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Climate Change Mitigation with Renewable Biomass: Shifting Legal Incentives away from Electricity and Towards Cogeneration

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CLIMATE CHANGE MITIGATION WITH "RENEWABLE" BIOMASS: SHIFTING LEGAL INCENTIVES AWAY FROM ELECTRICITY AND TOWARDS COGENERATION

*Sarah M. Hayter**

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I. INTRODUCTION

Biomass is the only "renewable" energy source that has played any significant role in the U.S. energy picture, accounting for eleven percent of total energy consumed in the United States in 2011.[1] According to one industry report, ninety new biomass-fired units totaling more than four gigawatts of potential power generation are currently being developed in

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1. Comparatively, hydroelectric generated 63% of renewable energy, wind 23%, geothermal 3%, and solar <1%. *Sources of Electricity Generation, 2011*, U.S. Energy Info. Admin., http://www.eia.gov/energy_in_brief/_electricity.cfm (last visited Nov. 11, 2012).

the United States.[2] Biomass power development benefits from using similar technology to that of coal combustion.[3] This factor, combined with the need to meet state renewable portfolio goals, has resulted in two additional development trends emerging in the energy sector: 1) the co-firing of coal and biomass and 2) the complete conversion from coal-fired to biomass-fired plants.[4]

The trends in biomass development are in large part due to the current focus on climate change. It is widely recognized that climate change is a global problem and that greenhouse gas emissions must be substantially reduced in the coming decades in order to prevent irreversible harm to the planet.[5] As a result, "renewable" energy has been championed as a solution. Accordingly, biomass is widely perceived as "clean and green" energy resource. Incentive programs such as state renewable portfolio standards and federal tax dollars promote "renewable" biomass electricity generation under the premise that it is a favorable alternative to traditional fossil fuels. Yet whether biomass electricity generation provides the perceived benefits of renewable energy and, more specifically, a solution for global warming, is disputed. Although incentive programs are designed to further a broad array of underlying policies in addition to mitigating climate change, it is clear that bioenergy policies must evolve to include, if not prioritize, carbon emission reduction.[6]

This Paper explores the range and impact of biomass generation applications and discusses the current legal treatment of bioenergy. This Paper ultimately concludes that state and federal regulatory regimes should be amended to encourage biomass cogeneration instead of biomass electricity generation. The Paper begins by providing an overview of the range of biomass fuels, energy applications, and their environmental "costs." Section III summarizes the current legal treatment of renewable biomass at the federal and state level, including the Public Utility Regulatory Policy

2. Divided by region, the Mid-Atlantic is leading the country in new biomass power facility development with twenty units, followed by the Southeast and Great Lakes regions, each with fifteen new units. *See U.S. Biomass-Fired Power Projects Booming to the Tune of Four Gigawatts, But Constraints to Development Loom*, Indus. Info. Res. (March 26, 2012), http://www.industrialinfo.com/showNews.jsp?newsitemID=206760&qiSessionId=DBE8FB6ED1EA23EBAA55EEE89F9CF4A3.wolf.

3. Like coal, biomass is combusted to create energy in a two-step process. First, the fuel (biomass and/or coal) is combusted to generate thermal energy, which in turn boils water to convert it to high pressure steam. The steam then enters a turbine, causing it to turn, which creates electrical energy. *See, e.g., Biomass Sustainability and Carbon Policy Study*, MANOMET CENTER FOR CONSERVATION SCIENCES 126 (June 2010), http://www.manomet.org//manomet.org/files/Manomet_Biomass_Report_Full_LoRez.pdf [hereinafter MANOMET STUDY]

4. *See, e.g.*, Cameron Chai, *California-Based Cogeneration Power Plant Converts from Coal to Biomass*, AzoCleanTech (February 24, 2012, 3:51 AM), http://www.azocleantech.com/news.aspx?newsID=16235; Desiree Parker, *Dominion Gets Approval to Convert Plants to Biomass, Wants Offshore Wind Lease*, WYDaily.com (March 21, 2012), http://wydailyarchives.com/local-news/8660-dominion-power-gets-approval-to-convert-plants-to-biomass-interested-in-offshore-large-wind-lease.html.

5. Nat'l Acad. Sci., America's Climate Choices: Report in Brief 2–3 (2011), *available at* http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/ACC-final-brief.pdf.

6. Letter from William H. Schlesinger, President, Nat'l Acad. of Scis., to Nancy Pelosi, Speaker, U.S. House of Representatives & Harry Reid, Majority Leader, U.S. Senate, (May 17, 2010) (on file with author).

Act of 1978 (PURPA), federal tax incentives, and Renewable Portfolio Standards (RPS). Section IV utilizes a recent study by the Manomet Center for Conservation Sciences to illustrate the wide array of environmental, economic, and technological implications of replacing fossil fuels with biomass. Finally, drawing from the conclusions of the Study discussed in Section IV, Section V speaks to the policy lessons learned from the Study and propose policy and regulatory changes. Specifically, Section V proposes that legal regimes be amended to remove all incentives for biomass electricity generation and instead promote biomass cogeneration.

II. Bioenergy Overview

A. *Forms of Biomass*

Biomass is organic matter that can be converted to energy[7] and which, as fuel, can be classified as either "closed-loop" or "open-loop." Closed-loop biomass is organic material grown and harvested specifically for energy purposes, also known as dedicated energy crops (e.g., switchgrass).[8] Open-loop biomass is organic waste or waste byproduct that is utilized for energy purposes.[9] The most common forms of open-loop biomass include wood waste, agricultural waste (e.g., grains, legumes, vineyard debris), livestock waste, and municipal solid waste.[10] Wood waste includes forestry-related products (e.g., slash and brush), solid wood waste (e.g., pallets and construction debris), urban wood waste (e.g., landscape and rights-of-way trimmings) and milling residues (e.g., sawdust).[11] The focus of this Paper is woody biomass.

B. *Biomass Energy Applications*

Despite its relatively insignificant role in U.S. energy production in comparison to the use of fossil fuels, biomass is utilized for energy generation in industrial, thermal, electric, and transportation applications.[12] The most ancient use of biomass has been for home heating.[13] Today, biomass is also used to meet thermal demand from institutions and industrial processes.[14] As discussed above, in the electricity sector, biomass is combusted by itself or in conjunction with coal to fuel power plants.[15] Since biomass contains very little sulfur, co-firing with coal reduces sulfur oxide emissions.[16]

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7. Kelsi Bracmort & Ross W. Gore, Cong. Research Serv., R40529, Biomass: Comparison of Definitions in Legislation Through the 111th Congress (2012).
8. *Id.*
9. *Id.*
10. *Id.*
11. *Id.*
12. *See, e.g.*, MANOMET STUDY, *supra* note 3, at 20-30.
13. *Id.* at 21.
14. *Id.* at 21-22.
15. *Id.* at 20-21.
16. *Id.* at 126.

An additional useful application of biomass is combined heat and power (CHP), also known as cogeneration, which is the simultaneous production of heat and electricity from a single fuel source.[17] Cogeneration can either be thermally-led, where the primary purpose of the facility is heat production with some electricity produced, or in the alternative, electricity-led, utilizing the excess heat from electricity production.[18] Electricity-led CHP is an option where a power plant is located near thermal demand, such as residential heating. For example, a twenty megawatt (MW) power plant produces enough heat to heat approximately 1100 homes.[19] On the other hand, a thermally-led CHP facility can produce one to five MWs of electricity while also heating a college campus or a community of two to five hundred homes and businesses.

Cogeneration, which captures and utilizes heat normally wasted during the production of thermal or electric energy, typically achieves a total system efficiency of sixty to eighty percent (compared to less than fifty percent for equivalent separate heat or power systems), and uses thirty-five percent less fuel to achieve the same energy output as other systems.[20] Because cogeneration is a relatively high-efficiency process, it offers several environmental and economic benefits, including reduced air pollutant emissions and lower operating costs.[21]

C. *Biomass "Costs"*

In recent years, biomass has seen renewed popularity as a "renewable" energy source. Although there are clear benefits to using biomass as an alternative to fossil fuels, as with all forms of energy, bioenergy is not without costs. Bioenergy is scrutinized for its adverse environmental impacts, including, but not limited to, large water consumption, water pollution, damage to forest ecosystems, and air pollution. Bioenergy is also criticized for its societal costs, including environmental justice and food security issues. Controversies regarding food security threats stem from the fact that the feedstock used for the production of ethanol is largely food crops.[22] Also, like many infrastructure projects, the siting of biomass power plants tends to have a disproportionate effect on low income communities and communities of color.[23] For the most part, these environmental and social issues are not unique to biomass energy. Yet since mainstream public policy and perception encourages the use of biomass and other renewable energy sources because they are "clean" sources of energy, many of the

17. *Id.* at 22.
18. *Id.* at 20.
19. *Id.* at 22.
20. *Efficiency Benefits*, U.S. Envtl. Prot. Agency, http://epa.gov/chp/basic/efficiency.html (last visited Nov. 11, 2012).
21. *Id.*
22. *See, e.g.*, *FAO's Views on Bioenergy*, Food & Agric. Org. of the U.N., http://www.fao.org// 47280/en/ (last visited Nov. 11, 2012).
23. *See, e.g.*, Bill Cotterell, *NAACP Challenges Biomass Site* (December 6, 2008), http://www.enviro-lawyer.com/NAACP_challenges.pdf.

"costs" associated with the use of biomass are overlooked. For the purposes of this Paper, the following discussion will focus on environmental costs of burning woody biomass.

The potential forest ecosystem impacts of harvesting millions of tons of forest biomass for energy production have been highly studied and documented.[24] The forestry industry is extensively regulated in the United States to protect water quality, wildlife, and soil productivity. There is, however, concern that existing regulations do not provide enough protection in the event of increased tree harvesting.[25] Specific risks to forest ecosystems, including soil fertility and species composition, are discussed in more detail in Section III below.

The most widely discussed environmental impact of biomass use relates to air quality. Although the industry praises biomass burning for being cleaner than coal, science shows that it is in fact dirtier and more dangerous to public health. Biomass combustion releases numerous pollutants into the air, including particulate matter, dioxins, ozone, and mercury, and current air pollution regulations do not adequately protect the air from these pollutants.[26] Scientists have been studying the carbon emissions and climate change implications of biomass use since the 1990s[27] and have determined that biomass burning indisputably releases carbon dioxide (CO_2), the most prevalent greenhouse gas (GHG), in amounts greater than fossil fuels.[28] In addition to stack emissions, biomass contributes to CO_2 emissions during the growing, harvesting, and refining process, during transport to the generation facility, while being stored on-site, and during the movement from storage piles to the boiler.[29]

Despite obvious carbon emissions, mainstream policies and the biomass industry promote biomass as being "carbon neutral," arguing that because plants naturally absorb and store CO_2, biomass energy simply releases carbon dioxide that would be in the atmosphere already or would naturally be returned to the atmosphere by way of natural decomposition. The opposition, on the other hand, while not disputing the potential carbon

24. *See, e.g.*, Manomet Study, *supra* note 3, at app. 4-B.

25. *Id.*

26. *See Air Pollution from Biomass Energy*, P'ship For Policy Integrity (April 2011), http://www.pfpi.net/air-pollution-2.

27. *See, e.g.*, *Task 38*, IEA Bioenergy, http://www.ieabioenergy-task38.org/index.htm (last visited Nov. 11, 2012) (use the menu on the left side of the page to find various information on these studies).

28. *See, e.g.*, *Carbon Emissions From Burning Biomass For Energy*, P'ship For Policy Integrity, http://www.pfpi.net/carbon-emissions (last visited Nov. 11, 2012) ("[B]iomass burning power plants emit 150% the CO_2 of coal, and 300–400% the CO_2 of natural gas, per unit energy produced . . . . The air permit for the We Energies biomass facility at the Domtar paper mill in Rothschild, WI, provides an example of how biomass and fossil fuel carbon emissions compare. The mill has proposed to install a new natural gas boiler alongside a new biomass boiler, and presented carbon emission numbers for both. They reveal that the biomass boiler would emit six times more carbon (at 3120 lb/MWh) than the adjacent natural gas turbine (at 510 lb/MWh).").

29. *See, e.g.*, Am. Renewables, LLC, *Permit Application, Gainesville Renewable Energy Center, app. A, tbl.A-1,* ANNUAL POTENTIAL EMISSIONS RATE SUMMARY, http://www.dep.state.fl.us/Air/emission/bioenergy//mEmissionRates.pdf (last visited Dec. 1, 2012).

benefits of biomass, claims this is a gross generalization of the carbon impacts of utilizing biomass for energy. Moreover, the U.S. Environmental Protection Agency (EPA) Scientific Advisory Board[30] recently rejected the notion of carbon-neutrality: "Only when bioenergy results in *additional* carbon being sequestered above and beyond the anticipated baseline (the "business as usual" trajectory) can there be a justification for concluding that such energy use results in little or no increase in carbon emissions."[31]

Multiple scientific analyses[32] have examined the GHG implications of woody biomass use for energy production over the course of the last few decades and, although scientists have yet to fully understand potential GHG implications, it is recognized that the implications involve a complex assessment that turns on several different factors:

> The potential of bioenergy to reduce greenhouse gas emissions inherently depends on the source of the biomass and the net land-use effects. Replacing fossil fuels with bioenergy does not by itself reduce carbon emissions, because CO_2 released by tailpipes and smokestacks is roughly the same per unit of energy regardless of the source. Bioenergy therefore reduces greenhouse gases only if the growth and harvesting of the biomass for energy capture carbon above and beyond what would be sequestered anyway and thereby offset emissions from energy use. This additional carbon may result from land management changes [that] increase plant uptake or from the use of biomass that would otherwise decompose rapidly.[33]

30. In Massachusetts v. EPA, 549 U.S. 497, 521 (2007), the Supreme Court held that carbon dioxide is a pollutant under the Clean Air Act. As a result, the U.S. Environmental Protection Agency has begun regulating carbon dioxide emitted from stationary sources such as power plants under the Act; however, in response to industry pressure, EPA temporarily suspended regulation of "biogenic" CO_2 for purposes of calculating total emissions from power plants. *See also* Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66496 (Dec. 15, 2009); Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31514, 31540 (June 3, 2010); Deferral for CO_2 Emissions From Bioenergy and Other Biogenic Sources Under the Prevention of Significant Deterioration (PSD) and Title V Programs, 76 Fed. Reg. 43490 (July 20, 2011).

31. U.S. EPA Sci. Advisory Bd., Deliberative Draft Report of the Biogenic Carbon Emissions Panel 3 (2012) (emphasis in original).

32. *See, e.g.*, Yimin Zhang et al., *Life Cycle Emissions and Cost of Producing Electricity from Coal, Natural Gas, and Wood Pellets in Ontario, Canada*, 44(1) ENVTL. SCI. & TECH. 538 (2010); Anil Baral & Gauri S. Guha, *Trees for Carbon Sequestration or Fossil Fuel Substitution: The Issue of Cost vs. Carbon Benefit*, 27(1) BIOMASS AND BIOENERGY 41 (2004); Gregg Marland & Bernhard Schlamandinger, *Biomass Fuels and Forest-Management Strategies: How Do We Calculate the Greenhouse Gas Emission Benefits*; 20(11) ENERGY—THE INT'L J., 1131–1140 (1995); D.O. Hall, H.E. Mynick & R.H. Williams, *Alternative Roles for Biomass in Coping with Greenhouse Warming*, 2(2–3) SCI. & GLOBAL SEC. 113 (1991).

33. Marland & Schlamandinger, *supra* note 32, at 1131–1140.

Thus, the crux of the carbon neutrality debate is whether the use of biomass yields benefits when replacing coal and, if so, whether those benefits are short-term or long-term.

III. Federal and State Bioenergy Policies and Laws

Energy security concerns related to the oil crisis of 1973 spurred modern international and domestic bioenergy development. Over the past four decades, U.S. domestic energy policies have taken many forms but have consistently been grounded in one goal: shifting energy consumption away from fossil fuels. For a quarter century, the most significant federal mandate in support of this goal was the Public Utility Regulatory Policy Act of 1978 (PURPA), which promoted the use of biomass as an alternative to the use of fossil fuels.[34] More recently, the federal government has promoted bioenergy within a broader system of "renewable" energy policies through tax incentives and grants.

In the mid-2000s, state-level renewable energy mandates became the predominant mandate-based policy, often known as Renewable Portfolio Standards (RPS) or Renewable Energy Standards (RES). RPSs require retail electricity suppliers to procure a percentage of their electricity from renewable energy resources or purchase renewable energy credits (RECs) from other sources to meet the statutory (or regulatory) standards.

A. *Federal Level: From PURPA to Tax Incentives*

U.S. federal policy first encouraged biomass in electricity applications through PURPA.[35] PURPA was intended to diversify the electric power industry by integrating alternative energy sources, or "qualifying facilities."[36] To achieve this goal, PURPA required utilities to purchase electricity from qualifying facilities, including small power producers, cogeneration facilities, and hydroelectric power production facilities, at a fixed cost.[37] Small power production facilities are no larger than eighty megawatts and use a primary (seventy-five percent or more) energy source of "biomass, waste, renewable resources, geothermal resources *or* any combination thereof."[38] PURPA regulations define biomass as "any organic material not derived from fossil fuels."[39] Small power production facilities are encouraged to use biomass for fuel because only fifty percent biomass fuel input is required in order to qualify as "biomass," a level lower than the other qualifying fuels.[40]

34. Public Utility Regulatory Policy Act of 1978, Pub. L. No. 95–617, 92 Stat. 3117 (1978) (codified as amended at 16 U.S.C. §§ 2601–45).

35. The term "biomass" was not written into the law and "biomass" was not defined under PURPA until the Federal Energy Regulatory Commission (FERC) promulgated the regulations in 1980. *See* Bracmort & Gore, *supra* note 7 (discussing the legislative history of the term "biomass").

36. *See generally* 16 U.S.C. § 2601 (2006).

37. 18 C.F.R. § 292.203 (2010).

38. 18 C.F.R. § 292.204(b)(1)(i) (2010) (emphasis added).

39. 18 C.F.R. § 292.202(a) (2010).

40. § 292.204(b)(1)(ii).

PURPA also encourages development of cogeneration facilities producing electricity along with other "forms of useful thermal energy (such as heat or steam), used for industrial, commercial, heating and cooling purposes"[41] and which meet operating and efficiency standards.[42] Biomass fuel usage is also promoted in cogeneration qualifying facilities, but unlike facilities with natural gas or oil energy inputs, biomass facilities are not subject to efficiency standards.[43] Pursuant to the Energy Policy Act of 2005, PURPA was amended to include additional criteria for all new cogeneration facilities that sell electricity pursuant to the Act, with specific incentive for development of five megawatt or less cogeneration facilities.[44]

Unlike PURPA, recent federal legislation promotes the development and use of biomass as a "renewable" energy source,[45] moving away from the "guaranteed cost" approach of PURPA by providing subsidies, tax incentives, or direct grants for renewable energy development. From 2002 to 2008, the U.S. government expended $29 billion on renewable electricity generation subsidies.[46]

The primary federal subsidy for biomass electricity generation is the Renewable Electricity Production Tax Credit (PTC).[47] The PTC provides $0.015 per kWh (kilowatt hour), or approximately $10 per MWh (megawatt hour), of tax credit, which although moderate in comparison to other incentives, is a significant and stable development incentive over time.[48] The PTC applies to facilities that use either "closed-loop" or "open-loop" biomass and does not apply to co-firing.[49] Closed-loop biomass is defined as "any organic material from a plant *which is planted exclusively for purposes of being used at a qualified facility to produce electricity*."[50] By definition, open-loop biomass includes agricultural livestock waste nutrients and solid nonhazardous cellulostic waste material derived from agriculture, forestry, or solid wood waste materials, and it expressly excludes pressure treated, chemically treated, and painted wood waste, municipal solid waste, gas derived from the biodegradation of solid waste, and paper that is commonly recycled.[51] As with PURPA, facilities that use municipal solid waste are not excluded from eligibility for the tax credit; however, they are treated

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41. § 292.202(c).

42. 18 C.F.R. § 292.205(a) (2010).

43. *Id.*

44. § 292.205(d)(4).

45. For a discussion of federal policies related to biomass, see LYNN CUNNINGHAM ET AL., CONG. RESEARCH SERV., R40913, RENEWABLE ENERGY AND ENERGY EFFICIENCY INCENTIVES: A SUMMARY OF FEDERAL PROGRAMS (2011). *See also* MANOMET STUDY, *supra* note 3, at app. 1-A.

46. ENVTL. L. INST., ESTIMATING U.S. GOVERNMENT SUBSIDIES TO ENERGY SOURCES: 2002-2008 (2009), http://www.elistore.org/Data/products/d19_07.pdf.

47. 26 U.S.C. § 45 (2006).

48. § 45(a).

49. § 45(c)(1) & (3)(A)(ii)(III).

50. § 45(c)(2) (emphasis added).

51. § 45(c)(3).

separately from facilities that use biomass.[52] The Energy Information Administration (EIA) estimates that in the fiscal year 2007, open-loop biomass facilities received $4 million under the PTC.

In addition to the PTC, the tax code provides for an investment tax credit (ITC) based on the value of the investment.[53] Certain electrical generation and cogeneration facilities are eligible for a ten percent credit.[54] Qualifying cogeneration facilities are subject to a minimum efficiency standard of sixty percent, except in the case of facilities using biomass (as defined by Section 45), which are not subject to any efficiency standard.[55]

The American Recovery and Reinvestment Act of 2009 (ARRA) created substantial incentives for biomass electric generation.[56] First, the ARRA expanded the availability of the ITC to biomass electricity generation facilities qualifying for the Section 45 PTC.[57] Second, the ARRA created an option for PTC-eligible taxpayers that allows the taxpayer to take the ITC in lieu of the PTC for thirty percent of the value of the property.[58] Finally, the ARRA created an option allowing ITC-eligible taxpayers to receive a cash grant from the U.S. Treasury Department in lieu of the ITC.[59] This grant, known as the Section 1603 grant, is for a credit of up to thirty percent for biomass electricity generation facilities and up to ten percent for combined heat and power facilities.[60] Section 1603 grants were originally set to expire December 31, 2010, but were extended to January 2012.[61] As of October 2011, forty-five biomass electricity generation facilities had received ARRA grants totaling $153 million.[62]

B. *State Level: Renewable Portfolio Standards*

The thrust of state-level policy promotion of the use of biomass has been towards electricity generation by way of Renewable Portfolio Standards. Thirty-eight states have enacted an RPS, and they vary widely in terms of program structure, enforcement mechanisms, size, and application.[63] Generally speaking, an RPS is a market tool that encourages production of electricity from renewable sources by mandating that retail

52. § 45(c)(3)(A)(ii)(II).
53. 26 U.S.C. § 48 (2006).
54. § 48(a)(2)(A)(ii).
55. § 48(c)(3)(D)(i).
56. American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).
57. *Id.* at sec. 1104, *amending* 26 U.S.C.§ 48(a)(5)(C)(ii).
58. *Id.* at sec. 1102, *amending* 26 U.S.C.§ 48(a)(5)(C).
59. *Id.* at sec. 1603.
60. *Id.*
61. On December 13, 2010, Section 707 of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, Pub. L. No. 111-312, 124 Stat. 3296 (2010), extended the Section 1603 program.
62. *Overview and Status Update of the §1603 Program*, DEP'T OF TREASURY, http://www.treasury.gov//recovery/Documents/Status%20Overview.pdf (last visited Dec. 1, 2012).
63. As of February 2012, thirty states and the District of Columbia had adopted an enforceable renewable portfolio standard or other mandated renewable capacity policies, and seven states have voluntary goals for renewable generation. *See Most States Have Renewable Portfolio Standards*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/todayinenergy/detail.cfm?id=4850 (last visited Nov. 11,

electricity suppliers include minimum percentages of eligible renewable energy in the electricity they sell to consumers. For example, California's RPS required California's electric utilities to derive thirty-three percent of their retail sales from eligible renewable energy resources in 2020, with interim targets of twenty percent by the end of 2013, and twenty-five percent by the end of 2016.[64]

As concerns about the unstable U.S. economy and climate change receive heightened importance by state governments, many states have incorporated economic development and environmental protection goals into their RPS programs, in addition to their historical promotion of fuel diversity and energy security. For example, many states specifically recognize that their economies will benefit by attracting investors and developers, which will increase job creation.[65] In addition, many states promote renewable energy for its potential to generally improve their state's environment and public health, specifically by reducing emissions and improving air quality.[66] Some states, for example Virginia, specifically reference climate change mitigation goals in their RPS.[67]

What constitutes a "renewable" resource under any RPS varies drastically from state to state and is determined by statutory regulations. In fact, the statutory definition of renewable resource sometimes goes beyond what most people, at least conceptually, consider "renewable." For example, a handful of states recognize clean coal, or coal plants utilizing carbon capture techniques, as a "renewable" resource.[68] Additionally, the "homegrown" nature of the RPS has led to varying treatment of each type of renewable resource, often because a resource is more readily available within the state's geographic boundaries, which gives that state an incentive to retain the economic development and environmental benefits of promoting that resource.[69]

2012); *see also Database for State Incentives for Renewables and Efficiency*, DSIRE, http://www.dsireusa.org/ (last visited Nov. 11, 2012).

64. *See* CAL. PUB. RES. CODE § 25742(d) (repealed 2012).

65. *See, e.g.*, WASH. REV. CODE § 19.285.020 (2012) ("Making the most of our plentiful local resources will stabilize electricity prices for Washington residents, provide economic benefits for Washington counties and farmers, create high-quality jobs in Washington, provide opportunities for training apprentice workers in the renewable energy field, protect clean air and water, and position Washington state as a national leader in clean energy technologies.").

66. *See, e.g.*, Del. Code Ann. tit. 26, § 351(b) (2012) ("The General Assembly finds and declares that the benefits of electricity from renewable energy resources accrue to the public at large, and that electric suppliers and consumers share an obligation to develop a minimum level of these resources in the electricity supply portfolio of the state. These benefits include improved regional and local air quality, improved public health, increased electric supply diversity, increased protection against price volatility and supply disruption, improved transmission and distribution performance, and new economic development opportunities.").

67. *See, e.g.*, VT. STAT. ANN. tit. 30, § 8001 (2012) ("The general assembly finds it in the interest of the people of the state to promote the state energy policy established in section 202a of this title by: . . . Contributing to reductions in global climate change and anticipating the impacts on the state's economy that might be caused by federal regulation designed to attain those reductions.").

68. *See, e.g.*, Ohio Rev. Code Ann. § 4928.01(A)(34)(c) (2012).

69. *See, e.g.*, MICH. COMP. LAWS § 460.1001 (2012) ("The purpose of this act is to promote the development of clean energy, renewable energy, and energy optimization through the implementation of a clean, renewable, and energy efficient standard that will . . . [p]rovide greater energy security

"Biomass" is recognized as a qualifying renewable energy source in every state RPS, but the states vary in their definition of qualifying "biomass."[70] Many states define biomass very broadly while others take a more narrow view of acceptable forms of biomass. In general, most states agree on what forms of biomass qualify as renewable, with qualifying biomass falling into one of five categories: forestry-related wood and waste, urban wood waste, agricultural products, dedicated energy crops, and biogas.[71] Likewise, the definitions uniformly exclude treated wood and old growth forest timber from renewable biomass qualification. Some types of biomass receive inconsistent treatment and are specifically excluded in one state but recognized favorably in others, such as black liquor, municipal solid waste, construction and demolition debris, tires, and milling residues such as sawdust, wood chips, and bark.

Overall, the most important biomass incentives for states are the Production Tax Credit and Renewable Portfolio Standards. The PTC is less valuable than a RPS, but is a stable source of income; however, the influence of the PTC beyond 2012 is uncertain because of the expiration of the credit in December 2012.[72]

IV. Manomet Center for Conservation Sciences' *Biomass Sustainability and Carbon Policy Study*

Mainstream public policies promote biomass as both a "renewable" resource and carbon friendly, thus providing for preferential treatment under the federal and state policies discussed above. The scientific community, however, acknowledges that the use of biomass deserves a more sophisticated cost-benefit analysis, but only a handful of policies have attempted to take such calculus into account. Recognizing that the greenhouse gas implications of biomass energy are likely more complicated than the popular "carbon neutral" policy supports and that RPS incentives should promote only beneficial sources of energy, the Massachusetts Department of Energy commissioned the Manomet Center for Conservation Sciences to conduct a study addressing the wide array of scientific, economic, and technological issues related to the use of forest biomass. In June 2010, the Manomet Center published the *Biomass Sustainability and Carbon Policy Study* (Study) which explored three main issues: 1) the

through the use of indigenous energy resources available within the state."); W. VA. CODE R. § 24-2F-2 (2012) ("West Virginia has considerable natural resources that could support the development of alternative and renewable energy resource facilities at a reasonable price").

70. *See also* Christine Elizabeth Zeller-Powell, *Defining Biomass as a Source of Renewable Energy: The Life Cycle Carbon Emissions of Biomass Energy and a Survey and Analysis of Biomass Definitions in States' Renewable Portfolio Standards, Federal Law and Proposed Legislation*, 26 J. ENVTL. L. & LITIG. 367 (2011) (comprehensively discussing biomass definitions within renewable portfolio standards).

71. Biogas includes gas resulting from the decomposition of organic material, landfill gas, wastewater treatment gas, and industrial digester gas.

72. MANOMET STUDY, *supra* note 3, at 17.

greenhouse gas implications of using biomass to replace fossil-fueled electric capacity, 2) the forest biomass supply, and 3) the potential threat increased harvesting poses to forest ecosystem sustainability.[73]

The Study rejects the view that biomass is a carbon neutral energy source and instead adopts a comprehensive lifecycle carbon accounting framework to calculate the atmospheric GHG impacts of burning forest biomass for energy.[74] The Study concluded that the atmospheric GHG implications of shifting energy production from fossil fuel resources to biomass resources depend on three factors: 1) the bioenergy technology being used, 2) the fossil fuel technology being replaced, and 3) the biophysical and forest management characteristics of the forest where the biomass is harvested.[75]

Accordingly, the Study examined the implications of replacing fossil fuels with biomass in electricity generation, thermal applications, and combined heat and power (cogeneration) applications.[76] The Study compared biomass-fueled electricity generation with three fossil-fueled electricity generation alternatives: coal, co-fired coal (twenty percent biomass, eighty percent coal), and natural gas.[77] Of these three fossil-fueled pathways, natural gas is the cleanest and lowest carbon emitting, due to its higher efficiency and the fact that it contains less carbon per unit of energy.[78]

The Study also measured carbon impacts at three stages of the energy cycle: the initial carbon debt, the carbon debt payoff, and cumulative carbon dividends.[79] The "initial carbon debt" measurement equaled the percentage of total biomass emissions that are in excess of what has been emitted from fossil fuel generation.[80] The Study concluded that the immediate carbon impacts of biomass combustion are greater per unit of energy produced than what fossil fuels produced in all applications, but also concluded that replacing fossil fuels in thermal and CHP applications typically resulted in lower "initial carbon debt" due to their greater overall efficiency in converting biomass to usable energy.[81] As a result of the lower initial carbon debt, the Study found that the time needed to "pay off" the carbon debt and begin accruing carbon benefits is shorter for thermal and CHP applications.[82]

Recognizing that the carbon "benefits" of biomass are realized as the re-growth of harvested biomass removes carbon from the atmosphere, the Study examined the carbon impacts over a timeline and determined that

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73. *Id* at 6.
74. *Id.*
75. *Id.*
76. *Id.* at 20–30, 126–31.
77. *Id.*
78. Natural gas is more efficient than coal-fired electric because it is combusted directly to create steam, whereas coal is combusted to heat water that is then converted to steam. *Id.* at 126.
79. *Id.* at 7.
80. *Id.*
81. When biomass replaces coal and natural gas in electric applications, the "carbon debt" is 33% and 66%, respectively. *Id.* fig.2.
82. *Id.* at 7.

the recovery of the carbon debt varies greatly depending on the forest management practices utilized by landowners.[83] The Study modeled the carbon recovery in growing forests under a number of alternative scenarios.[84] Assuming that comparable forest management practices were utilized, the Study concluded that biomass yields the greatest carbon benefits when replacing oil-fired thermal and cogeneration applications, determining that the carbon debt will be paid off in five years,[85] with lower atmospheric GHG levels (twenty-five percent lower) at year 2050.[86] Using comparable forest management assumptions, the Study determined that carbon benefits are not realized when biomass replaces coal and oil-fired electricity generation applications for twenty-one and ninety years, respectively.[87] The Study also found that, when replacing coal-fired electricity generation applications, biomass does not have any short-term potential to reduce atmospheric levels of CO_2 and substantially increases emissions when replacing natural gas-fired electricity generation applications.[88]

Since the timber inventory in Massachusetts has attracted the attention of bioenergy investment, the Study also examined the economic and environmental implications of replacing fossil fuels with harvested forest biomass.[89] When the Study was conducted, several large-scale biomass electric plants were proposed for construction in Massachusetts; thus, the adequacy of wood supplies to furnish the proposed plants was a central issue of concern and the purpose of the Study was to evaluate how much forest biomass was available to furnish the potential expansion of bioenergy capacity and production in that state.[90] The Study found that the future biomass supply in Massachusetts depended heavily on the prices paid for the fuel, concluding that the biomass supply would be limited because retail electricity suppliers would not be able to significantly increase the price they pay to landowners.[91] Although this conclusion was specific to Massachusetts, the Study also indicated that, regardless of supply source and availability, cogeneration facilities are generally better positioned to utilize biomass fuel than electricity purchasers because cogenerators have the ability to pay much higher prices on a delivered basis and are thus able to outbid electric power facilities if necessary.[92]

83. *Id.* at 7.

84. *Id.* at 7.

85. *Id.* fig.3. The pay-off for gas fired thermal is twenty-four years.

86. The study showed similar results for replacement of natural gas fired thermal; at year 2050, thermal had -13% compared to year 2100, where thermal had 12%. *Id.* fig.4.

87. *Id.* fig.3.

88. Replacement of coal-fired electric with biomass could not achieve short-term carbon dividends; at year 2050 the net cumulative emissions were -3% but at year 2100 reached 19%, and when replaced with biomass, natural gas fired electric would never yield carbon dividends. *Id.*

89. *Id.* at 31–32.

90. *Id.*

91. "At present, landowners in the region typically receive $1–2 per green ton of biomass, resulting in delivery prices . . . around $30 per green ton." *Id.*

92. "The cost structure of thermal and CHP plants and their competition with facilities that use oil and natural gas allow them to pay much higher prices for wood than electric power plants. For

The Study concluded that in Massachusetts, the amount of "incremental biomass," biomass generated solely from logging debris, would contribute minimally to commercial-scale biomass facilities and that the only way to meet higher demand would be through an increase of the annual harvest.[93] In Massachusetts specifically, the Study estimated that the total yearly amount of economically available "new" biomass would be between 150,000 and 250,000 green tons.[94] The Study also indicated that higher prices could potentially increase the biomass supply; however, this would require the price of electricity to also rise because of substantially higher fossil fuel prices or significant public policy shifts.[95] For this reason, the Study also explored the challenges that increased harvesting would have on the health of the forest ecosystem and identified several sustainability issues arising from harvesting forest biomass for electricity generation.

The Study discussed two specific ecological issues related to harvesting: first, the impact harvesting has on soil and its productivity, and second, the impact harvesting has on forest habitat and biodiversity.[96] Most of the potential ecological impacts related to increased harvesting are directly attributable to the removal of living and dead woody material,[97] and therefore they are generally applicable to harvesting regardless of location. Downed woody material (DWM)[98] and its natural accumulation and decomposition in forests is a critical factor for the chemical, physical, and biological attributes of soil and its productivity.[99] The concentration of nutrients and rate of decomposition vary greatly depending on the type of DWM.[100] Furthermore, DWM also plays an important physical role in protecting lands from erosion.[101] Thus, it is impossible to generalize the ecological impacts of biomass harvesting on soil quality and its productivity, but as the Study indicates, the silvicultural choices relating to what and how much of the forest is harvested, along with the methods of harvesting, are very important factors that need to be considered to protect soil.[102]

Increased harvesting directly impacts habitats and biodiversity because standing trees and DWM are a central element of the habitat in forests for

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example, in current markets (assuming oil prices of $3 per gallon), thermal and CHP plants could pay up to $85–$95 per ton of wood . . . and still cover their full cost of capital . . . ." *Id.* at 33.

93. *Id.*

94. *Id.* at 34.

95. *Id.*

96. *Id.* at 63. The study also indicated that the impact on hydrology and water quality is an issue but determined that increased biomass harvesting should not impact water quality because Best Management practices are already in place in Massachusetts. *Id.*

97. *Id.*

98. The Study uses the term "downed woody material" to describe all sizes of downed woody material; however, the U.S. Forest Service classifies woody material based on size: coarse woody material (CWM) is downed dead wood with a small-end diameter of at least three inches and a length of at least three feet fine woody material (FWM) has a diameter of less than three inches; and large woody material (LWM) are logs greater than twelve inches in diameter. *Id.* at 64.

99. *Id.*

100. *Id.*

101. *Id.*

102. *Id.*

many types of species, including vertebrates, insects, plants, fungi, and mosses,[103] with some species relying on DWM for refuge from predation, others for feeding, and others for the nutrients and water contained in the DWM.[104] Thus, the retention of dead wood and standing trees in forests in sufficient quantities and sizes is a vital issue to be considered in the removal of forest biomass.

V. Lessons from the Biomass Sustainability and Carbon Policy Study and Proposal for Policy and Regulatory Change

It is clear that the carbon benefits of replacing fossil fuels with biomass to produce electricity hinge on a complex array of factors, and in order to promote climate change mitigation, regulatory regimes must be designed to account for all of those factors. It is less clear, however, what the best method is for accounting for all of those factors. Accordingly, the legal regime does not yet reflect such "accounting," and therefore, is not promoting the best use of biomass. The bottom line is simple: current renewable energy policies must not promote biomass-powered, stand-alone electricity generation. Recognizing the clear economic and potential environmental benefits of utilizing biomass for energy production, this Paper does not suggest that the energy sector abandon using biomass altogether. On the contrary, it urges policy makers to redesign financial incentives to encourage the use of biomass in the cogeneration sector instead. Thus, states can still amend their RPSs to stimulate other biomass applications, which would minimize the shock to the system. Lastly, generally speaking, legal definitions of biomass must be written in a manner that ensures the environmental health of the air, water, and forests.

A. *Eliminate Federal and State Biomass Electricity Generation Incentives*

According to the Energy Information Administration, state RPS laws are and will continue to be a driving force for biomass development.[105] Yet state level policies are presently unsophisticated (for the most part), and do not take into account the multitude of factors that are determinative of the net beneficial use of biomass. Furthermore, even within suitable regulatory frameworks, it is questionable whether there are adequate regulatory resources to ensure that facilities are complying with those regulations. Thus, Renewable Portfolio Standards should cease the promotion of new biomass electricity generation development. Additionally, as the trend towards conversion of coal to biomass-fired plants continues, policies should ensure that they do not incentivize developer investment in the conversion of coal-

103. In New England, scientists have catalogued at least forty species that rely on DWM. *Id.* at 67.

104. *Id.*

105. U.S. Energy Info. Admin., *AEO2012 Early Release Overview* 7 (2012), EIA.GOV, http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2012).pdf [hereinafter *AEO2012 Early Release Overview*].

fired power plants, which would extend the life of facilities that will not provide GHG benefits.

For many reasons, this will likely be an unwilling change for many states for many reasons, not the least of which is industry opposition. First, as energy demand increases and environmental regulations tighten, many states are turning to biomass to generate electricity. Additionally, like fossil fuels, biomass resources provide "base load" power; thus biomass resources are a popular alternative to fossil fuels and are supplying an increased share of the energy portfolio. Nonetheless, elimination of biomass subsidies will allow cleaner alternatives such as natural gas to meet base load demand.

Currently, another obstacle is that several states rely heavily on existing biomass resources to meet their RPS mandates. Although not a definitive removal of biomass electricity generation incentives, Massachusetts's revised regulations[106] provide a model for states that are looking to amend their RPS in a way to discourage biomass electric facilities. Although the revised regulations do not entirely exclude biomass electricity generation from RPS eligibility, it is discouraged in two ways. First, the regulations require higher efficiency standards for biomass units to qualify for renewable energy credits, and second, the regulations lower the economic value of the biomass energy.[107] In order to qualify for *any* renewable credit, a biomass unit must achieve a minimum of forty percent efficiency overall; at forty percent efficiency, the facility only qualifies for one half of a renewable energy credit per MWh.[108] To receive a full credit, the plant must reach sixty percent efficiency overall.[109] The result is that biomass electricity generation units are effectively prohibited in Massachusetts because neither proposed nor existing facilities can meet these efficiency standards without incorporating additional technology that converts heat waste into useful thermal energy.[110]

Also, in order to account for the deficiencies of biomass electricity generation, existing facilities should be subject to higher standards that can be phased-in over future years in order to give existing facilities time to adapt to new standards while maintaining operations. For example, Massachusetts's draft regulations temporarily grandfather existing qualified units

106. In the midst of uncertainty regarding the implications of biomass energy, the Massachusetts Department of Energy suspended qualification of biomass units pending the Manomet Study and rulemaking. DOER has published a draft of its proposed regulation but, as of April 2, 2012, has yet to issue a final regulation. *See Renewable Portfolio Standard—Biomass Policy Regulatory Process*, MASS. OFFICE OF ENERGY & ENVTL. AFFAIRS, http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/biomass/renewable-portfolio-standard-biomass-policy.html (last visited Nov. 11, 2012).

107. *Id.*

108. Shakuntala Makhijani, *As Massachusetts Limits Biomass in Its RPS, National Debate Continues*, WORLDWATCH INST. REVOLT BLOG (May 18, 2011), http://blogs.worldwatch.org/revolt/as-massachusetts-limits-biomass-in-its-rps-national- debate-continues/.

109. *Id.*

110. *Id.*

until 2015, at which point they are required to meet the higher standards applicable to new units.[111]

All federal incentives for renewable electric energy should also be revised to exclude biomass as an eligible fuel. Arguably, revision of federal law is less contentious than state RPS because there is no inherent dilemma in eliminating federal biomass subsidies, as there is no federal renewable mandate. Specifically, if the most significant subsidy, the Production Tax Credit, is extended past December 2012, it should be revised. Similarly, PURPA should be amended to exclude biomass-qualified small power producers.[112]

B. *Promotion of Biomass Cogeneration*

The stricter standards in Massachusetts shift the demand for biomass to cogeneration applications—applications that are also promoted by state regulations. Although biomass will not be available to satisfy RPS requirements, by shifting biomass demand away from electricity generation and towards cogeneration, policymakers can still promote job creation. Thirteen states provide some sort of incentive for cogeneration units through a variety of models and with varying aggressiveness.[113] For the remaining states that have an RPS but do not promote cogeneration, regulatory change is not out of reach because the RPS is an inherently flexible tool that can and should be reworked in order to accomplish environmental, energy, and economic development goals.

Some states promote cogeneration by permitting efficiency measures to count towards the energy goal. For example, Hawaii's RPS requires fifteen percent renewable electrical energy to be generated in 2015 (and twenty percent in 2020); renewable electrical energy includes electrical energy savings "brought about by the use of energy efficiency technologies,"

111. *See Renewable Energy Portfolio Standard—Class I*, 225 MASS. CODE REGS. 14.00 (proposed), *available at* http://www.mass.gov/eea/docs/doer/renewables/biomass/225-cmr-14-00-050311-biomass-draft-reg-with-tracked-changes.pdf.

112. The focus of this Paper is the legal regime that directly promotes biomass electric development. However, it is important to note the relationship between the federal Renewable Standard and biomass electric development. According to the EIA, the Renewable Fuel Standard is the second driver for biomass development because of the cogeneration of electricity with biofuel refining. *See AEO2012 Early Release Overview*, *supra* note 105, at 7. Furthermore, it is important to recognize the significance of biofuels in the transportation sector because substantial federal funding is being committed to the development of advanced biofuels, bioenergy, and high-value biobased products. Joanna Schroeder, *New Funding for Biomass Research & Development*, DOMESTICFUEL.COM (March 23, 2012), http://domesticfuel.com/2012/03/23/new-funding-for-biomass-research-development/; *see also Initiative*, BIOMASS RESEARCH &DEV., http://www.usbiomassboard.gov/initiative/initiative.html (last visited Nov. 11, 2012).

113. Colorado, Connecticut, Hawaii, Massachusetts, Michigan, Nevada, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Utah, and Washington. *Energy Portfolio Standards and the Promotion of Combined Heat and Power*, U.S. ENVTL. PROT. AGENCY 1 (2009), http://www.epa.gov/chp/documents/eps_and_promotion.pdf [hereinafter *Energy Portfolio Standards*]. Arizona explicitly includes renewable fueled CHP systems but only has a RPS goal, not requirement. *Id.* at 6 n.6. Three states indirectly promote the CHP technology by way of including recycled energy or energy recovery processes as qualifying resources under the RPS; however, the most common form of CHP, electricity led CHP, is excluded from eligibility. *Id.* at 9.

including the "use of rejected heat from co-generation and combined heat and power systems . . . ."[114] Similarly, in North Carolina, municipal utilities and electric cooperatives must meet a target of ten percent eligible energy resources by 2018; up to twenty-five percent of the energy requirements can be met by energy efficiency measures such as CHP.[115]

Other states mandate that a percentage of energy be produced by cogeneration by way of a carve-out or Alternative Energy Portfolio Standard (AEPS). For example, in Connecticut, four percent of total generation must come from Class III sources, including CHP.[116] The Class III carve-out is currently capped at four percent, but the overall target (for all Classes) will continue to increase each year, reaching twenty-seven percent in 2020; thus, despite the mandate, the actual incentive for CHP will gradually decrease in the next decade.[117] Comparatively, Massachusetts law includes an AEPS that requires a minimum percentage of electricity sales to be produced from alternative energy sources including CHP.[118] Unlike Connecticut's carve-out, the Massachusetts AEPS mandate is written to continue promoting alternative energy into the future—one percent in 2009, increasing to five percent by 2020, and a one quarter percent increase each year thereafter, with no stated expiration date.[119]

With renewable development, REC eligibility can have a serious effect on project economics; thus, it is important that these regulations make biomass cogeneration economically attractive to developers. Although there are state level policies in place that promote cogeneration, none of these policies seem to directly encourage biomass cogeneration over natural gas or oil cogeneration. In fact, by virtue of efficiency requirements, some policies actually seem to discourage the use of biomass cogeneration. For example, in Massachusetts, Alternative Energy Attributes[120] are awarded to cogenerators based on overall electric and thermal efficiency.[121] In this scenario, a profit-driven developer will be inclined to build a facility that operates at the highest possible efficiency, cost permitting. As discussed in Section IV, in all cases, natural gas and oil are the most efficient fuels and would trump biomass; thus, by virtue of this incentive, biomass is a loser.

Another feature of RPSs that will be determinative of biomass development is whether statutory requirements reward generation from preexisting facilities. In some states, preexisting facilities do not qualify for

114. *Id.* at 6–7; *see also* HAW. REV. STAT. § 269–96 (2012).

115. *Energy Portfolio Standards*, *supra* note 113, at 8; *see also* N.C. GEN. STAT. § 62-133.8 (2012).

116. *Energy Portfolio Standards*, *supra* note 113, at 6; *see also* CONN. GEN. STAT. ANN. § 16-243q (2012).

117. *Energy Portfolio Standards*, *supra* note 113, at 6; *see also* CONN. GEN. STAT. ANN. § 16-243q.

118. *Energy Portfolio Standards*, *supra* note 113, at 7; *see also* MASS. GEN. LAWS ch. 25A, § 11F1/2 (2012).

119. *Energy Portfolio Standards*, *supra* note 113, at 7; *see also* MASS. GEN. LAWS ch. 25A, § 11F1/ 2.

120. The Alternative Energy Attribute is to the Alternative Portfolio Standard as the Renewable Energy Credit is to the Renewable Portfolio Standard.

121. *Energy Portfolio Standards*, *supra* note 113, at 7.

renewable energy credits, although this is changing. For example, in Washington, the state legislature originally designed the law only to incentivize new development, and therefore excluded biomass facilities pre-dating 1999 from eligibility.[122] However, as a state with an established timber industry, many existing timber mills were not receiving the REC benefits even though they were utilizing their wood waste on-site for energy production.[123] Under the amended law, biomass energy produced on-site by pulp mills is eligible under the mandate, starting in 2016.[124] Although Washington's amended law does not directly promote the development of new CHP, it serves to reinforce a sector already relying on the technology, thus strengthening CHP's foothold in the economy.

At the federal level, PURPA gives biomass cogeneration an advantage over fossil fuel cogeneration by providing an exemption from operating and efficiency standards. Although this is a good start, new biomass cogeneration development should not be promoted without regulatory limits. Such standards need to be designed in a way that encourages development without risking environmental and energy goals. Accordingly, the Federal Energy Regulatory Commission should amend PURPA regulations to eliminate the operating and efficiency standards exemption afforded to biomass cogeneration facilities and should provide sufficient safeguards.

Similar to state level revisions, tax dollars should be shifted away from biomass electricity generation and used instead to promote biomass cogeneration. Cogeneration incentives provided in Section 1603 grants and investment tax credits should be increased and, similar to PURPA, efficiency standards should be tightened. It is especially important that federal incentives only promote the most beneficial use of biomass because a handful of states do not have RPS mandates or goals.

Research shows that the use of biomass can be advantageous economically while being an environmentally advantageous approach to cogeneration, and with appropriate incentives in place, could displace coal. The industry refers to biomass as an "opportunity fuel"—"any type of fuel that is not widely used, but has the potential to be an economically viable source of power generation."[125] Opportunity fuels are typically derived from some sort of waste or byproduct and are generally inferior in one way or another to conventional fossil fuels; however, opportunity fuels can provide a cheap and reliable alternative, and "with the increasing and unstable prices of fossil fuels, and the need for more environment-friendly energy sources, are likely to gain in market share."[126] A study conducted for the U.S. Department of Energy (DOE) examined the current status, technology, economics, market conditions, and environmental issues associated

122. *Id.*

123. *Washington State Plan Extends Renewable Energy Law*, CBS NEWS (March 8, 2012) http://www.cbsnews.com/8301-505245_162-57393226/washington-state-plan-expands-renewable-energy-law/.

124. *Id.*

125. Res. Dynamics Corp., *Combined Heat and Power Market Potential for Opportunity Fuels* 1-1 (2004), http://www1.eere.energy.gov/industry/distributedenergy/pdfs/chp_opportunityfuels.pdf.

126. *Id.*

with twenty opportunity fuels and identified six biomass fuels as having a high cogeneration potential, including forest residues and wood waste.[127] That is because in most applications, "the wood [or wood waste] is dried, cut into chips, and transported to a boiler, where it is burned to produce steam that powers a steam turbine/generator."[128]

Wood fuel is an attractive opportunity fuel only when the cost is less than the fuel being replaced on a BTU (British Thermal Unit) basis.[129] Currently, the majority of solid wood energy consumption takes place in on-site cogeneration applications, primarily in the lumber processing, pulp, and paper industries.[130] Because these industries have a "free" and secure fuel source, they can meet on-site thermal and electric power demands with their own wood waste.[131]

While wood waste is ideal for wood and paper processing industries, outside customers also purchase wood fuels produced from forest residues, urban wood waste, or excess lumber waste.[132] Generally speaking, wood waste is cheaper per ton than coal, but the cost of the technology and the maintenance of wood systems is typically much higher than coal.[133] Transportation costs can also make wood fuels uneconomical for outside consumers; thus, the cost is most beneficial when the user is close to the source.[134] According to the DOE study, if the right incentives are offered and an infrastructure was developed, wood waste could potentially replace coal in many cogeneration applications.[135]

C. Legal Definitions that Ensure the Environmentally Safe Use of Biomass

Regardless of the application, the use of biomass fuels can have severe negative environmental consequences if not adequately regulated. All incentives promoting biomass must be written in a way that recognizes and minimizes the potential adverse environmental impacts. For example, urban wood waste can be highly contaminated if it is painted or pressure treated, and if combusted, will release those contaminants into the air; legal definitions of biomass should either exclude urban wood waste or require that contaminants be removed prior to burning. Currently this exception is included in the federal incentive language, but only a handful of state RPSs make this specific exception.[136]

As indicated by the Manomet Study, forest biomass is plentiful and an increasingly popular energy resource that can pose a severe environmental

127. *Id.* at 2-1.
128. *Id.* at 2-22.
129. *Id.* at 5-9.
130. *Id.* at 2-23.
131. *Id.*
132. *Id.*
133. *Id.* at 5-10.
134. *Id.* at 2-23.
135. *Id.* at 5-9 to 10.
136. 26 U.S.C. § 45(c)(3)(A)(ii)(II) (2006).

threat if not properly regulated. The DOE study indicates that, unlike wood waste, the use of harvested wood in cogeneration applications is not likely to be successful unless government incentives are offered because the cost is so high.[137] Accordingly, it is extremely important that any policies that incentivize forest biomass harvesting incorporate standards to prevent adverse impacts on forest health, the forestry products industry, and the role that forests play in carbon sequestration. Such standards should limit the amount of forest-derived biomass to ensure that fuel removal is consistent with sustainability principles, ensure soil quality and biodiversity, and preserve forest stands to the extent that they effectively store carbon. Moreover, if designed appropriately, such standards can also advance the industry and overall health of forests by encouraging consumption of woody biomass that would otherwise threaten forests by way of forest fires or pest infestations.

Practically speaking, legal definitions of biomass should not be carbon copies of each other. But it is important that definitions are adequately specific and consistent so as to prevent regulatory loopholes. Federal laws, notably PURPA, should be amended so they define biomass consistently. Because biomass is a geographically limited resource, state laws should be narrowly tailored to protect individual regional resources. Moreover, federal definitions should require that applicable state standards, such as harvesting guidelines, be met.

VI. CONCLUSION

The documented climate, health, and environmental impacts of biomass electricity generation are at least comparable, if not worse, than fossil fuels. The Manomet Study is only one of many studies that deflate the myth that biomass is "carbon neutral"—a myth that has both distorted international, federal, and state laws and policies for decades and has allowed biomass-generated electricity to claim renewable energy status.

Biomass generation development is booming. The Energy Information Administration predicts it will increase four-fold by 2035.[138] Thus, it is pertinent that energy policy promotes the best use of biomass by acknowledging all of the costs. Yet the science is not fully developed on how best to account for the costs and benefits of biomass generation, and specifically, the carbon benefits of replacing fossil fuels with biomass. Accordingly, the legal regime cannot possibly incentivize biomass electricity generation while truly promoting environmental and climate goals. The Manomet Study shows, however, that biomass can effectively be utilized in another capacity. By promoting the use of biomass for cogeneration, legal policies will minimize the carbon emissions associated with bioenergy and simultaneously continue to benefit both the economy and the environment.

137. *Id.*

138. *AEO2012 Early Release Overview*, *supra* note 105, at 1. This prediction includes biomass used in industrial combined heat and power applications, advanced biofuels cogeneration, and the power sector.

As Massachusetts Governor Mitt Romney noted in introducing the 2004 Massachusetts Climate Protection Plan:

> The same policies that protect the climate also promote energy efficiency, smart business practices, and improve the environment in which our citizens live and work . . . . Although many of the policies will not be easy to implement, the benefits will be long-lasting and enormous—benefits to our health, our economy, our quality of life, our very landscape.[139]

139. *Massachusetts Climate Protection Plan*, COMMONWEALTH OF MASS. 3 (2004), http://www.newamerica.net/files/MAClimateProtPlan0504.pdf.