Monday, April 11, 2011

To: Kevin Rennert and Kellie Donnelly
From: Mary S. Booth, PhD, and Richard Wiles, Partnership for Policy Integrity

Re: Comments on definition of a Clean Energy Standard: selected responses to Question 2, **"What resources should qualify as "clean energy"**

Executive summary

We have focused on four sub-questions of question 2, "What resources should qualify as "clean energy".

On what basis should qualifying "clean energy" resources be defined?

- Any credible definition of "clean" energy must take into account *both* greenhouse gas production and conventional pollutant production. Otherwise, what distinguishes it as "clean"?

- Burning biomass emits similar amounts of conventional pollutants (such as NOx and CO) as coal and natural gas, and greater amounts of CO_2

- EPA's own "boiler rule" recognizes that biomass emits as much pollution as coal. For filterable particulate matter, carbon monoxide, hydrogen chloride, mercury, and dioxins, the average emission standard set for biomass is identical to, or higher than the standard set for coal.

What is the role for energy efficiency in the standard?

- In the real world, we need to generate a certain amount of electricity, so a clean energy standard should ask, How do we generate electricity with the least impact on air quality and the lowest carbon emissions? It is thus extremely important that efficiency be taken into account, because by governing the amount of fuel burned to create power, it also governs emissions.

- Utility-scale biomass power averages about 24% efficiency, compared to 33% average efficiency for the U.S. coal fleet, and around 44% for modern gas plants. When efficiency is a criteria for a clean energy standard, direct-fired biomass plants and indeed many other forms of biomass energy do not measure up.

Should retrofits or retirements of traditional fossil-fuel plants be included in the standard?

- We confine our comments to the co-firing and re-firing of coal plants with biomass. Considerable data exist to demonstrate that adding just 5 – 10% biomass to the fuel stream can reduce overall plant efficiency by 1 – 2%. Completely re-firing coal plants with wood always results in a substantial decrease in plant capacity and a decrease in efficiency.

- Data from a proposal to co-fire biomass at the Killen coal plant in Ohio demonstrates that large increases in pollutant emissions can occur when biomass is co-fired with coal. The Killen plant proposes to co-fire 5% wood by heat content (amounting to over 8% by mass). This amounts to around 180,000 tons of wood per year, or the equivalent of the wood that could be produced by clearcutting about 2,050 acres of Ohio's forests per year.

- Replacing 5% of the Killen coal plant's heat input with biomass produces no improvement in criteria pollutant emissions (SOx, NOx, and PM). However it does produce large increases in carbon monoxide (150% increase), volatile organic compounds (126% increase), and organic hazardous air pollutants such as benzene (456% increase), formaldehyde (2,135% increase), and toluene (521% increase) (see http://www.pfpi.net/air-pollution-2 for data).

Should the definition of "clean energy" account only for the greenhouse gas emissions of electric generation, or should other environmental issues be accounted for?

- For ratepayers and taxpayers to willingly support development of clean renewable energy, it is incumbent on Congress to ensure that what is delivered is actually "clean" and "renewable".

- Biomass energy is not carbon neutral. New science demonstrates that net emissions from using whole trees for biomass are not only higher than from fossil fuels (especially natural gas), but that they remain so over years, decades, and even more than a century, even taking forest regrowth into account. Burning biomass increases greenhouse gas emissions.

- Forest cutting will increase to meet emerging biomass fuel demand. Even if the industry did only use "waste" forestry residues as fuel as is often claimed, co-firing this material and utilizing 50% of all the logging residues generated in the US (a generous estimate of availability) would replace only 1.7% of our current coal usage.

- Given the prevailing climate of fiscal conservatism, there is also a new climate of skepticism about "clean" energy claims. We expect that Congress would share our aim of ensuring that any new clean or renewable energy standard actually delivers what it promises. A technology that increases forest cutting, pollution emissions, and carbon emissions does not belong in a clean energy standard.

2. What resources should qualify as "clean energy"? *On what basis should qualifying "clean energy" resources be defined?*

We submit these brief comments in response to a call from Senators Bingaman and Murkowski about the nature of Clean Energy Standard. We preface this by stating that we do not support a "clean" energy standard in lieu of a renewable energy standard; but we do support a renewable energy standard that ensures that the technologies promoted are actually "clean", meaning, they do not substantially add to greenhouse gas emissions and air and water pollution.

That being said, we will respond to the questions posed in the whitepaper about what a clean energy standard should include, focusing our objections to including biomass combustion in a clean energy standard.

Any credible definition of "clean" energy must take into account *both* greenhouse gas production and conventional pollutant production. Otherwise, what distinguishes it as "clean"?

We argue that most if not all forms of biomass energy utilizing the combustion of solid fuels should not qualify for the definition of "clean" energy. Burning biomass emits similar amounts of conventional pollutants (such as NOx and CO) as coal and natural gas, and greater amounts of CO_2. Due to the low efficiency of biomass boilers and the inherent emissions from biomass, actual stack emissions of CO_2 from biomass facilities are 150% those of coal and greater than 300% those of natural gas. While modern pollution control technology can reduce the amount of conventional pollution emitted, but does nothing to control the amount of CO_2 emitted.

These numbers are not controversial. If anything, they are too conservative. Actual data from the air permit issued to the We Energies/Domtar biomass plant in Rothschild, WI, bear this out. The plant proposes to install two new boilers, one to burn biomass and one to burn natural gas. Comparing the emissions from the two boilers reveals that with the exception of nitrogen oxides, emissions from the biomass boiler are substantially greater than emissions from the natural gas boiler (the relatively high NOx rate from the Domtar gas boiler is likely due to its size and comparative lack of controls; NOx emission rates from the gas combustion turbine at the proposed Pioneer Valley Energy Center in Westfield, MA, would be 0.052 lb/mmbtu, about one quarter the rate at the Domtar plant gas boiler).

With the exception of CO_2 all pollutants are expressed on a heat input basis, meaning that if the rates were expressed on the basis of energy produced, a metric that takes into account boiler efficiency, the difference between emissions from the two boilers would be even greater.

Pollutant (emission rate)	Natural gas boiler	Biomass boiler	biomass as % natural gas
total particulate matter (PM2.5; lb/mmbtu)	0.0076	0.024	316%
sulfur dioxide (SO2; lb/mmbtu)	0.0006	0.2	33333%
nitrogen oxides (NOx; lb/mmbtu)	0.2	0.1	50%
carbon monoxide (CO; lb/mmbtu)	0.06	0.12	200%
volatile organic compounds (VOC; lb/mmbtu)	0.06	0.12	200%
carbon dioxide (CO2; lb/MWh)	508	3,050	600%

Final air permit emission rates from new biomass and natural gas boilers to be installed at the Domtar/We Energies biomass plant in Rothschild, WI

A Clean Energy Standard needs to go above and beyond the pollution emission standards set under EPA and state-level air pollution permitting, otherwise, there is nothing to distinguish any technology as being inherently "clean". In fact, even while setting new emission standards that are intended to reduce emissions, EPA's own "boiler rule" recognizes that biomass emits as much pollution as coal. The EPA standard essentially sets a single solid fuel standard for both biomass and coal, and includes permissible rates for filterable particulate matter (as opposed to total PM, as shown in the table above), hydrogen chloride (HCl), mercury, carbon dioxide, and dioxins/furans. In practically every case, even mercury, the average emission standard set for biomass is identical to, or considerably higher than (for carbon monoxide, and dioxins) the standard set for coal.

Subcategory	Particulate Matter	Hydrogen Chloride	Mercury (Hg)	Carbon Monoxide (ppm @3%oxygen)	Dioxin/ Furan (TEQ) (ng/dscm)
Existing –CoalStoker	0.039	0.035	4.6E-06	270	0.003
Existing -Coal Fluidized Bed	0.039	0.035	4.6E-06	82	0.002
Existing –Pulverized Coal	0.039	0.035	4.6E-06	160	0.004
Existing –Biomass Stoker/other	0.039	0.035	4.6E-06	490	0.005
Existing -Biomass Fluidized Bed	0.039	0.035	4.6E-06	430	0.02
Existing –Biomass Dutch Oven/Suspension Burner	0.039	0.035	4.6E-06	470	0.2
Existing –Biomass Fuel Cells	0.039	0.035	4.6E-06	690	4
Existing –Biomass Suspension/Grate	0.039	0.035	4.6E-06	3,500	0.2
Existing –Liquid	0.0075	0.00033	3.5E-06	10	4
Existing – Gas2 (OtherProcess Gases)	0.043	0.0017	1.3E-05	9	0.08
Existing –non-continental liquid	0.0075	0.0003	7.8E-07	160	4
New –Coal Stoker	0.0011	0.0022	3.5E-06	6	0.003
New - Coal Fluidized Bed	0.0011	0.0022	3.5E-06	18	0.002
New – Pulverized Coal	0.0011	0.0022	3.5E-06	12	0.003
New – Biomass Stoker	0.0011	0.0022	3.5E-06	160	0.005
New - Biomass Fluidized Bed	0.0011	0.0022	3.5E-06	260	0.02
New – Biomass Dutch Oven/Suspension Burner	0.0011	0.0022	3.5E-06	470	0.2
New – Biomass Fuel Cells	0.0011	0.0022	3.5E-06	470	0.003
New - Biomass Suspension/Grate	0.0011	0.0022	3.5E-06	1,500	0.2
New – Liquid	0.0013	0.0031	2.1E-07	3	0.002
New – Gas 2 (Other ProcessGases)	0.0067	0.0017	7.9E-06	3	0.08
New – non-continental liquid	0.0013	0.0032	7.8E-07	51	0.002

Major source "boiler rule" emission standards from EPA (as lb/mmbtu for PM, HCl, and mercury).

Thus, EPA's own data and standards acknowledge that biomass and coal have comparable emissions. We do not endorse inclusion of coal in a clean energy standard, and neither do we endorse inclusion of biomass combustion, which is by EPA's own standards required to be no cleaner than coal.

2. What resources should qualify as "clean energy"? *What is the role for energy efficiency in the standard?*

We assume that some combustion-based generation will be included in any "clean" energy standard that emerges from this process. If this is the case, it is extremely important that efficiency be taken into account, because by governing the amount of fuel burned to create power, it also governs emissions. In the real world, we need to generate a certain amount of electricity, so a clean energy standard should ask, How do we generate electricity with the least impact on air quality and the lowest carbon emissions?

Utility-scale biomass power averages about 24% efficiency, compared to 33% average efficiency for the U.S. coal fleet, and around 44% for modern gas plants. This discrepancy, combined with the fact that burning biomass produces comparable amounts of conventional pollution and

carbon dioxide as coal, means that per unit energy produced, biomass is as polluting or more polluting than coal, and vastly more polluting than natural gas.

When efficiency is a criteria for a clean energy standard, direct-fired biomass plants and indeed many other forms of biomass energy do not measure up.

2. What resources should qualify as "clean energy"? *Should retrofits or retirements of traditional fossil-fuel plants be included in the standard?*

We confine our comments to the co-firing and re-firing of coal plants with biomass, which is often advertised as a way to reduce the emissions of coal.

There is a reason that our civilization stopped using wood and switched to coal and oil. Wood is about 50% water by mass, and its chemical makeup is not energy dense, meaning that you need substantially more of it by mass than you do of fossil fuels to generate an equivalent amount of energy. Proposals to co-fire or re-fire coal plants with wood are therefore quite literally a step into the past that ignore physical realities and substantially increase the mass of fuel that must be transported to a facility.

There are a number of consequences of adding biomass to coal. Considerable data exist to demonstrate that adding just 5 – 10% biomass to the fuel stream can reduce overall plant efficiency by 1 – 2%. Completely re-firing coal plants with wood always results in a substantial decrease in plant capacity and a decrease in efficiency.

Theoretically, because wood contains less sulfur than coal, adding biomass can indeed reduce emissions of sulfur dioxide from coal plants, but this reduction is slight in light of what can be accomplished with installation of modern pollution control equipment. Meanwhile, emissions of other pollutants can increase significantly. Data from an actual proposal to co-fire biomass at the Killen coal plant in Ohio demonstrates this. The Killen plant proposes to co-fire 5% wood by heat content (amounting to over 8% by mass). This amounts to around 180,000 tons of wood per year, or the equivalent of the wood that could be produced by clearcutting about 2,050 acres of Ohio's forests per year.

Replacing 5% of the Killen coal plant's heat input with biomass produces no improvement in criteria pollutant emissions (SOx, NOx, and PM) with the exception of a negligible decrease in lead emissions. It does, however, produce large percentage increases in carbon monoxide (150% increase), volatile organic compounds (126% increase), and organic hazardous air pollutants such as benzene (456% increase), formaldehyde (2,135% increase), and toluene (521% increase) (see http://www.pfpi.net/air-pollution-2 for data). It bears repeating that these increases (verified by the plant's own test-firing data) result from adding just 5% heat input from biomass and continuing to burn 95% coal.

2. What resources should qualify as "clean energy"? *Should the definition of "clean energy" account only for the greenhouse gas emissions of electric generation, or should other environmental issues be accounted for?*

The definition of clean energy should include, but not be limited to greenhouse gas emissions. As described above, biomass electricity generation plants emit more of many criteria and hazardous air pollutants than do coal fired plants of comparable size. In addition, fueling these plants present a major threat to forests, because at the scale proposed, there is not other available fuel than whole trees.

There is already a rush to build biomass facilities underway in response to state-level renewable energy standards and federal incentives. The financial incentives (renewable energy credits; federal energy tax production credits; eligibility for stimulus funds that reimburse 30% of facility development costs) – amount to millions of dollars in ratepayer and taxpayer money per facility, per year. For these ratepayers and taxpayers to willingly support development of clean renewable energy, it is therefore incumbent on Congress to ensure that what is delivered is actually "clean" and "renewable".

No matter what the prevailing political discourse states, the fact is that atmospheric CO_2 is increasing, and this is disrupting the climate. It is therefore ironic, given that biomass energy facilities emit so much more CO_2 than even coal facilities, that biomass energy should have been treated as "carbon neutral" on the thin premise that these biogenic emissions don't matter – that they would be produced "anyway" in the course of waste decomposition, or that they will be "resequestered" after release by new forest growth (for a detailed explanation of the historic reasoning behind biomass carbon accounting, see http://www.pfpi.net/carbon-emissions).

New science demonstrates that even if these two premises are true, net emissions from using whole trees for biomass are not only higher than from fossil fuels (especially natural gas), but that they remain so over years, decades, and even more than a century, even taking forest regrowth into account.

Further, the amounts of biomass needed to provide even a small fraction of the power consumed in the United States are unacceptably high. To meet emerging demand, forest harvesting must increase. Nationally, the more than 115 "standalone" biomass plants planned to come on line in the next three years will burn around 55 million tons of wood, or the equivalent of about 650,000 clear-cut acres per year by 2014, assuming average forest biomass per acre in the US. An unknown amount of wood will be required for co-firing in coal plants, with estimates for Ohio alone, where the State's Public Utilities Commission has approved over 2,100 MW of biomass power, of about 20 million tons of wood required for fuel annually. Wood demand from new and proposed wood pellet production facilities represents about another 20 million tons a year, and wood demand for liquid biofuels represents another 10 million tons per year, for a combined "clearcut equivalent" of about 1.2 million acres per year to meet emerging biomass energy wood demand nationally.

Even if the industry did only use forestry residues as fuel, and co-fired them in coal plants, which is more efficient than burning them in standalone facilities, utilizing 50% of all the logging residues generated in the US (a generous estimate of availability) would replace only 1.7% of our current coal usage. This is the real math behind the industry that has been relentlessly promoted as "clean" and "green".

Given the prevailing climate of fiscal conservatism, there is also a new climate of skepticism about "clean" energy claims. We expect that Congress would share our aim of ensuring that any new clean or renewable energy standard actually delivers what it promises. A technology that increases forest cutting, pollution emissions, and carbon emissions does not belong in a clean energy standard.

Thank you for the opportunity to comment.

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