



**BIOMASS:
Climate, Economy,
Sustainability & Policy**

EnTAP

Goldsboro, NC – October 1, 2009

Our Mission:

Southern Alliance for Clean Energy promotes responsible energy choices that create solutions to global warming, while ensuring clean, safe and healthy communities throughout the Southeast.

I work in five states, helping farmers and woodland owners learn about the opportunities in clean, renewable energy and EE.



We've heard enough about the changing climate. And frankly, anyone who works outdoors, doing anything associated with the land, has seen the changes. Milder winters, earlier springs, more extreme rainfalls, longer droughts, invasive species, more pests & diseases. But I will say that since I learned in the 1990s that solving this problem can also boost our economy, this has been my driving motivation ever since.

And here in the South, what this means is helping our beautiful Southern states reduce our addiction to coal and petroleum. While fossil energy is useful, it also contaminates our fisheries with mercury (so pregnant women are warned to limit their fish intake), causes acid rain in the Appalachians, smog in the Smokeys, toxic coal ash, and human health problems in the urban areas.

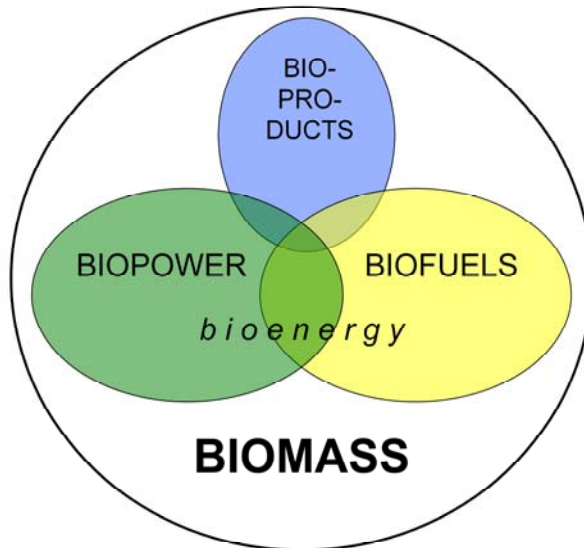
To do this, we must decrease our use of energy, and shift to renewable energy sources. And we must rebuild our economy and grow jobs by relying more and more on these clean energy sources. The source of renewable energy I want to speak about is nature's stored solar energy.



Biomass is stored solar energy!

“I believe that the great Creator has put ores and oil on this Earth to give us a breathing spell.... As we exhaust them, we must be prepared to fall back on our farms, which are God’s true storehouse. We can learn to synthesize materials for every human need from things that grow.” — George Washington Carver.

What is Biomass Used For?



BIOMASS:

- bio-products
- biofuels
- biopower

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This is a helpful diagram to grasp all the good that can come from renewable biomass.

Bioproducts include everything from paper, turpentine, and compost - to the new “biodegradable” plastics and soy-based inks.

Biofuels includes corn ethanol, biodiesel (which comes from animal fats and plant oils), and the so-called “next generation” biofuels to be made from waste materials and low-value cellulosic biomass.

Biopower is electricity made from biomass.

The last two categories are both considered bioenergy.

My work in promoting climate change solutions includes promotion of ALL solutions from farms and forests. So this includes both cellulosic biofuels and biopower. To solve our economic woes, our trade imbalance, and our climate and environmental problems, it will require both forms of bioenergy, plus lots of energy efficiency, and many other forms of renewable energy. But I would point out that the jury is still out on cellulosic biofuels – Because they are not yet commercially viable, we don’t know if they will really help the economy. We also don’t yet know for sure how beneficial to the climate they will be. One important study this summer (UC-Merced) concluded that it is a less efficient use of biomass resources to convert biomass into biofuels, and then burn them in internal combustion engines. The study said it is more efficient to convert the biomass directly into heat, to make steam, to run combustion turbines, to power electric cars.

What is Biomass?

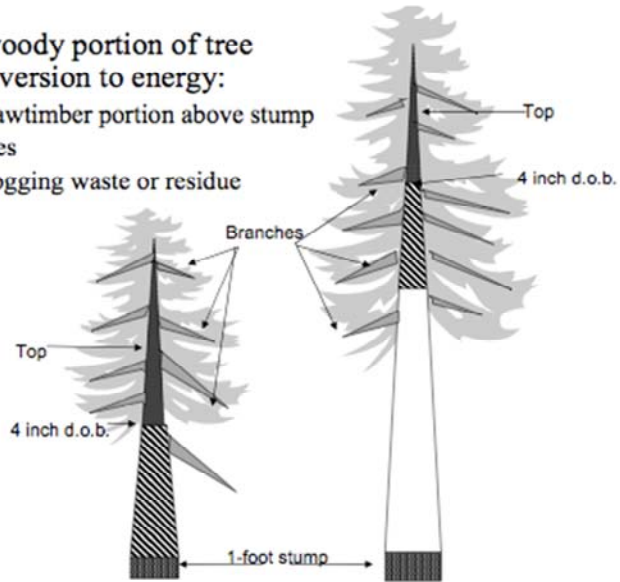


Biomass is plant material, vegetation, agricultural waste or animal waste used as an energy source. The dominant sources will be urban wood waste, tree trimmings, logging residues, culled or diseased trees, or even purpose-grown energy crops.

In my work, I often focus on woody biomass because there is so much more of it: In NC for example, available woody-biomass outweighs animal waste on a 9:1 ratio (Btu basis). (Source: NC Biomass Roadmap, 2007.)

What is Biomass?

- Biomass is the woody portion of tree available for conversion to energy:
 - non-pole, non-sawtimber portion above stump
 - tops and branches
 - also known as logging waste or residue



Among biomass sources, wood waste is the most economical and abundant today. So that's my current focus. And when forest specialists talk about wood biomass, this is what they mean. Not the whole tree, just the twigs and branches. The rest is too valuable for lumber, paper, and other products. We're talking low-value stuff. The reason, as several independent biopower plant developers have told me, is that they simply cannot afford to make electricity out of higher value, large diameter trees.



This image shows an experimental harvest of a purpose-grown energy crop. A stand of five-year old willows is cut and chipped on-site. The economics prevent this from commercial use at this time, but we expect it will be necessary in the near term.

Let me give you a taste of the economics of emerging bioenergy crops:

Wood-waste: \$20 to \$40 per ton delivered.

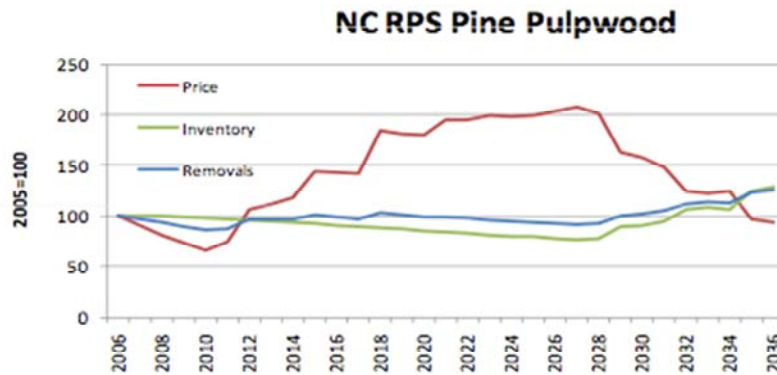
Hybrid poplar: \$55 to \$70 per ton delivered (projected).

Switchgrass: \$100 to \$150 baled at field's edge.

Pulpwood: \$49 per dry ton delivered (about double this to show price for green ton)

Happily, I can report that our analysis shows the land-use impacts of this will be minimal. We project energy crops will use less than 4% of current farmland.

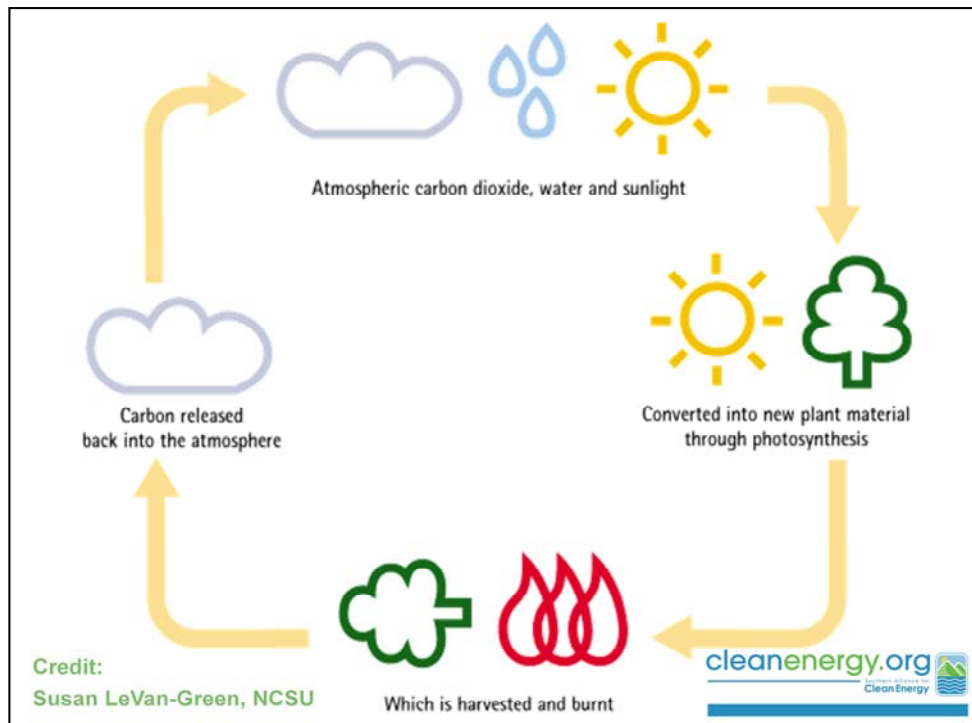
One Projection of Price Increases Due to Biopower



SOURCE: Bob Abt, NCSU School of Forestry,
"Abt Heinz-TAG," September 2009.
http://www.cnr.ncsu.edu/sofac/sfc_pres.html



If biomass markets develop as rapidly as we need them to (both to rebuild the rural economy and to help the planet), here's one view of what might happen. Bob Abt has suggested that we will see expansion of demand beyond wood waste, into pulpwood. With this new demand on pulpwood will be a doubling of pulpwood price over 2005. He sees us reaching this point by about 2020, in line with the goals in NC's Renewable Electricity Portfolio Standard (REPS).



If done properly, the use of biomass for energy can be carbon neutral. Closed-carbon-loop is required for the claim of carbon neutrality. At very least, this means replanting of trees, best management practices, and probably more intensive management of woodlands. Some suggest we emphasize waste materials and dedicated energy crops grown on lands not suitable for food production.

If biomass displaces the use of fossil energy, it is climate-friendly. Why? Because instead of emitting fossil carbon that was pulled out of the atmosphere eons ago, bioenergy emits new carbon, biogenic carbon, recycled carbon.

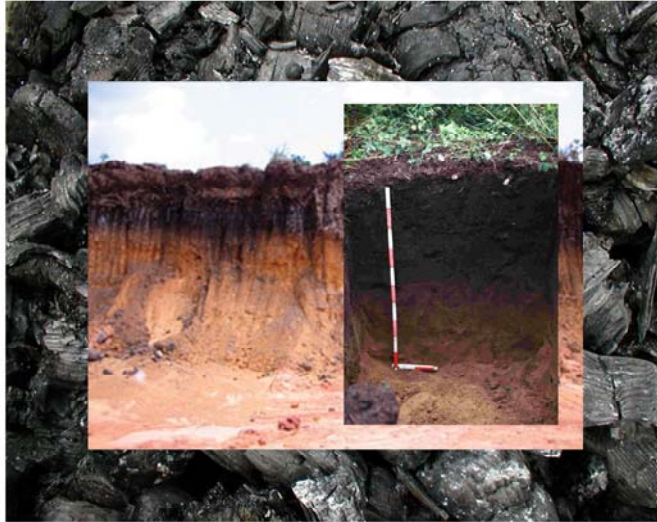
Another consideration is the fact that biomass left to decompose on the forest floor will emit methane, a greenhouse gas 23 times more powerful than CO₂.

With extra effort, bioenergy can be carbon negative, sequestering carbon while giving renewable energy. Biochar is the secret ingredient for carbon NEGATIVE bioenergy.

METHANE:

Study Concludes that Biomass Energy Reduces Greenhouse Gas Emissions

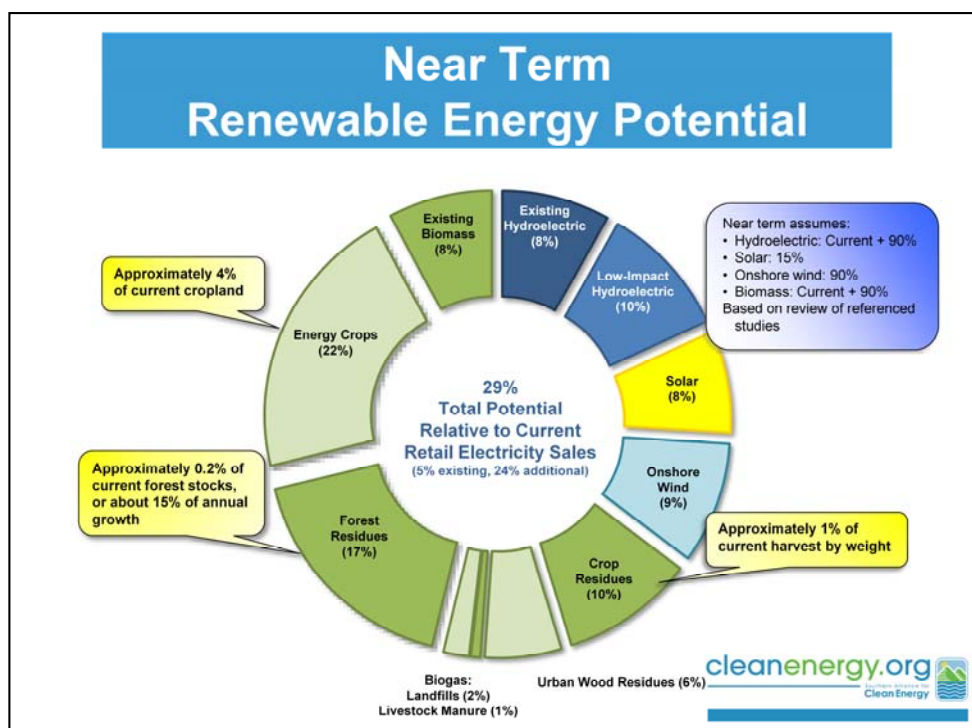
Bioenergy can be carbon negative! Charcoal / Biochar / Terra Preta



- Pyrolysis or Gasification
- Incomplete Combustion
- Starved of O₂, 400 to 1000° F
- >4,000 years old & very stable
- Beneficial to soil, plants & climate

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Biochar is the magic behind carbon NEGATIVE bioenergy. By processing the biomass materials carefully, we can produce both bioenergy (in form of heat, power, gases, liquids, or any combination), plus charcoal. This charcoal can be tilled into the soil where it remains for a very long time (carbon-dated to 4000 years ago). It also can boost soil productivity, improve drainage, increase resistance to drought.



SO How much energy can we reasonably expect to get from renewables, biomass in particular?

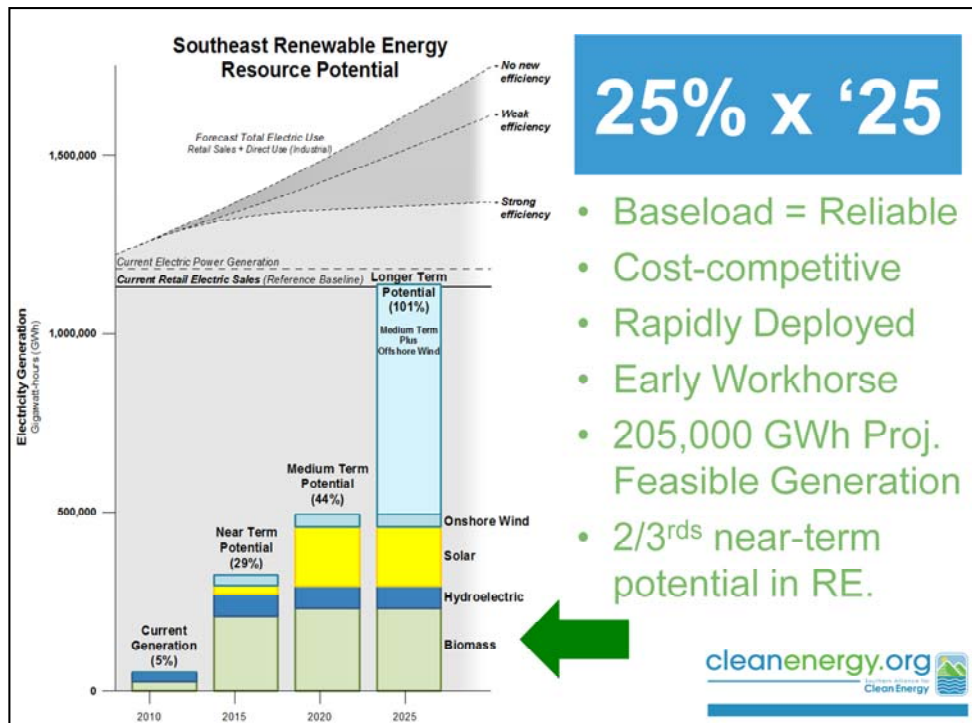
From all the green on this chart, you can see the important role biopower plays in a broader portfolio of renewable potential.

Biopower will play an important part of our future electricity portfolio.

My organization has analyzed the Southeast’s ability to generate renewable energy, and we’ve found that we can feasibly meet 25% of our own needs, using homegrown renewables, by the year 2025.

This doughnut chart is from our new report, “Southern Solutions for a National Renewable Energy Standard (RES),” which confirms the ability of the South to meet a 25% by 2025 mandate. You can see the important role biopower plays – nearly 60% of our near term renewable energy potential.

A crop like switchgrass would be in the category of “Energy Crops,” which we project as meeting 22% of our total renewable energy potential.



This graph shows how we can get to 25% by 2025. It also shows the crucial role of biopower as a low-cost, easily implemented, baseload power technology. Again from our recent report, “Yes We Can: Southern Solutions for a National RES.”

Near Term: Biopower represents about two thirds of the South’s near-term potential for expanding renewable energy.

Mid and Long Term: We will see decreasing percentages as Wind and Solar and micro-hydro increase.

So, how much more do we need?

With the 24,000 GWh of biomass electricity currently on the grid here in the South, in order to make early headway on a 25x25 RES, we need another 205,000 GWh, or 27,000 MW of new biopower capacity.

By our estimates, we have the biomass resources to achieve this, economically, and feasibly, with minimal impact on higher-value markets or the environment.



This is what a biomass power plant looks like. This is a 50MW plant in Burlington, VT. It provides enough energy to power about 35,000 homes. It consumes about 600,000 tons of wood waste per year, employing about 100 people to deliver this fuel. About two dozen people are employed inside the plant, running the equipment, the boilers, the steam turbines, etc.

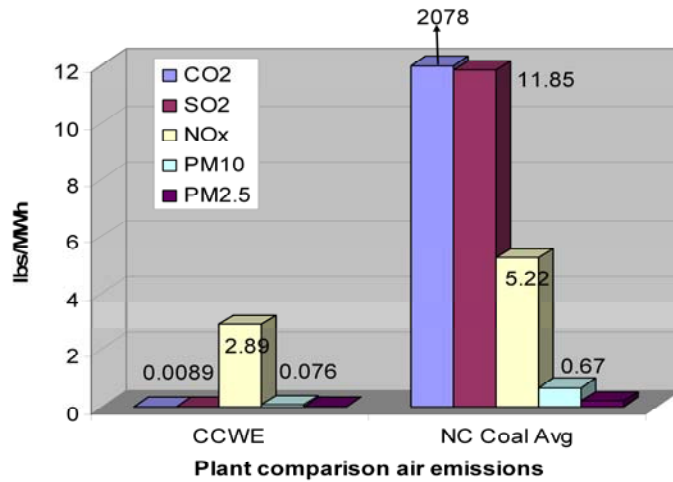


- Craven County Wood Energy, New Bern, NC.
- Running since 1990, 46 MW (50 MW nominal)
- Wood chips, sawdust, logging residue, urban wood debris, etc.



We have a very similar plant in North Carolina, with a 19 year operating history. Craven County Wood Energy has been running since 1990, putting 46MW onto the grid. It consumes stuff like wood chips, sawdust, logging residue, and urban wood debris.

Emissions: Wood vs. Coal (NC data)



Data: NC Division of Air Quality. Slide courtesy of NCSU Solar Center.

So you may ask, but isn't wood burning very dirty? This graph compares pollution emissions from Craven Wood Energy and the average coal-fired power plant. Biopower is clearly superior. And the big difference isn't even on this slide: No mercury!

Biopower Potential: Economics



- 9 jobs projected per MW of biopower
- >24,000 new jobs in Southern states



Biopower is cost-competitive with new coal and nuclear. If you don't believe this study, look to Georgia Power, where they are converting Plant Mitchell (and old coal-fired plant) to burn 100% woody biomass, and their argument to the public utilities commission was rate-payer savings! So if it is reliable, baseload, affordable, renewable electricity – why isn't everyone doing it?

As low-hanging fruit – you might ask, why aren't more of our regulated monopoly electric utilities plucking it?

Biopower Potential: Economics



- 7- or 8-fold expansion to meet 25x25
- Projected jobs: 4.5 to 9 per MW
- Tens of thousands new jobs (direct)
- Hundreds of thousands new jobs in SE
- Tens of billions new revenue & income

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Economic benefits:

Renewable biopower has significant potential for expansion and great returns for the rural economy.

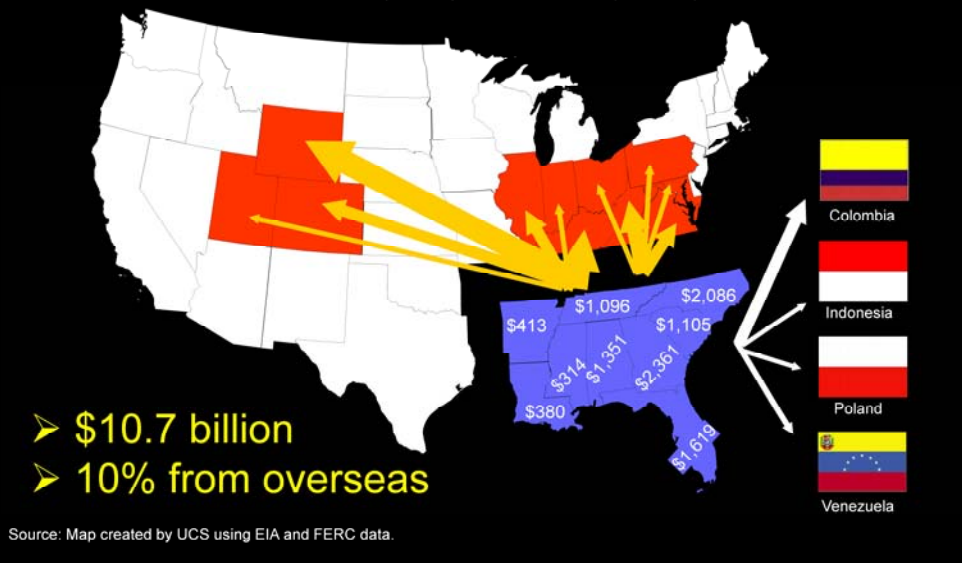
The rule of thumb among biopower plant developers is 24 jobs in a small plant (50MW), plus another 75 to 100 indirect jobs, supplying biomass feedstock, for example. Hodges and Rahmani (University of Florida) found that new biopower plants will bring a total of 9 jobs per MW, on average. Based on our projections of feasible capacity in the South, we project more than 24,000 new jobs in biopower resulting from a 25% RES. With indirect job-creation and multiplier effects, this could be 7 or 8 times higher.

According to the SAFER Alliance Roadmap, Hodges and Rahmani also found, on average, a 40MW biopower plant generated \$21.6 million in annual revenues, \$13 million in personal and business income. From this, a quick calculation suggests that our region might keep as much as \$15 billion in annual revenues, and \$9 billion in personal and business income from new biopower. Similar calculations for NC suggests that we might keep as much as \$500 million in annual revenues, and \$300 million in personal and business income. So for North Carolina, where we project 2,300 MW of biopower, how does 2,000 to 8,000 jobs sound?

Sources: SACE report, "Yes We Can: Southern Solutions for a National RES"; GA Power regulatory filings; Hodges, Alan W. and Mohammad Rahmani, Economic Impacts of Generating Electricity Fact Sheets;

Coal is a Wealth Transfer

Annual Coal Import Expenditures, 2006 (million \$)



If we're ever going to rebuild our economy with clean energy, we need to have straight talk.

As T. Boone Pickens tells us, petroleum imports cost the US \$700 billion per year.

Coal imported to the Southeast causes > \$10 billion / year in losses to our states' economies. In 2006, we spent \$10.7 billion in 2006 on coal imports—an increase of nearly 50% over 2005 levels—from outside of the region, to countries as far away as Indonesia

SAFER Alliance concluded that the economic contributions of current biopower production in 2007 included \$7.3 billion in company revenues, \$4.3 billion in labor income, and over 110,000 jobs for the region.

Investing in homegrown renewable energy resources can help keep energy dollars from leaving a region. Increasing the use of renewable energy—especially biomass in the Southeast that can be directly co-fired in existing coal plants—can help cut down on coal imports and instead keep those dollars flowing through the local economies.

In April of this year, Bill Johnson, CEO of Progress Energy said:

“You know, no matter what happens in policy space, electric prices are going to go up in the future.

Coal is a big part of the reason for Mr Johnson's statement.

Sustainability Concerns



- Carbon Lifecycle
- Concentration of Demand
- Pollution Emissions
- Soil Productivity
- Water Quality & Quantity
- Biodiversity & Wildlife
- Indirect Effects
- Land Use Impacts

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Some might find it ironic that I chose a picture of a cut log in an old growth forest. But it's a great example of sustainability: This log is smiling inside because it was allowed to remain on the earth in this special ecosystem known as the Joyce Kilmer Memorial Forest.

So what are the issues of sustainability in biopower?

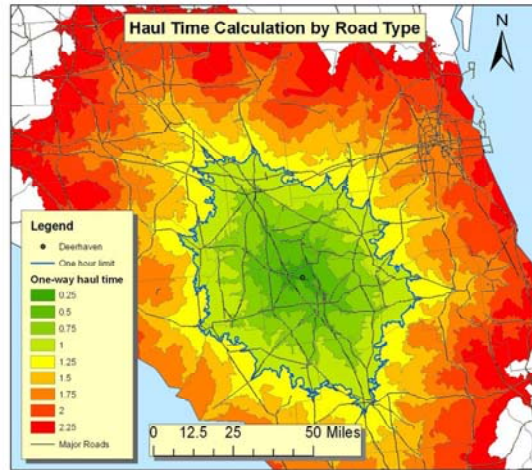
Concentration of demand? Either too many consumers built in one region, or too much demand concentrated in one plant (i.e., large utility-scale biomass burning power plants). This is still a concern for my organization, although the developers insist that there is no way they will build it if the supply is not there (i.e., their lenders won't lend the money). But future scenarios of dramatic fossil fuel price hikes are a situation that undermines this argument that the market knows best.

Pollution emissions – existing coal plants are clearly more polluting than most all new biomass electricity plants. The regulations are simply more stringent than in the 1950s when our coal fleet was built.

Soil: no immediate threat (We might ask, have BMPs protected our soil from harvests for pulp&paper, wood products?)

avg NC removals are 85%, foresee no harmful impacts for 1 or 2 rotations (25 to 50 years)

Sustainability Policies



- Soil & Water BMPs
- State Biomass Harvest Guidelines
- Enhanced Forest Management Plans
- Improved Forest Certif. Programs
- Look-Back Provisions?

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This is an Optimal Siting Map, showing haul-times in relation to the resource base. This is one way plant developers pick a site. And I might suggest that this is a good way for sustainability advocates to focus their concerns constructively. Afterall, any potential impacts, such as competition for biomass supply, are going to be proximate to the source of demand.

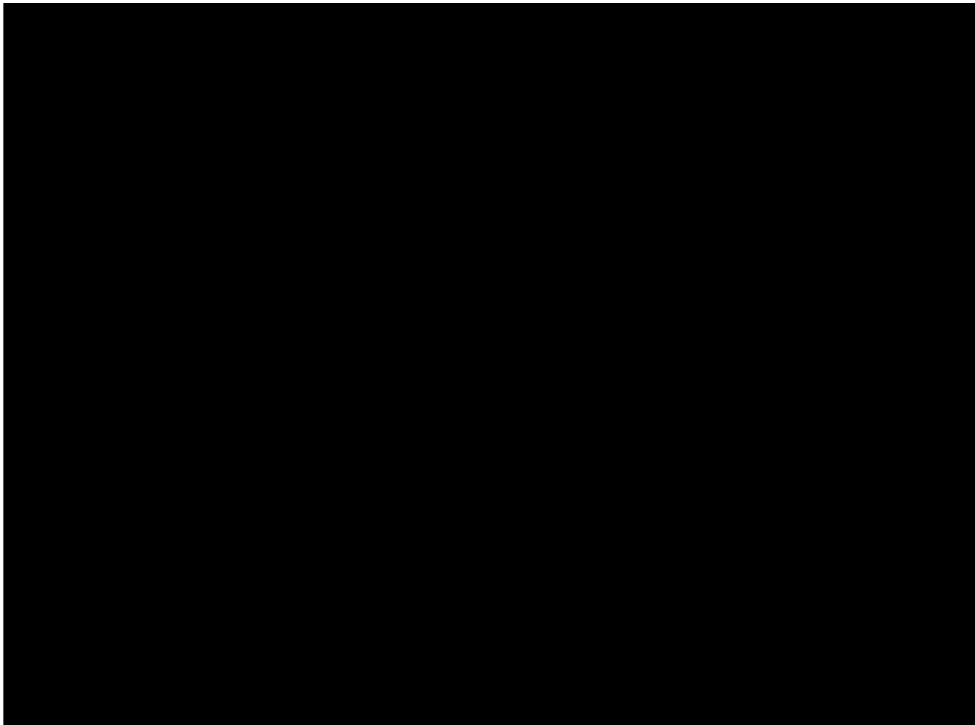
But what can policy-makers do to address sustainability concerns? We've been working on the "definition of renewable biomass." Based on our consensus dialogues with stakeholders, we have settled upon this "menu" of options available to those who wish to sell biomass into these new energy markets:

Our position is that broadening the definition of biomass is crucial to our climate and our economy, and that we must also accept some policies to prevent un-intended consequences.

The intractable problems in this debate are twofold:

- 1) The idea that any environmental or sustainability provisions might limit the market is viewed by some as an infringement of property rights. Yet when mills say, "you can't bring us dirt in your wood chips" how is this any different from a biopower plant disallowing chips from a late-successional forest?
- 2) Some DC enviros are very concerned about expansion of what they call "plantation" forests. But are planted forests worse than paved parking lots and suburban lawns? Are highly managed woods worse than high-graded, overstocked, unproductive land that doesn't even pay the tax bill?

I share these problems with you because this is a very smart and engaged group. I think it remains unsolved simply due to lack of imagination. Perhaps ya'll can help us move beyond the impasse?



Let's pause for a moment to think about this.

Biomass is reliable, proven, and cost-effective. Compared to coal, it's better for the economy, the environment, human health, and the climate. So why aren't we seeing more adoption? Any ideas?

I think it is clearly and simply a market failure caused by weak regulation of regulated monopolies.

Remember the history of rural electrification? In the face of this monumental task, with all the financial risks involved, the government set-up regulated monopolies to get the job done. The importance of cheap, reliable electricity was viewed as a public good, which is why such a high level of government involvement was justified.

So let's be clear, the electric utilities are not private businesses as we know them. They are monopolies, and they are regulated for the purpose of providing the common good of cheap, reliable, clean electricity. Returning to the question of why we aren't seeing more adoption: I think it is clearly and simply a market failure caused by weak regulation of regulated monopolies. This is why I have reluctantly concluded that we must pass strong national law requiring the utilities to begin shifting their business model to include clean, renewable energy and energy efficiency.

Policies

- **Strong National Renewable Electricity Standard (RES)
25% x 2025**
- **Cap & Trade (w/ 100% auction)**
- **Helpful State Level Policies**
(Net Metering, Intercon. Standards, Fair Payment)



- 1) RES
 - Boost our rural economies and create new family-wage jobs
 - Create new competition to help restrain fossil fuel price increases
 - Reduce a growing addiction to imported fuel and electricity
 - Increase resilience in our Grid and Improve our national security
 - Diversify our fuel mix and enhance the reliability of fuel supplies
 - Insulate our economy from fossil fuel price spikes and supply shortages or disruptions
 - **The number one reason why we need an RES? Jobs!** If we send the right signal to investors by setting the goals and ensuring markets for the IPP developers, we can get started in just a few years, building this biopower generation capacity. The technology is proven. The resource is there. We have experience in the region. We can do this.
- 2) Carbon Regulation: A strong Cap & Trade law will
 - Cut America's global warming pollution 80% by 2050 to avoid the catastrophic threats of runaway climate change.
 - Unleash powerful economic incentives for American manufacturers to build and install clean energy technologies.
 - Create millions of good paying jobs in towns large and small across the country.
 - Reward innovation and ingenuity and establish America as the global leader in green energy technologies.

This past March, SACE released a statement signed by hundreds of economists who support auctioning all credits in a national carbon cap-and-trade program. Economists agree that the most equitable and efficient means of implementing a cap-and-trade program requires auctioning off the credits instead of giving them away to polluters for free. Auctioning carbon credits also generates revenue, which the government can use to offset rising energy costs or invest in clean energy solutions.

Resources

- 25x'25 Alliance <http://www.25x25.org/>
- Biomass Power Association (BPA)
<http://www.farmenergy.org/>
- DSIRE <http://www.dsireusa.org/>
- Environmental Law & Policy Center (ELPC)
<http://www.farmenergy.org/>
- GRIST <http://www.grist.org/article/series/skeptics/>
- RES Alliance for Jobs <http://www.res-alliance.org/>
- Southern Alliance for Clean Energy (SACE)
<http://www.cleanenergy.org/>
- Union of Concerned Scientists (UCS)
<http://www.ucsusa.org/>

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Questions?

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