% for projects that demonstrate energy efficiency, energy cost savings or reduced energy demand.

- Interconnection Standards

The North Carolina Utilities Commission adopted simplified interconnection standards for small distributed generation, which apply to renewable-energy systems up to 20 kilowatts (kW) in capacity for residential systems, and up to 100 kW in capacity for non-residential systems.

[10] This graph came from the *Analysis of a Renewable Portfolio Standard for the State of North Carolina*, which was produced by La Capra Associates, LLC in December of 2006.

- NC GreenPower Production Incentive

NC GreenPower is a statewide green-power program that offers production payments for grid-tied renewable electricity generation.

- North Carolina - Net Metering

The North Carolina Utilities Commission (NCUC) adopted an order requiring the state's three investor-owned utilities – Progress Energy, Duke Energy and Dominion North Carolina Power – to make net metering available to customers who produce renewable electricity.

- Renewable Energy Tax Credit - Corporate

This statute provides a corporate/personal tax credit of 35% of the cost of renewable energy property constructed, purchased or leased by a taxpayer and placed into service in North Carolina during the taxable year.

- Renewable Energy Tax Credit - Personal

This statute provides for a personal tax credit of 35% of the cost of renewable energy property constructed, purchased or leased by a taxpayer and placed into service in North Carolina during the taxable year.

- Alternative Fuel Refueling Infrastructure Tax Credit

A tax credit is available that is equal to 15% of the cost of construction and installation of a qualified refueling facility that dispenses biodiesel, 100% ethanol or ethanol/gasoline blends consisting of at least 70% ethanol.

- Biofuel Production Tax Credit

A tax credit is available that is equal to 25% of the cost of constructing and equipping a qualified facility that produces biodiesel, 100% ethanol or ethanol/gasoline blends consisting of at least 70% ethanol.

- Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund

This energy credit banking program generates funds from the sale of Energy Policy Act of 1992 (EPAct) credits, which enables state agencies to offset the incremental costs of alternative fuel, related refueling infrastructure, and purchasing AFVs.

- Mobile Source Emission Reduction Grants

Grants from the Department of Environment and Natural Resources Division of Air Quality are available for the incremental cost of purchasing and retrofitting AFVs, implementing idle reduction programs, and constructing or installing public alternative fueling stations.

- Alternative Fuel Tax Exemption

The retail sale, use, storage or consumption of alternative fuels is exempt from the state retail sales and use tax.

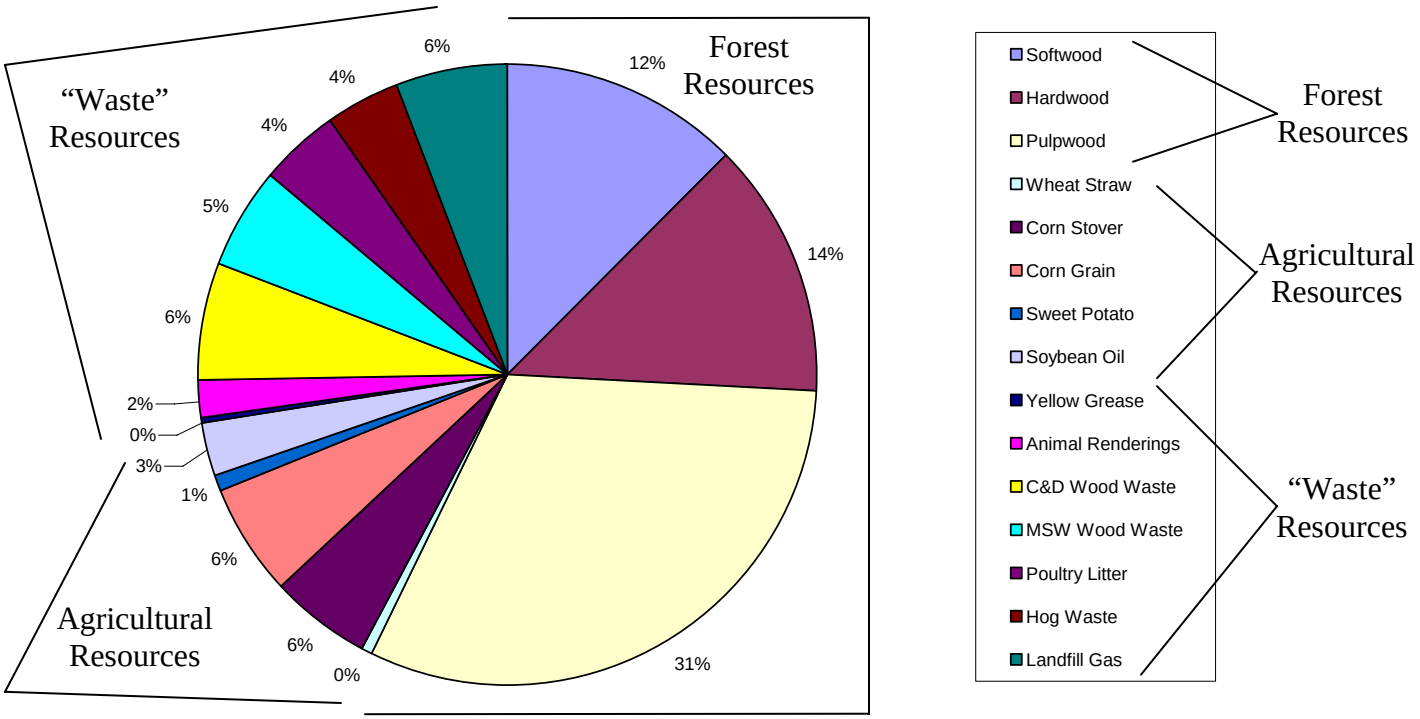
- Alternative Fuel Use and Fuel Efficient Vehicle Requirements

This plan enables state-owned fleets to achieve a 20% reduction or displacement of the current petroleum products consumed by January 1, 2010.

II. Potential Biomass Resources in North Carolina

North Carolina has an abundance of untapped biomass resources that are distributed across the state. Currently, our national bioenergy policies support the resources typical of Midwestern states, but North Carolina has a very different mix of existing crops and potential biomass resources. Iowa, for example, is equivalent in size to North Carolina, but grows 7 times more soybeans and 17 times more corn, which are the nation's current biofuel feedstocks of choice.[11] North Carolina, on the other hand, has almost 7 times more forestland than Iowa and thus has significantly more *lignocellulosic* biomass (plant fibers containing lignin and cellulose) that could be utilized. Since North Carolina is unique in its feedstock supply, it requires a distinct approach to make use of these resources.

Figure 5: Distribution of the Potential Biomass Energy in North Carolina[12]



Total Available Energy of Biomass Resources = 259 Trillion BTUs

Figure 5 shows the distribution of North Carolina's annual biomass resources according to their available energy content for their most likely energy conversion. For example, softwood is listed according to its heat value for biopower production while corn grain is listed according to the

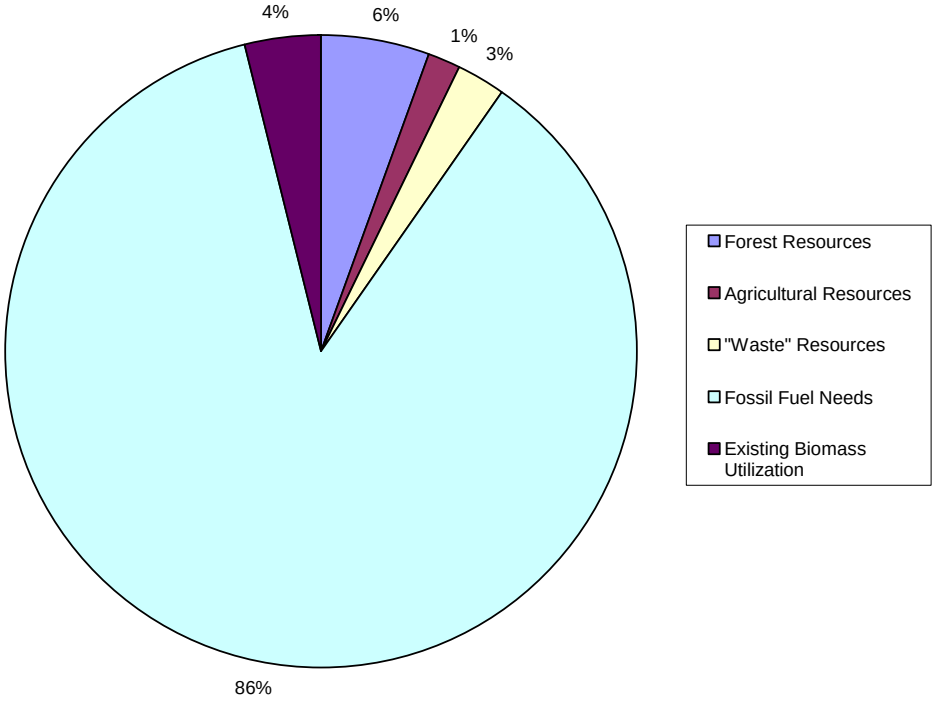
[11] United States Department of Agriculture. 23 Jan. 2007. www.usda.gov

[12] The majority of this information was derived from North Carolina's practical potential data, as defined by *Analysis of a Renewable Portfolio Standard for the State of North Carolina,* which was produced by La Capra Associates, LLC in December of 2006. The remaining data was obtained from the North Carolina Department of Agriculture and Consumer Services (soybean oil and corn grain) and experts at North Carolina State University and Appalachian State University. These experts included Kurt Creamer, NCSU (hog waste, poultry litter, and animal renderings), Dr. Craig Yencho, NCSU (sweet potato), and Dr. Jeff Ramsdell, ASU (yellow grease).

total energy value of its corresponding ethanol production. Some of these resources are currently being used in alternate markets, but could be utilized for energy without significant impact in North Carolina. For example, North Carolina's corn grain is already being used to feed its livestock, and the state is even importing corn to meet its nutritional needs. However, when corn grain is consumed in the ethanol process it produces a high energy and high protein byproduct, dry distillers grains (DDGS), which can be used as animal feed to supplement North Carolina's needs. Furthermore, a majority of North Carolina's pulpwood is being consumed in the paper industry, but the profitability of this industry has been steadily declining in the Southeast. Therefore, pulpwood was included as a potential resource because ethanol production will become an economically viable product for pulp and paper mills as the wood to ethanol process becomes more profitable than that of wood to paper.

To put this annual supply of resources into perspective, Figure 6 (below) illustrates the biomass supply in relation to North Carolina's current energy consumption. As can be seen from this chart, North Carolina could meet an additional 10% of its current energy needs using these biomass resources. Combined with the current biomass energy production, North Carolina could decrease its current dependence on fossil fuels by a total of 14%. Furthermore, as new dedicated energy crops such as canola, hulless barley, industrial sweet potato, switchgrass, and hybrid poplar are grown, this percentage could increase.

Figure 6: Potential North Carolina Energy Consumption



Total Energy Consumption = 2,634 Trillion BTUs

On the following page, Table 1 expands on North Carolina's potential biomass resources and includes energy crops as a possible scenario. The table presents the most likely energy product that would be derived from each feedstock whether it is biofuel such as ethanol and biodiesel or electric power.[13] It also provides the percentage of North Carolina consumption that a particular energy source would replace. For example, ethanol production in this state could displace more than 10% of North Carolina's gasoline consumption.[14] Producing bioproducts such as bio-plastic will also displace petroleum and can even be produced as co-products within an integrated biorefinery[15]. Bioproducts are not included in Table 1, but the sidebar on page 13 provides more details on bioproducts and their potential impact in North Carolina.

[13] In some cases, using biomass to create steam instead of power is the most efficient and economical application, but only power production was displayed in this analysis for ease of comparison.
[14] Vehicles using ethanol get 25% fewer miles per gallon than gasoline, which was accounted for in this analysis.
[15] A large integrated processing facility that produces energy, fuels, and chemicals from biomass.

Table 1: Key Biomass Resources in North Carolina[16]

Biomass Resources	Quantity	Units	Total Energy** (Trillion Btus)	Ethanol (Gallons/year)	Biodiesel (Gallons/year)	Electricity**** (MW)
Softwood	1,894,305	Tons/year	32.2			314
Hardwood	2,061,063	Tons/year	35.04			342
Pulpwood	4,779,566	Tons/year	81.25	382,365,280***		
Wheat Straw	60,413	Tons/year	0.9424			9
Corn Stover	963,494	Tons/year	14.26			139
Corn Grain	78,125,000	Bushels/year	15.04	195,312,500		
Sweet Potato	24,500,000	Bushels/year	1.39	18,014,000		
Soybeans	39,420,00	Bushels/year	7.155		60,480,000	
Yellow Grease	115,000,000	Pounds/year	1.183		10,000,000	
Animal Rendering	323,400,000	Pounds/year	5.1		43,120,000	
C&D Wood Waste	897,784	Tons/year	15.26			149
MSW Wood Waste	836,779	Tons/year	14.22			139
Poultry Litter	1,415,988	Tons/year	10.77			105
Hog Waste	9,900,000	Hogs	9.534			93
Landfill Gas	30	Landfills	15.44			150
Total			**259**	**595,691,780**	**113,600,000**	**1440**
% of NC Consumption (Fossil energy, gasoline, diesel, and electricity respectively)			**10.25%**	**10.12%**	**7.70%**	**6%**
Energy Crops*						
Canola	300,000	Acres	4.258		36,000,000	
Hulless Barley	300,000	Acres	4.233	54,480,000		
Industrial Sweet Potato	35,000	Acres	1.95	25,360,000		
Switchgrass	263,132	Tons/year	4.21	21,050,560		
Hybrid Poplar	302,909	Tons/year	5.149			50
New Total:			**277**	**696,587,046**	**146,600,000**	**1490**
New % of NC Consumption (Fossil energy, gasoline, diesel, and electricity respectively)			**10.95%**	**11.83%**	**10.20%**	**6.60%**

Table 1 includes the biomass resources available in North Carolina and potential energy crop production. *Derived from replacing ½ of North Carolina's winter wheat acres with canola, the other ½ with hulless barley, doubling the sweet potato acreage with industrial types, and planting all 104,000 acres of conservation land with switchgrass and hybrid poplar. **Only the energy content of the gallons produced was included for biofuels feedstock. ***If ethanol is produced at 80 gallons per ton. ****Note that more power could be produced per unit of biomass if the biomass is co-fired, but that was not included here.

[16] The majority of this information was derived from North Carolina's practical potential data, defined by *Analysis of a Renewable Portfolio Standard for the State of North Carolina*, which was produced by La Capra Associates, LLC in December of 2006. The remaining data was obtained from the North Carolina Department of Agriculture (soybean oil and corn grain) and experts at North Carolina State University and Appalachian State University. These experts included Kurt Creamer, NCSU (hog waste, poultry litter, and animal renderings); Dr. Craig Yencho, NCSU (sweet potato); and Dr. Jeff Ramsdell, ASU (yellow grease).

Bioproducts: An Emerging Industry for North Carolina

*Written by **Bill Schy**, Manager of the Education and Training Program, NC Biotechnology Center*

With the recent instability in oil prices, and no guarantee of a stable petroleum supply in the future, manufacturers in many sectors are seeking domestic sources of non-petroleum-based raw materials. Agricultural products will likely be the preferred source of these *bioproducts* (materials and goods produced from biomass) as they were before the emergence of the petroleum industry. The transition to bioproducts has already begun and only promises to accelerate in the coming decades. The long-term benefits of this conversion – decreased U.S. dependence on foreign oil, improvement in environmental quality, and economic growth – make the bio-based industrial platform a lynchpin for a sustainable society. If the bioproducts manufactured thus far are any indication, all of these benefits can be cost-competitive, with no diminution in quality. Bioproduct specifications can meet or exceed those of their petroleum-based counterparts.

Some of the world's largest and most powerful chemical, energy, and food-processing companies have begun to form joint ventures that build on these companies' core competencies. These companies include the likes of DuPont, BP, Archer Daniels Midland and Cargill. Recently Wal-Mart, the world's largest retailer, announced it is adding its considerable weight to influence its suppliers to provide products and packaging from renewable resources. North Carolina also has a toehold in the emerging bioproducts sector, since DuPont located a plant in Kinston that produces one of its newest and most versatile bio-based polymers, Serona. Serona is subsequently shipped from the Kinston plant to other facilities that produce fibers and polymers used in the production of carpeting, clothing, and in automotive and industrial components. Smaller North Carolina manufacturers have also proven adept at making the transition to bioproducts. Hickory Springs Manufacturing Company in Hickory uses a soy-based polyol, in place of polyurethane, in the manufacture of its Preserve foam product. Twin City Knitting Company in Conover incorporates a corn-based fiber, Ingeo, in producing some of its socks. However, all of these rely on raw materials derived from food crops grown outside of North Carolina.

A recent 15-month period (January 2006- March 2007) witnessed nearly a doubling in corn prices partly due to the rapidly growing ethanol industry. The relative abundance of non-food sources of biomass in North Carolina could make it a very attractive location for bioproduct manufacturing if the remaining technical and cost hurdles associated with lignocellulosic biomass can be overcome. To meet this challenge and make North Carolina competitive with corn belt states, the state needs to make a substantial investment now in basic research to improve lignocellulosic biomass conversion in a host of different crops, while developing best practices for growing, storing, transporting, and processing biomass. To make lignocellulosic biomass conversion cost-competitive with existing starch conversion technologies used with food crops, the state must leverage its considerable expertise in biotechnology. North Carolina is the third-leading state in biotechnology, based on the number of companies. Furthermore, Novozymes, based in Franklinton, N.C., is a world leader in industrial biotechnology and could be a valuable state partner in the future. An integrated approach to improve lignocellulosic biomass conversion is necessary to achieve the technical and cost breakthroughs required to make North Carolina's vast amount of biomass accessible for industrial uses. Only then will North Carolina reach its full potential in developing vibrant, new sectors in bioethanol and bioproducts.

III. Targets for Biomass Utilization and Fossil Fuel Displacement

Biofuels Target: "10 in 10"

North Carolina should displace 10% of its gasoline and diesel fuel consumption by 2017 using in-state biomass resources while incorporating energy efficiency measures. Energy efficiency is important because, for example, a vehicle running on biofuel that achieves 45 miles per gallon will displace 3 times more petroleum than a bio-fueled vehicle that only gets 15 miles to the gallon. As Table 1 demonstrates, it is possible for North Carolina to provide 10% of its current gasoline and diesel consumption using existing resources. If North Carolina's predicted increase in transportation fuel consumption models that of the country as a whole, these existing feedstocks will still supply over 8% of the state's predicted needs in 2017. However, by increasing biomass production and utilization while incorporating energy efficiency measures, North Carolina could displace 10% of its transportation fuels within the next 10 years using in-state production and resources.

Biopower Target: "7 by 17"

North Carolina should displace 7% of its predicted power consumption by 2017 using its available biomass resources while incorporating energy efficiency measures. The December 2006 document, *Analysis of a Renewable Portfolio Standard for the State of North Carolina* shows this to be practical if North Carolina uses its existing resources (outlined in Table 1) and reduces its power demand by 14% through energy efficiency by 2017. This target will most likely be achieved in conjunction with a 10% Renewable Portfolio Standard in North Carolina that includes energy efficiency for 25% of its RPS.

Bioproducts Target: "Leader in Bioproducts Research and Development"

North Carolina should become a leader in bioproducts research and development by 2017. With the firm foundation of biotechnology embodied in this state's Research Triangle Park, university and community college system, and businesses such as Novozymes and Dupont, North Carolina is in a prime position to become a national leader in bioproducts R&D. This leadership will ultimately create more bio-production in North Carolina, but more significantly, it will create an intellectual foothold around bioproducts.

IV. Specific Recommendations to Achieve Biomass Targets

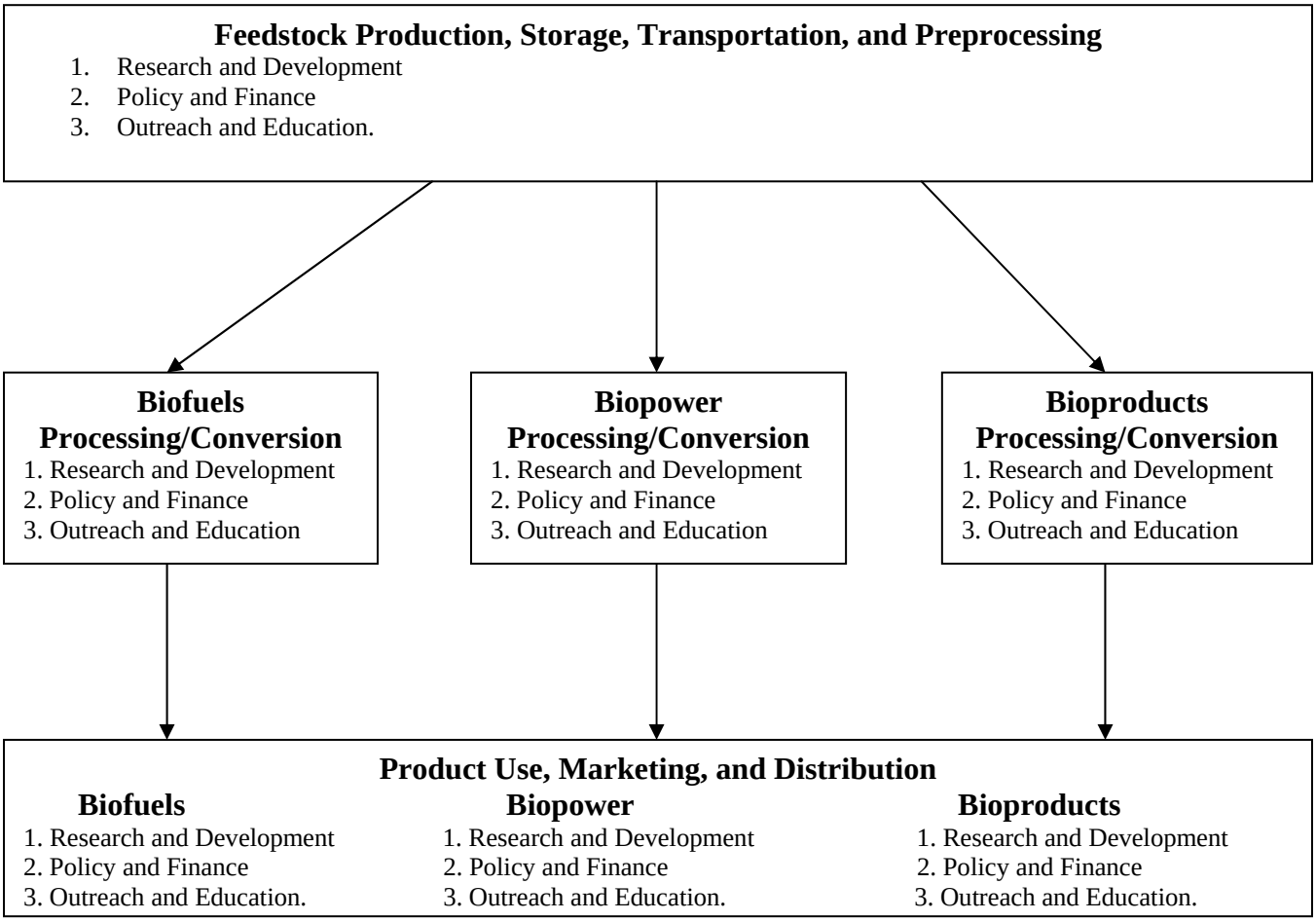
The North Carolina Biomass Council produced hundreds of recommendations that would increase biomass utilization and then rated these recommendations on their individual importance and ease of implementation. The 17 highest priority recommendations (most important and easiest to implement) are listed in the following pages and include a recommended funding period, lead agency, and key partners. Figure 8 outlines the structure of these objectives, which were organized into the following three main headings:

1. *Feedstock Production, Storage, Preprocessing, and Transportation*
2. *Processing and Conversion*
3. *Product Use, Marketing and Distribution.*

And then analyzed within each heading using three specific activity areas:

1. *Research and Development*
2. *Policy and Finance*
3. *Outreach and Education*

Figure 7: Roadmap Flowchart



Feedstock Production, Storage, Transportation, and Preprocessing

Recommendation One: *Develop economically and agronomically viable bioenergy feedstocks (biomass) suitable for North Carolina. Subtasks under this recommendation include:*

- *Focus research and development on plant varieties that yield an abundance of inexpensive sugar, starch, and/or cellulose. Breed these plants to be higher yielding and easily digestible by enzymes.*
- *Educate farmers and timber growers on new production practices.*
- *Conduct research on storage, preprocessing, and transportation techniques for these different feedstocks and determine the most feasible method of supplying a year-round bioenergy production facility in North Carolina.*
- *Develop forest management techniques that will maximize biomass production using sustainable practices under the auspices of the Forest Development Program.*
- *Create Energy Extension Specialist positions within Cooperative Extension to inform farmers and timber growers of new high yielding crops and tree species, incentives, and production practices.*

Funding Period: 2-5 years
Leading Agency: University Research and Development
Key Partners: University Extension, NC Department of Agriculture and Consumer Services, University Energy Centers, NC Biotechnology Center, State Energy Office, NC Forestry Association, Institute for Forest Biotechnology NC Division of Forest Resources, and Foundations such as Golden LEAF

Recommendation Two: *Create new incentives for farmers and timber growers that give them risk-adverse avenues to produce the new energy feedstock used in recommendation one. Subtasks under this recommendation include:*

- *Provide loan guarantees and remove regulatory obstacles so land owners and farm operators can invest in biomass energy facilities in their region.*
- *Finance preprocessing facilities, such as regional multi-oilseed crushing facilities that will provide the necessary oil for biodiesel production.*
- *Provide tax credits to farmers who produce non-food crops to be sold to bioenergy or bioproduct facilities.*

Funding Period: 5+ years
Leading Agencies: NC Rural Economic Development Center and Department of Commerce
Key Partners: University Energy Centers, State Energy Office, NC Department of Agriculture and Consumer Services, NC Agribusiness Council, NC Farm Bureau, NC Division of Forest Resources, and Foundations such as Golden LEAF

Biofuels Processing and Conversion

Recommendation Three: *Fund in-state pilot plants that convert biomass to biofuels on a pre-commercial scale. This facility will conduct testing, technology validation, and serve as a readily accessible demonstration unit.*

Funding Period: 2-5 years
Leading Agency: University Research and Development
Key Partners: University Extension, University Energy Centers, NC Rural Economic Development Center, NC Forestry Association, and Foundations such as Golden LEAF

Recommendation Four: *Provide added incentives to bioenergy producers who use biomass produced in North Carolina. This includes feedstock grown by farmers and timber growers as well as waste products produced in state such as yellow grease, animal fats and manure, landfill gas, and agriculture and forest residues.*

Funding Period: 2-5 years
Leading Agency: State Energy Office
Key Partners: NC Department of Commerce, NC Rural Economic Development Center, NC Agribusiness Council, NC Farm Bureau, Utilities Commission and NC Department of Agriculture and Consumer Services

Recommendation Five: *Create a government payment per gallon of new biofuel production that inversely rises and falls with the cost of petroleum-based fuels.*

Funding Period: 2-5 years
Leading Agencies: NC Departments of Transportation and Commerce
Key Partners: University Energy Centers, Community College System, State Energy Office, and NC Sustainable Energy Association

Recommendation Six*: Offer state matching funds to leverage federal funds awarded in programs such as USDA's Section 9006 Renewable Energy and Energy Efficiency Program (and other Farm Bill programs) and the Value-added Producer Grant Program. State funding could be used for preparing up-front feasibility studies and for guaranteed loans to complement Federal funding. (**Cross cutting with Biopower Processing and Conversion section).***

Funding Period: 2-5 years
Leading Agency: NC Department of Commerce
Key Partners: NC Department of Environment and Natural Resources, NC Rural Economic Development Center, State Energy Office, NC Department of Agriculture and Consumer Services, NC Department of Revenue, and Foundations such as Golden LEAF

Biopower Processing and Conversion

Recommendation Seven: *Increase the market entrance and profitability of producing power from renewable sources, such as biomass. Subtasks under this recommendation include:*

- *Pass the 10% Renewable Energy and Energy Efficiency Portfolio Standard (REPS) in North Carolina that includes energy efficiency for 25% of its REPS; this will ultimately lower costs to the consumer.*
- *Create statewide Renewable Energy Credits (RECs) and structure this program to allow long term contracts for RECs from energy suppliers, so that these contracts can be used to attract equity investments and loans.*
- *Create incentives for power companies to buy and produce green power.*

Funding Period: 5+ years
Leading Agencies: State Energy Office and Utilities Commission
Key Partners: University Energy Centers, NC Department of Commerce, NC Sustainable Energy Association, Utilities, and Independent Power Producers

Recommendation Eight: *Provide funding for pilot facilities that demonstrate more sophisticated biopower technologies such as anaerobic digestion and advanced gasification. Validate these technologies on a pre-commercial scale to entice investors.*

Funding Period: 2-5 years
Leading Agency: University Research and Development
Key Partners: University Extension, University Energy Centers, NC Biotechnology Center, and State Energy Office

Recommendation Nine: *Resolve emission standards for different bioenergy processes. Subtasks under this recommendation include:*

- *Invoke more moderate emission standards for facilities that use more advanced and environmentally sound technologies such as gasification.*
- *Adopt the EPA's output emission standard, which evaluates producers on work output, not fuel input. This will encourage efficiency measures as well as the incorporation of combine heat and power in biomass energy facilities.*
- *Review and streamline the State Environmental Policy Act (SEPA) for biomass energy projects so that: (1) prohibitions under SEPA are specifically tied to a violation of existing environmental laws, standards or regulations, (2) impacts from environmental discharges automatically meet SEPA requirements if the corresponding permits for these discharges have been obtained, and (3) a lead agency is designated for SEPA reviews of bioenergy projects; this lead agency would develop well-documented guidelines to reduce the inconsistent application of the State Environmental Policy Act to bioenergy projects.*

Funding Period: 2-5 years
Leading Agency: NC Department of Environment and Natural Resources
Key Partners: University Energy Centers, NC Rural Economic Development Center, State Energy Office, NC Sustainable Energy Association and Environmental Community

Recommendation Ten: *Create state tax credits and incentives for the production of steam from biomass. Currently, all credits and incentives focus on the production of power, but creating steam for heat is sometimes a more efficient option for producers. Furthermore, allow the credits also to be accrued for steam that is consumed on-site and not sold to a third party.*

Funding Period: 2-5 years
Leading Agency: State Energy Office
Key Partners: University Energy Centers, NC Department of Commerce, and NC Sustainable Energy Association

Bioproducts Processing and Conversion

Recommendation Eleven: *Establish a technology screening pilot scale biorefinery center that can produce multiple high value products from various North Carolina feedstocks. It will engage researchers and businesses and be an incubator for new start-up companies, which will lead to privately held pilot facilities. Subtasks under this recommendation include:*

- *Engage biotechnology experts in North Carolina and other industry leaders to research biological pathways to produce high value products.*
- *In addition to these biological pathways, research catalytic pathways that can produce a host of bioproducts through gasification and pyrolysis.*

Funding Period: 2-5 years
Leading Agency: Center for Integrated Biomass Refining at NCSU
Key Partners: University Research and Development, NC Biotechnology Center, Novozymes, Dupont, and others in the NC Biotech Industry

Recommendation Twelve: *Research and develop bioproducts that can be formed from alternate streams of bioenergy production, thus making bioenergy and bioproducts more financially competitive. Subtasks under this recommendation would include:*

- *Create new product streams for glycerin and dry distiller's grains, the co-products of biofuel production.*
- *Research gasification/pyrolysis processes that create bioenergy while producing a wide variety of bioproducts, making the overall process more economical.*

Funding Period: 2-5 years
Leading Agency: Center for Integrated Biomass Refining at NCSU
Key Partners: University Research and Development, NC Biotechnology Center, Novozymes, Dupont, and others in the NC Biotech Industry

Product Use, Marketing and Distribution

Recommendation Thirteen: *Fund and conduct economic analyses and market research that identify cost effective expenditures and strategies that will increase biomass utilization. Subtasks under this recommendation include:*

- *Quantify the non-market benefits of producing bioenergy and bioproducts, such as reduced greenhouse gas and other air emissions, enhanced energy security, and increased economic development; this will make biomass utilization "cost effective."*
- *Quantify the economic benefits of a carbon trading system, which will place a price on carbon emissions so they are included in the cost structure of a production facility.*
- *Explore new markets for bioproducts and develop different value propositions for these markets. Determine what companies could/would use various bioproducts and if these products can be made from North Carolina Biomass.*

Funding Period: 1 year
Leading Agencies: University Research and Development and Energy Centers
Key Partners: University Extension, NC Biotechnology Center, NC Department of Commerce, NC Rural Economic Development Center, and NC Agribusiness Council

Recommendation Fourteen: *Create an in-state lab that will conduct efficient and inexpensive ASTM standard testing for all biodiesel producers. Several entities have expressed interest including the motor fuels testing lab operated by the North Carolina Department of Agriculture and Consumer Services and the Advanced Vehicle Research Center.*

Funding Period: 2-5 years
Leading Agency: NC Department of Agriculture and Consumer Services
Key Partners: University Energy Centers, Community College System, Advanced Vehicle Research Center and NC Department of Transportation

Recommendation Fifteen: *Update interconnection standards in accordance with the Energy Policy Act of 2005 and simplify interconnection for small producers (< 2 MW).*

Funding Period: 1 year
Leading Agency: Utilities Commission
Key Partners: University Energy Centers, State Energy Office, NC Sustainable Energy Association, Utilities, and Independent Power Producers

Recommendation Sixteen: *Provide a credit to biofuel distributors that is equal to the state motor fuels tax. Subtasks under this recommendation include:*

- *Permit distributors to claim this credit through the Biodiesel and Fuel Alcohol Providers Form that they submit monthly.*
- *Reimburse distributors in a streamlined manner so they can immediately pass a large portion of the incentive on to the consumer.*
- *Allocate funds for the distributors' credit from General Revenues, not the Department of Transportation highway budget.*

Funding Period: 2-5 years
Leading Agencies: NC Department of Revenue
Key Partners: NC Department of Commerce, NC Department of Transportation, University Energy Centers, and State Energy Office

Recommendation Seventeen: *Conduct a comprehensive public relations initiative that will create public awareness of biofuels, biopower, and bioproducts. Subtasks under this recommendation include:*

- *Educate the public on the benefits outlined above through an elaborate media campaign that includes radio and television public service announcements.*
- *Establish a bioenergy agenda in schools comparable to past recycling and non-smoking movements and engage children as a conduit for information.*
- *Encourage the recycling and reprocessing of bioproducts, so that they achieve their full environmental and petroleum displacement benefits.*

Funding Period: 2-5 years
Leading Agency: State Energy Office
Key Partners: All organizations should be involved, but specifically University Energy Centers, University Extension, NC Department of Agriculture and Consumer Services, NC Division of Forest Resources, NC Department of Environment and Natural Resources, and NC Department of Transportation

APPENDIX I
RECOGNIZED BIOMASS COUNCIL MEMBERS

Adrian Atkinson – Research Associate, Agriculture and Resource Economics, NCSU
Dimitris S. Argyropoulos – Finland Distinguished Professor of Chemistry, NCSU
Marjorie Benbow – Director, Greater Charlotte Office, NC Biotechnology Center
Wade Bennett – General Manager, Biomass Operations, CMS Enterprise
John Bonitz – Farm Outreach and Policy Advocate, Southern Alliance for Clean Energy
Sterling Bowen – Information and Referral Center Manager, State Energy Office
Sam Brake – Red Birch Energy
J.D. Brooks – Manager, BioNetwork-BioAg Center
Leonard Bull, Ph.D. – Associate Director, Animal and Poultry Waste Management Center, NCSU
Steven Burke, Ph.D. – Senior VP, Corporate Affairs, North Carolina Biotechnology Center
Dean F. Bushey, Ph.D. – New Business Venture, Bayer Bioscience
Ruben Carbonell, Ph.D. – Director, Kenan Institute for Engineering, NCSU
Jay Cheng, Ph.D. – Associate Professor, Biological & Agricultural Engineering, NCSU
Kurt Creamer – Biomass Program Manager, North Carolina Solar Center
Penn Cox – Rollcast Energy, Inc
Annette Dunlap – Extension Associate, NCSU
Holly Emerson –Manager, Ingersoll Rand Energy Systems
Lyle Estill – Vice President, Piedmont Biofuels
Ron Fish – Assistant Director, NCDA&CS
Nicholas George, Ph.D. – Agricultural Research Coordinator, Crop Science, NCSU
Anne Gilliam – Diesel and Biofuels Program Coordinator, Southern Alliance for Clean Energy
Dennis Grady – Director, Appalachian State University Energy Center
Alex Hobbs, Ph.D. – Associate Director, North Carolina Solar Center
Nathan Holleman – Agribusiness Developer, NCDA&CS
Charles Hall – CEO, North Carolina Soybean Producers Association
Steve Kalland – Director, North Carolina Solar Center
Judy Kincaid – Principal, Sage Collaboration
Henry Lamb, Ph.D. – Associate Professor, Chemical and Bimolecular Engineering, NCSU
Bob Leker – Renewables Program Manager, State Energy Office
Poul Lindegaard – Director of Applications Technology, Novozymes
Scott Mouw – Section Chief, Pollution Prevention and Environmental Assistance, NCDENR
Lyra Rakusin – Outreach and Training Manager, North Carolina Solar Center
Jeffrey E. Ramsdell, Ph.D. – Associate Professor, Appalachian State University
Ben Rich – Biomass Program Coordinator, North Carolina Solar Center
Gwyn Riddick – Director, Piedmont Triad Office, North Carolina Biotechnology Center
Terry A. Ruse – COO, Agri-Ethanol Products, LLC
Ghasem Shahbazi, Ph.D. – Director, Biological Engineering, NC A&T State University
John Steffens – Regulatory Affair Manager, Syngenta
Bryon Sosinski, Ph.D. – Associate Professor of Horticultural Science, NCSU
Larry Shirley – Director, State Energy Office
William Schy – Manager, Education and Training Program, NC Biotechnology Center
Ken R. Swartzel, Ph.D. – Coordinator Bioprocessing Programs, Ag. & Life Sciences, NCSU
Ratna Sharma-Shivappa, Ph.D. - Assistant Professor, Biological and Agricultural Engineering, NCSU
Frank Shepard – Manager, NC Energy Services, Siemens
Ray S. Taylor – RST Engineering PLLC
Anne Tazewell – Transportation Program Manager, North Carolina Solar Center
Tatjana Vujic – Attorney, Environmental Defense
Kim Tungate, Ph.D. – Research Specialist, Crop Science, NCSU
Craig Yencho, Ph.D. – Associate Professor, Horticulture Science, NCSU

APPENDIX II
DEFINITIONS AND TERMS[17]

Agronomy: The science of plant production and soil management.
Anaerobic: Life or biological processes that occur in the absence of oxygen.
Biobased Product: Commercial or industrial products, other than food or feed, derived from biomass feedstocks. Many of these products possess unique properties unmatched by petroleum-based products or can replace products and materials traditionally derived from petrochemicals.
Biocatalyst: Usually refers to enzymes and microbes, but it can include other catalysts that are living or that were extracted from living organisms, such as plant or animal tissue cultures, algae, fungi, or other whole organisms.
Biochemical Conversion Process: The use of living organisms or their products to convert organic material to fuels or other products.
Biodiesel: Conventionally defined as a biofuel produced through transesterification, a process in which organically-derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl esters can be blended with conventional diesel fuel or used as a neat fuel (100% biodiesel). Biodiesel can be made from soybean or rapeseed oils, animal fats, waste vegetable oils, or microalgae oils.
Bioenergy: Useful, renewable energy produced from organic matter. The conversion of the complex carbohydrates in organic matter to energy. Organic matter may either be used directly as a fuel processed into liquids and gases, or be a residual of processing and conversion.
Biofuels: Fuels made from biomass resources, or their processing and conversion derivatives. Biofuels include ethanol, biodiesel, and methanol.
Biogas: A methane-bearing gas from the digestion of biomass.
Biomass[*]: Any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants (including aquatic plants), grasses, residues, fibers, animal wastes, and segregated municipal waste... Processing and conversion derivatives of organic matter are also biomass.
Biopower: The use of biomass feedstock to produce electric power or heat through direct combustion of the feedstock, through gasification and then combustion of the resultant gas, or through other thermal conversion processes. Power is generated with engines, turbines, fuel cells, or other equipment.
Biorefinery: A processing and conversion facility that (1) efficiently separates its biomass raw material into individual components and (2) converts these components into marketplace products, including biofuels, biopower, and conventional and new bioproducts.
Biotechnology: A set of biological techniques developed through basic research and now applied to research and product development. In particular, biotechnology refers to the use by industry of recombinant DNA, cell fusion, and new bioprocessing techniques.
British Thermal Unit: Measure of energy based on the amount of heat required to raise the temperature of one pound of water from 59°F to 60°F at one atmosphere pressure.

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[17] *Roadmap for Biomass Technologies*. Biomass Research and Technical Advisory Committee. December, 2002.
[*] Part of this definition was eliminated (…) to meet the specific needs of North Carolina. Originally the definition specifically excluded "unsegregated wastes; painted, treated, or pressurized wood; wood contaminated with plastic or metals; and tires." It was determined by the North Carolina Biomass Council that the definition of biomass should be as inclusive as possible and one should allow permit conditions and sampling requirements for the biomass processor to ensure environmental protection.

Cellulose: The main carbohydrate in living plants. Cellulose forms the skeletal structure of the plant cell wall.
Co-Firing: The simultaneous use of two or more different fuels in the same combustion chamber of a power plant.
Co-Generation: The sequential production of electricity and useful thermal energy from a common fuel source. Reject heat from industrial processes can be used to power an electric generator (bottoming cycle). Conversely, surplus heat from an electric generating plant can be used for industrial processes, or space and water heating purposes (topping cycle).
Combined Cycle: Two or more generation processes in series, configured to optimize the energy output of the system.
Commercial Sector: An energy-consuming sector that consists of service-providing facilities of businesses; federal, state, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters.
Conservation Reserve Program: A voluntary USDA program whereby agricultural landowners can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. The Commodity Credit Corporation (CCC) makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices. Participants enroll in CRP contracts for 10 to 15 years. The program is administered by the CCC through the Farm Service Agency (FSA), and program support is provided by Natural Resources Conservation Service, Cooperative State Research and Education Extension Service, state forestry agencies, and local Soil and Water Conservation Districts.
Corn Wet Milling: A corn milling process in which an initial step is steeping (soaking in warm water) the corn. This enables separation of the germ from the rest of the corn kernel during the milling process. The germ contains the majority of the oil and is processed separately to produce that product while the remaining part of the kernel is further processed into commercial products which may include starch, ethanol, corn gluten feed, etc.
Densification: A mechanical process to compress biomass (usually wood waste) into pellets, briquettes, cubes, or densified logs.
Electric Utility: A corporation, person, agency, authority, or other legal entity or instrumentality that owns and/or operates facilities for the generation, transmission, distribution, or sale of electric energy primarily for public use. Utilities provide electricity within a designated franchised service area and file form listed in the Code of Federal Regulations, Title 18, Part 141. Includes any entity involved in the generation, transmission, or distribution of power.
Energy Crops: Crops grown specifically for their fuel value. These crops may include food crops such as corn and sugarcane, and nonfood crops such as poplar trees and switchgrass.
Energy Density: The energy content of a material measured in energy per unit weight of volume.
Environmentally Sustainable: An ecosystem condition in which biodiversity, renewability, and resource productivity are maintained over time.
Enzyme: A protein that acts as a catalyst, speeding the rate at which a biochemical reaction proceeds but not altering the direction or nature of the reaction.
Ethanol: Ethyl alcohol produced by fermentation and distillation. An alcohol compound with the chemical formula CH3CH2OH formed during sugar fermentation.
Feedstock: Any material converted to another form or product.

Fermentation: The biological conversion of biomass.
Forest Residues: Material not harvested or removed from logging sites in commercial hardwood and softwood stands as well as material resulting from forest management operations such as pre-commercial thinnings and removal of dead and dying trees.
Fossil Fuel: Solid, liquid, or gaseous fuels formed in the ground after millions of years by chemical and physical changes in plant and animal residues under high temperature and pressure. Oil, natural gas, and coal are fossil fuels**.**
Fuel Cell: A device that converts the energy of a fuel directly to electricity and heat, without combustion.
Gasification: A chemical or heat process to convert a solid fuel to a gaseous form.
Genetics: The study of inheritance patterns of specific traits.
Genetically Engineered Organism: An organism whose DNA has been altered through the application of biotechnology in order to produce a specific characteristic. This is often accomplished by inserting a gene from one species into another.
Genomics: The study of genes and their function.
Greenhouse Gases: Gases that trap the heat of the sun in the Earth's atmosphere, producing the greenhouse effect. The two major greenhouse gases are water vapor and carbon dioxide. Other greenhouse gases include methane, ozone, chlorofluorocarbons, and nitrous oxide.
Grid: A system for distributing electric power.
Grid Connection: Joining a plant that generates electric power to an electric system so that electricity can flow in both directions between the electric system and the plant.
Hydrolysis: Conversion of biomass into sugars and sugar substrates via chemical or biological processes or through biocatalysis.
Industrial Sector: An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses manufacturing; agriculture, forestry, and fisheries; mining; and construction.
Inorganic Compounds: A compound that does not contain carbon chemically bound to hydrogen. Carbonates, bicarbonates, carbides, and carbon oxides are considered inorganic compounds, even though they contain carbon.
Kilowatt: (kW) A measure of electrical power equal to 1,000 Watts. 1 kW = 3,413 Btu/hr = 1.341 horsepower.
Kilowatt hour: (kWh) A measure of energy equivalent to the expenditure of one kilowatt for one hour. 1 kWh = 3,413 Btu.
Landfill Gas: Gas that is generated by decomposition of organic material at landfill disposal sites.
Lipid: Any of various substances that are soluble in non-polar organic solvents (as chloroform and ether), that with proteins and carbohydrates constitute the principal structural components of living cells, and that include fats, waxes, phosphatides, cerebrosides, and related and derived compounds.
Lignin: An amorphous polymer related to cellulose that, together with cellulose, forms the cell walls of woody plants and acts as the bonding agent between cells.

Life Cycle Assessment (LCA): LCA is an internationally recognized assessment model of a product's impact on energy, economic, and environmental values. LCA extends from "cradle to grave": from material acquisition and production, through manufacturing, product use and maintenance, and finally, through the end of the product's life in disposal or recycling. The LCA is particularly useful in ensuring that benefits derived in one area do not shift the impact burden to other places within a product's life cycle.
Methane: An odorless, colorless, flammable gas with the formula CH4 that is the primary constituent of natural gas.
Municipal Solid Waste (MSW): Garbage. Refuse includes residential, commercial, and institutional wastes and includes organic matter, metal, glass, plastic, and a variety of inorganic matter.
Organic Compounds: Compounds that contain carbon chemically bound to hydrogen. They often contain other elements (particularly O, N, halogens, or S).
Precommercial Thinning: Thinning for timber stand improvement purposes, generally in young, densely stocked stands.
Pyrolysis: The thermal decomposition of biomass at high temperatures (greater than 400°F, or 200°C) in the absence of air. The end product of pyrolysis is a mixture of solids (char), liquids (oxygenated oils), and gases (methane, carbon monoxide, and carbon dioxide) with proportions determined by operating temperature, pressure, oxygen content, and other conditions.
Quad: One quadrillion Btu (1015 Btu). An energy equivalent to approximately 172 million barrels of oil.
Residential Sector: An energy-consuming sector that consists of living quarters for private households. The residential sector excludes institutional living quarters.
Residue: Unused solid or liquid by-products of a process.
Rural: Of or relating to the small cities, towns, or remote communities in or near agricultural areas.
Sewage: The wastewater from domestic, commercial, and industrial sources carried by sewers.
Silviculture: A branch of forestry dealing with the development and care of forests.
Syngas: A syntheses gas produced through gasification of biomass. Syngas is similar to natural gas and can be cleaned and conditioned to form a feedstock for production of methanol.
Therm: A unit of energy equal to 100,000 Btus; used primarily for natural gas.
Transportation Sector: An energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use.
Urban: Of, relating to, characteristic of, or constituting a city, usually of some size.

APPENDIX III

BIOMASS/BIOFUEL PLANTS IN NORTH CAROLINA

Plant	Location (County)	Product	Fuel Source	Capacity	Status
Craven County Wood Energy Plant	Craven	Electricity	Wood	50 MW	Operational
Coastal Carolina Clean Power, LLC	Duplin	Electricity / Steam	Wood	32 MW	Operational
Weyerhaeuser	Martin	Electricity	Wood	10 MW	Operational
Corn Products Corporation	Forsyth	Electricity	Wood	8.4 MW	Operational
New Hanover County	New Hanover	Electricity	Wood	7.5 MW	Operational
Wood Waste Drying Project	McDowell	Electricity	Wood	4.5 MW	Operational
Texfi Textile Finishing	Cumberland	Electricity	Biomass	1.5 MW	Operational
Weyerhaeuser Company Pulp and Paper Mill	Washington	Electricity	Black Liquor	99.5 MW	Operational
International Paper Riegelwood Mill	Columbus	Electricity	Black Liquor	58.3	Operational
Weyerhaeuser Company Pulp and Paper Mill	Craven	Electricity	Black Liquor	25 MW	Operational
DTE Biomass Energy, Enerdyne Power Systems, Inc.	Forsyth	Electricity	Landfill Gas	4.3 MW	Operational
Gas Recovery Systems, LLC	Cabarrus	Electricity	Landfill Gas	4 MW	Operational
Enerdyne Power Systems, Inc.	Catawba	Electricity	Landfill Gas	3 MW	Operational
Enerdyne Power Systems, Inc.	Buncombe	Electricity	Landfill Gas	1 MW	Operational
Enerdyne Power Systems, Inc.	Buncombe	Electricity	Landfill Gas	0.5 MW	Operational
DTE Biomass Energy	Wake	Landfill Gas	Landfill Gas	1.296 mmscf/d	Operational
Enerdyne Power Systems, Inc.	Pitt	Landfill Gas	Landfill Gas	1 mmscf/d	Operational
Enerdyne Power Systems, Inc.	Henderson	Landfill Gas	Landfill Gas	0.82 mmscf/d	Operational
DTE Biomass Energy, Enerdyne Power Systems, Inc.	Cumberland	Landfill Gas	Landfill Gas	0.725 mmscf/d	Operational
Natural Power, Inc., Palmer Capital Corporation	Wake	Landfill Gas	Landfill Gas	0.72 mmscf/d	Operational
Natural Power, Inc.	Wake	Landfill Gas	Landfill Gas	0.72 mmscf/d	Operational
DTE Biomass Energy	Wake	Landfill Gas	Landfill Gas	0.504 mmscf/d	Operational

Plant	Location (County)	Product	Fuel Source	Capacity	Status
Enerdyne Power Systems, Inc.	Buncombe	Landfill Gas	Landfill Gas	0.288 mmscf/d	Operational
Natural Power, Inc.	Yancey	Landfill Gas	Landfill Gas	0.054 mmscf/d	Operational
Piedmont Biofuels	Chatham	Biodiesel	Poultry Fat/Soy	4 million gallons/year	Begun Production
Smokey Mountain Biofuels	Jackson	Biodiesel	WVO	1.5 mgpy	Begun Production
Foothills Biodiesel	Caldwell	Biodiesel	Soy/Poultry Fat	5 mgpy	Begun Production
Blue Ridge Biofuels	Buncombe	Biodiesel	WVO	.2 – 1 mpgy	Proposed
Filter Specialties	Sampson	Biodiesel	WVO	.5 – 1.6 mgpy	Proposed
Agri-Ethanol	Beaufort	Ethanol	Corn	114-180 mgpy	Proposed
DFI Group	Martin	Ethanol	Corn		Proposed
Clean Burn Fuels, LLC	Hoke	Ethanol	Corn		Proposed
Solv-It Technologies	Robeson	Ethanol	Corn		Proposed
Xethanol	Nash	Ethanol	Corn		Proposed

Abbreviations:

MW = Megawatt

mmscf/d = Million standard cubic feet of gas per day

mgpy = Million gallons per year

WVO = Waster Vegetable Oil

APPENDIX IV
NC BIOPOWER RELATED INCENTIVES, POLICIES, AND REGULATIONS
www.dsireusa.org

Energy Improvement Loan Program (EILP)

Last DSIRE Review: 08/21/2006

Incentive Type: State Loan Program
Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Chillers, Furnaces, Boilers, Heat pumps, Air conditioners, Heat recovery, Caulking/Weather-stripping, Duct/Air sealing, Building Insulation, Windows, Doors, Siding, Roofs, Motor-ASDs/VSDs
Eligible Renewable/Other Technologies: Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Wind, Biomass, Hydroelectric
Applicable Sectors: Commercial, Industrial, Nonprofit, Schools, Local Government
Amount: Varies by project
Maximum Amount: $500,000
Terms: 1% interest rate for renewables; 3% interest rate for energy efficiency; 10-year maximum term
Website: http://www.energync.net/funding/eilp.html
Authority 1: N.C. Gen. Stat. § 143-345.18
Date Enacted: 8/3/01

Summary: The Energy Improvement Loan Program (EILP) is available to North Carolina businesses, local governments, public schools and nonprofit organizations for projects that include energy efficiency improvements and renewable energy systems. Loans with an interest rate of 1% are available for certain renewable-energy projects and energy-recycling projects. Eligible renewable-energy projects generally include solar, wind, small hydropower (less than 20 megawatts) and biomass. Loans with a rate of 3% are available for projects that demonstrate energy efficiency, energy cost savings or reduced energy demand. Energy conservation projects usually include improvements to HVAC systems, energy management controls, high efficiency lighting and building envelope improvements.

Through December 31, 2006, the North Carolina State Energy Office will pay the letter-of-credit fees (up to 1% of the loan value for the duration of the loan) for approved EILP applicants. Note that letter-of-credit fees do not apply to government agencies and public schools.

In order to qualify for the EILP, a project must (1) be located in North Carolina; (2) demonstrate energy efficiency, use of renewable-energy resources, energy cost savings or reduced energy demand; (3) use existing, reliable, commercially-available technologies; (4) meet federal and state air and water-quality standards; and (5) be able to recover capital costs within the loan's maximum term of 10 years through energy cost savings.

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Interconnection Standards

Last DSIRE Review: 12/19/2006

Incentive Type: Interconnection
Eligible Renewable/Other Technologies: Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Fuel Cells, Municipal Solid Waste, CHP/Cogeneration, Anaerobic Digestion, Small Hydroelectric, Microturbines, Other Distributed Generation Technologies
Applicable Sectors: Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Fed. Government, Agricultural, Institutional
Authority 1: NCUC Order, Docket No. E-100, Sub 101
Date Enacted: 3/22/05

Summary: The North Carolina Utilities Commission (NCUC) adopted simplified interconnection standards for small distributed generation (DG) in 2005. The standards apply to renewable-energy systems and other forms of DG up to 20 kilowatts (kW) in capacity for residential systems, and up to 100 kW in capacity for non-residential systems. The state's three investor-owned utilities -- Progress Energy, Duke Energy and Dominion North Carolina Power -- must abide by the standards.

There is a $100 application fee for residential systems and a $250 application fee for nonresidential systems. Utilities may not require residential customers to carry liability insurance beyond the amount required by a standard homeowner's policy ($100,000 minimum coverage), but nonresidential generators are required to carry "comprehensive general liability insurance" ($300,000 minimum coverage). Significantly, generators are responsible only for upgrade and improvement costs associated directly with a system's interconnection. Utilities are prohibited from imposing indirect fees and charges. North Carolina's interconnection standards include provision for mutual indemnification.

A redundant external disconnect switch is required, and the capacity of all interconnected generation is limited to a maximum of 2% of rated circuit capacity. Applications for interconnected systems that exceed this saturation limit may be reviewed on a case-by-case basis. Utilities have committed to reconsider the saturation limits, if necessary, after gaining more experience with small-generator interconnections. Utilities must file semiannual reports with the NCUC detailing the number of interconnection requests approved and denied, and the reasons for any denial.

The NCUC has subsequently ruled that renewable-energy credits (RECs) generally remain with the generator. However, for net-metered systems, any net excess generation (NEG) and the RECs associated with NEG are granted to the utility once annually.

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NC GreenPower Production Incentive

Last DSIRE Review: 12/18/2006

Incentive Type: Production Incentive
Eligible Renewable/Other Technologies: Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Anaerobic Digestion
Applicable Sectors: Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Agricultural, Institutional
Amount: Varies by technology and customer demand for NC GreenPower
Terms: Payments contingent on program success
Authority 1: NCUC Order, Docket No. E-100, Sub 90
Date Enacted: 1/28/03
Website: http://www.ncgreenpower.org

Summary: NC GreenPower, a statewide green-power program designed to encourage the use of renewable energy in North Carolina, offers production payments for grid-tied electricity generated by solar, wind, small hydro (10 megawatts or less) and biomass resources. Payment arrangements for electricity generated by most renewable-energy systems are available through a periodic request for proposals (RFP) process. However, owners of small solar-energy systems and small wind-energy systems (10 kilowatts or less) may apply to receive program incentives at any time. Owners of small solar-energy systems or wind-energy systems are encouraged to review, fill out and return a one-page application to NC GreenPower. Note that customer-generators who choose to net meter are not permitted to sell electricity under the NC GreenPower Program.

Generators are required to enter into power-purchase agreements with their utility and with NC GreenPower. However, because premiums paid to NC GreenPower are funded exclusively by voluntary contributions from North Carolina electric customers, NC GreenPower does not provide guaranteed contracts to generators. Production incentives are based on the amount expected to make the installation of renewable-energy systems approach economic feasibility. The incentives, which are in addition to payments from utility power-purchase agreements, are made on a per-kWh basis and vary by technology. (Owners of solar-electric systems enrolled in NC GreenPower receive approximately $0.18/kWh from the program, plus approximately $0.04/kWh from their utility under the power-purchase agreement, for a total production payment of approximately $0.22/kWh.)

NC GreenPower is an independent, nonprofit organization created by state-government officials, electric utilities, nonprofit organizations, consumers, renewable-energy advocates and other stakeholders. It began operation in October 2003 as the first statewide green-power program in the United States. North Carolina's three investor-owned utilities -- Progress Energy, Duke Energy and Dominion North Carolina Power -- and many of the state's municipal utilities and electric cooperatives are participating in the NC GreenPower Program.

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North Carolina - Net Metering

Last DSIRE Review: 07/27/2006

Incentive Type: Net Metering Rules
Eligible Renewable/Other Technologies: Photovoltaics, Landfill Gas, Wind, Biomass, Anaerobic Digestion, Small Hydroelectric
Applicable Sectors: Commercial, Industrial, Residential
Limit on System Size: 20 kW for residential systems; 100 kW for non-residential systems
Limit on Overall Enrollment: 0.2% of each utility's North Carolina retail peak load for the previous year
Treatment of Net Excess: Credited to customer's next bill at retail rate; granted to utility (annually) at beginning of each summer season
Utilities Involved: Investor-owned utilities (Progress Energy, Duke Energy, & Dominion)
Interconnection Standards for Net Metering? Yes
Authority 1: NCUC Order, Docket No. E-100, Sub 83
Date Enacted: 07/06/2006

Summary: In October 2005, the North Carolina Utilities Commission (NCUC) adopted an order requiring the state's three investor-owned utilities -- Progress Energy, Duke Energy and Dominion North Carolina Power -- to make net metering available to customers that own and operate systems that generate electricity using photovoltaics (solar-electric energy), wind or biomass resources. Micro-hydro systems became eligible for net metering under terms of an NCUC order adopted in July 2006. Systems must be interconnected and operated in parallel with the utility's distribution system. (The NCUC adopted interconnection standards in March 2005.)

The maximum capacity of net-metered residential systems is 20 kilowatts (kW); the maximum capacity of net-metered nonresidential systems is 100 kW. Net metering is available on a first-come, first-served basis in conjunction with the utility's interconnection standards, up to an aggregate limit of 0.2% of the utility's North Carolina jurisdictional retail peak load for the previous year. Utilities may not charge customer-generators any standby, capacity or metering fees, or other fees and charges in addition to those approved for all customers under the applicable time-of-use demand-rate schedule. The NCUC's July 2006 order extended net metering to eligible renewable-energy systems with battery storage. Previously, system owners with battery storage were not allowed to net meter. (The NCUC noted that "gaming" a net-metering arrangement by using battery storage to manipulate a time-of-use tariff is not allowed.)

Net excess generation (NEG) is credited to the customer's next bill at the utility's retail rate, and then granted to the utility (annually) at the beginning of each summer season. Any renewable-energy credits (RECs) associated with NEG are granted to the utility when the NEG balance is zeroed out. This provision is designed to limit the size of individual facilities to match on-site power needs, according to the NCUC. Significantly, customer-generators who choose to net meter are not permitted to sell electricity under the NC GreenPower Program.

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Renewable Energy Tax Credit - Corporate

Last DSIRE Review: 01/31/2007 www.dsireusa.org

Incentive Type: Corporate Tax Credit
Eligible Renewable/Other Technologies: Passive Solar Space Heat, Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Renewable Transportation Fuels, Spent Pulping Liquor, Solar Pool Heating, Daylighting, Anaerobic Digestion, Ethanol, Methanol, Biodiesel
Applicable Sectors: Commercial, Industrial
Amount: 35%
Maximum Incentive: $2,500,000 per installation
Carryover Provisions: Credit is taken in five equal installments; allowable credit may not exceed 50% of a taxpayer's liability for the year, reduced by the sum of all other credits.
Eligible System Size: Maximum of 50 kWh battery storage capacity per kW of hydro generator capacity (DC rated); maximum of 35 kWh battery storage capacity per kW for other technologies
Equipment/Installation Requirements: System must be new and in compliance with all applicable performance and safety standards. Specific equipment and installation requirements vary by technology.
Authority 1: N.C. Gen. Stat. § 105-129.15 et seq.
Date Enacted: 1977; revised 1994, 1999, 2005
Website: http://www.ncsc.ncsu.edu/information_resources/renewable_energy_tax_guidelines.cfm

Summary: In 1999 North Carolina's various renewable-energy tax credits were revised and unified into a statute that addresses nearly all renewables. The revised statute provides for a tax credit of 35% of the cost of renewable energy property constructed, purchased or leased by a taxpayer and placed into service in North Carolina during the taxable year. These tax credits took effect January 1, 2000. In September 2005, the credits were extended for another five years.

A maximum credit of $2,500,000 can be taken for all solar, wind, hydro and biomass applications on commercial and industrial facilities, including photovoltaic (PV), daylighting, solar water-heating and space-heating technologies. Renewable-energy equipment expenditures eligible for the tax credit include the cost of the equipment and associated design; construction costs; and installation costs less any discounts, rebates, advertising, installation-assistance credits, name-referral allowances or other similar reductions.

Under North Carolina's tax code, the allowable credit may not exceed 50% of a taxpayer's liability for the year, reduced by the sum of all other credits. Single-family homeowners who purchase and install a qualifying renewable-energy system must take the maximum credit amount allowable for the tax year in which the system is installed. If the credit is not used entirely during the first year, the remaining amount may be carried over for the next five years. For all other taxpayers, the credit is taken in five equal installments beginning with the year in which the property is placed in service. If the credit is not used entirely during these five years, the remaining amount may be carried over for the next five years. The credit can be taken against franchise tax, income tax or, if the taxpayer is an insurance company, against the gross premiums tax.

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Renewable Energy Tax Credit - Personal

Last DSIRE Review: 07/27/2006 www.dsireusa.org

Incentive Type: Personal Tax Credit
Eligible Renewable/Other Technologies: Passive Solar Space Heat, Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Renewable Transportation Fuels, Spent Pulping Liquor, Solar Pool Heating, Daylighting, Anaerobic Digestion, Ethanol, Methanol, Biodiesel
Applicable Sectors: Commercial, Residential, Multi-Family Residential
Amount: 35%
Maximum Incentive: $1,400 - $10,500 (varies by technology); $2.5M for commercial applications
Carryover Provisions: Single-family dwellings: excess credit may be carried forward five years; all other property: credit taken in five equal installments; allowable credit not to exceed 50% of taxpayer's liability for the year, reduced by the sum of all other credits.
Eligible System Size: Maximum of 50 kWh battery storage capacity per kW of hydro generator capacity (DC rated); maximum of 35 kWh battery storage capacity per kW for other technologies
Equipment/Installation Requirements: System must be new and in compliance with all applicable performance and safety standards. Specific equipment and installation requirements vary by technology.
Authority 1: N.C. Gen. Stat. § 105-129.15 et seq.
Date Enacted: 1977; revised 1994, 1999, 2005
Website: http://www.ncsc.ncsu.edu/information_resources/renewable_energy_tax_guidelines.cfm

Summary: In 1999 North Carolina's various renewable-energy tax credits were revised and unified into a statute that addresses nearly all renewables. The revised statute provides for a tax credit of 35% of the cost of renewable energy property constructed, purchased or leased by a taxpayer and placed into service in North Carolina during the taxable year. These tax credits took effect January 1, 2000. In September 2005, the credits were extended for another five years.

A maximum credit can be taken of $3,500 for residential active space heating, combined active space and domestic water-heating systems, and passive space heating; $1,400 for residential solar water-heating systems, including solar pool-heating systems; $10,500 for photovoltaic (solar electric), wind, or other renewable-energy systems for residential use. Furthermore, a maximum credit of $2,500,000 can be taken for all solar, wind, hydro and biomass applications on commercial and industrial facilities. Renewable-energy equipment expenditures eligible for the tax credit include the cost of the equipment and associated design; construction costs; and installation costs less any discounts, rebates, advertising, installation-assistance credits, name-referral allowances or other similar reductions.

Under North Carolina's tax code, the allowable credit may not exceed 50% of a taxpayer's liability for the year, reduced by the sum of all other credits. Single-family homeowners who purchase and install a qualifying renewable-energy system must take the maximum credit amount allowable for the tax year in which the system is installed. If the credit is not used entirely during the first year, the remaining amount may be carried over for the next five years. For all other taxpayers, the credit is taken in five equal installments beginning with the year in which the property is placed in service. If the credit is not used entirely during these five years, the remaining amount may be carried over for the next five years. The credit can be taken against franchise tax, income tax or, if the taxpayer is an insurance company, against the gross premiums tax.

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APPENDIX V
NC BIOFUEL RELATED INCENTIVES, POLICIES, AND REGULATIONS
www.eere.energy.gov/afdc/

Alternative Fuel Refueling Infrastructure Tax Credit

A tax credit is available for qualified refueling facilities that dispense biodiesel, 100% ethanol or ethanol/gasoline blends consisting of at least 70% ethanol. The credit is equal to 15% of the cost to the taxpayer of construction and installation portion of the dispensing facility, including pumps, storage tanks, and related equipment, that is directly and exclusively used for dispensing or storing the fuel. The credit must be taken in three equal annual installments beginning with the taxable year in which the facility is placed in service. Facilities must be placed in service before January 1, 2011. (Reference North Carolina General Statutes 105 129.16D)

Biodiesel Production Tax Credit

A biodiesel provider that produces at least 100,000 gallons of biodiesel during the taxable year is allowed a credit equal to the per gallon excise tax the producer paid in accordance with motor fuel excise tax rate. The credit does not apply to tax paid on the diesel fuel portion of the biodiesel blends and the credit may not exceed $500,000. This credit is effective for taxable years beginning on January 1, 2008, and is in effect until January 1, 2010. (Reference Senate Bill 1741, 2006, and North Carolina General Statutes 105 129.16F)

Alternative Fuel Production Tax Credit

A tax credit is available for the processing of biodiesel, 100% ethanol or ethanol/gasoline blends consisting of at least 70% ethanol. The credit is equal to 25% of the cost of constructing and equipping the facility, and facilities must be placed in service before January 1, 2011.

In lieu of the above credit, a taxpayer that constructs and places in service in North Carolina three or more commercial facilities for processing renewable fuel and invests a total amount of at least $400,000,000 in the facilities is allowed a credit equal to 35% of the cost to the taxpayer of constructing and equipping the facilities. In order to claim the credit, the taxpayer must obtain a written determination from the Secretary of Commerce that the taxpayer is expected to invest within a five-year period a total amount of at least $400,000,000 in three or more facilities. Facilities must be placed in service before January 1, 2011. (Reference Senate Bill 1741, 2006, and North Carolina General Statutes 105-129.16D)

Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund

The State Energy Office administers an energy credit banking program that enables the state to generate funds from the sale of Energy Policy Act of 1992 (EPAct) credits. The moneys generated by the sale of EPAct credits are deposited into the Alternative Fuel Revolving Fund (Fund), which enables state agencies to offset the incremental costs of alternative fuel, related refueling infrastructure, and purchasing AFVs. Funds are distributed to state departments, institutions and agencies in proportion to the number of EPAct credits generated by each. For the purposes of this program, “alternative fuel” includes biodiesel (minimum of B20), ethanol (minimum of E85), compressed natural gas, propane, and electricity and includes hybrid electric vehicles. The Fund also covers additional projects approved by the Energy Policy Council. (Reference North Carolina General Statutes 143-58.4, 143-58.5, 143-341(8)i, and 136-28.13)

Alternative Fuel Vehicle (AFV) Grants

Grants from the Department of Environment and Natural Resources Division of Air Quality are available for the incremental cost of purchasing Original Equipment Manufacturer (OEM) AFVs, vehicle retrofits, implementing idle reduction programs, and constructing or installation of alternative fuel public refueling facilities. More than $500,000 in funding is available.

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Alternative Fuel Vehicle (AFV) Acquisition Requirements

Since January 1, 2004, it has been the goal of the state, that at least 75% of the new or replacement light duty cars and trucks (8,500 pounds or less Gross Vehicle Weight Rating) purchased by the state must be AFVs or low emission vehicles. (Reference North Carolina General Statutes 143-215.107C)

Alternative Fuel Tax Exemption

The retail sale, use, storage or consumption of alternative fuels is exempt from the state retail sales and use tax. (Reference North Carolina General Statutes 105-164.13)

Alternative Fuel Use and Fuel Efficient Vehicle Requirements

State-owned vehicle fleets, with more than 10 motor vehicles designed for highway use, have plans to improve the use of alternative fuels and efficient vehicles. The plans must enable the state-owned fleets to achieve a 20% reduction or displacement of the current petroleum products consumed by January 1, 2010. Reductions may be met by petroleum or oils displaced through he use of biodiesel, ethanol, synthetic oils or lubricants, other alternative fuels, the use of hybrid electric vehicles, other fuel-efficient or low-emission vehicles or additional methods as may be approved by the State Energy Office. (Reference Session Law 2005-276, Section 19.5)

Clean Fuel Advanced Technology (CFAT)

This is a three-year project focused on reducing transportation related emissions in North Carolina counties that have air quality concerns. The two million dollar project is funded by the NC Department of Transportation (DOT), State Energy Office (SEO) and the Division of Air Quality (DAQ) and covers three broad areas: education and outreach, project funding, and recognition of exemplary activities. There is $625,000 available for 2007, and the maximum per project award is $150,000. Eligible participants are vehicle and fleet operators, fuel providers, and public and Private entities in the following 24 counties: Cabarrus, Catawba, *Chatham, Davidson, Davie, Durham, Edgecombe, Forsyth, Franklin, Gaston, Granville, Guilford, *Haywood, *Iredell, Johnston, Lincoln, Mecklenburg, Nash, Orange, Person, Rowan, *Swain, Union and Wake. (*represents partial counties)

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www.ncsc.ncsu.edu/resources_by_sector/information_resources/2007_CFAT_RFP.doc