

Fuels for Schools

Initiative Summary: Increase the state’s utilization of carbon-neutral, biomass-based energy production on the community level through biomass heating systems. This can be accomplished via the work and coordination of the Pennsylvania Fuels for Schools and Communities (Fuels for Schools) working group or similar initiatives.¹ The Fuels for Schools working group is focusing on using wood residues and warm-season grasses to displace heating oil in schools, hospitals, other institutions, and commercial and industrial boilers/furnaces.

In developing these projects care is needed to ensure that the harvesting of wood biomass for this and F-9 is done in an ecologically sustainable manner, and that we account for availability of timber resources for other purposes, both of which are addressed through the discounts applied to the total availability figure.

Goal:

- Implement biomass heating systems at 50 schools, institutions or commercial businesses in Pennsylvania by 2020. While the focus of these projects is on wood chips it could alternatively include warm season grasses, such as switchgrass. At least two such projects have already begun operation in PA. These biomass heating systems will maximize, within the limits of resource sustainability, local, highly efficient installations that significantly benefit PA manufacturing jobs, trades workers and those involved processing and supplying the fuel.

Implementation Period: 2013–2020

Possible New Measure(s):

Increase the number of community-based and district-scale energy initiatives that reduce net carbon emissions through the utilization of forested woody biomass and other clean wood source material. This can be accomplished through:

- Providing state leadership to encourage these facilities as part of an energy independence strategy;
- Providing technical assistance to communities on project design and development and biomass procurement;
- Providing access to capital financing for the development of such projects; and
- Addressing policy issues needed to ensure adequate and affordable procurement of biomass material for these projects.

Utilization of woody biomass for small-scale electric and thermal production is a proven technology. The forest products industry is the nation’s largest source of renewable biomass energy, generating 80% of the nation’s biomass energy output. Paper and larger wood product companies generate an average of 65% of their energy needs from carbon-neutral biomass, mostly woody mill residuals.

A large group of locally financed small projects spread widely across the Commonwealth could capture the value of replacing high-cost fuel imports and gain carbon benefits while limiting transportation costs of the feedstock. This model has been shown to allow displacement of significant quantities of current or projected fossil carbon release from a broad range of users—including industry, public institutions, commercial offices, and even multi-family buildings.

The Pennsylvania Fuels for Schools working group is the catalyst for promoting community-based initiatives across the Commonwealth. Other initiatives are being driven by local communities and dedicated private citizens.

¹ Pennsylvania Fuels for Schools <http://www.pafuelsforschools.psu.edu/>

Data Sources/ Assumptions/ Methods:

In 2008, the Pennsylvania Fuels for Schools working group surveyed school districts throughout Pennsylvania to evaluate and quantify the desire to install heating systems fired from sustainably available wood residues. The results of that survey indicated that 52 school districts with 415 buildings were interested moving forward with some type of biomass heating system.

With the detailed energy data from each school district, it has been calculated that the fossil energy demands for heating these buildings can be offset by approximately 154,000 tons of sustainably-sourced wood chips. The working group is establishing a plan to prioritize assistance with each of these school districts. Within the context of this, the DEP and Pennsylvania Energy Development Authority (PEDA) have previously provided financial assistance, via grant programs, for the installation of several new systems. In doing so, these grants placed an emphasis on energy efficiency of buildings prior to consideration of funding.

The displacement of the fossil fuels with wood to heat these buildings would result in an annual reduction of 0.11 MMtCO₂e in 2020. Though biomass is widely assumed to be carbon neutral in its life cycle, greenhouse gas emissions associated with the combustion of wood chips were included in the analysis because given the short time frame under consideration the biomass-related GHG emissions would not have been offset by re-growth. That said, it is also important to note that wood chips used as fuel come from many sources, including waste wood such as old pallets but that even those chips originating from tree trimmings and forest thinning are the resultant residues from other primary industries such as timber operations, sawmill residues, etc. As such the appropriateness of completely associating these GHG emissions with a secondary or tertiary end use may be highly questionable. It is also noteworthy to recognize that this analysis does not consider or account for indirect life cycle GHG emissions that may result from transportation of the wood or other aspects, consistent with the analyses of all of the work plans in this action plan report.

The greenhouse gas reductions are based on calculations from the results of the Fuels for Schools survey. The survey results provide detailed information regarding the heating systems of each school, including the boiler age, fuel type and quantity used, square footage of buildings heated, etc. The surveys were used to prioritize technical assistance and outreach. Calculations were made to estimate the equivalent volume of wood or other biomass resources that would be necessary to replace these older boilers with biomass boiler systems. These calculations assumed an energy content of 12.04 million Btu per ton of wood chips at a moisture content of 30%.

Methodology:

This quantification is based on implementing wood-chip-based heating systems at 50 schools through the end of 2020. Table 1 illustrates the number of installations per year and the associated emissions reductions from achieving this initiative. Actual data reported on the Fuels for Schools survey was used to determine an average heating load from which, GHG reductions could be calculated. The analysis considers the displacement of heating oil-only systems.

Table 1. Emission Reductions Associated With Implementation of Fuels for Schools

Year	Number of Installations	Cumulative Number of Installations	Heating Consumption (MMBtu/heating season)	Emissions From wood (tCO ₂ e/year)	Avoided Fossil Fuel Emissions (tCO ₂ e/year)	Net Avoided Emissions (MMtCO ₂ e/year)
2013	5	5	13,799	43	1,114	0.001
2014	5	10	27,599	85	2,227	0.002
2015	6	16	44,158	137	3,563	0.003
2016	6	22	60,718	188	4,899	0.005
2017	7	29	80,037	248	6,458	0.006
2018	7	36	99,356	307	8,017	0.008
2019	7	43	118,676	367	9,576	0.009
2020	7	50	137,995	427	11,135	0.011
Cumulative Totals	50	50	38,473,344	1,801	46,991	0.045

MMBtu = million British thermal units; tCO₂e = metric tons of carbon dioxide equivalent; MMtCO₂e = million metric tons of carbon dioxide equivalent.

Economic cost:

Capital costs for these systems are based on average data collected by DEP from systems that have been financed by the Commonwealth in recent years. The net economic benefit associated with fuel switching is the difference between the cost of wood chips and the avoided cost of the heating oil that is replaced. In this analysis, no change in annual operating and maintenance costs was assumed, because typically the existing maintenance staff can accommodate the new wood chip technology. Also, no difference in operational system efficiencies was assumed.

Capital costs were estimated to be \$1.24 million per installation based on average data for varying system sizes installed in Pennsylvania. Assuming a 30-year boiler lifetime, annualized capital costs per plant were thus \$41,441. The cost of wood chips is \$40 per ton, based on current prices and recommendations by members of the Fuels for Schools working group. Results of the economic cost analysis are shown in Table 2. The difference between the fuel costs is an important driver of the cost-effectiveness of this option, and leads to a net economic savings in all years of implementation. The net present value (NPV) of this option in \$2010 is -\$366, with a levelized cost-effectiveness of -\$86.79/ tCO₂e reduced.

Table 2. Economic costs of implementing wood chip heat at 20% of PA schools

Year	Cumulative Number of Installations	Annualized Capital Costs (\$/ year)	Annual Heating Oil Consumption (Gallons)	Annual Heating Oil Cost	Wood Chip Consumption (tons)	Cost of Wood Chips (\$)	Net Economic Cost (\$Million)	Discounted Cost (\$2010) (\$Million)	Cost Effectiveness
2013	5	\$207,203	278,000	\$828,565	\$3,198	\$127,917	(\$0.49)	\$ (0.43)	\$ (398)
2014	10	\$414,406	556,000	\$1,754,591	\$6,396	\$255,834	(\$1.08)	\$ (0.89)	\$ (417)
2015	16	\$663,050	889,600	\$2,930,763	\$10,233	\$409,334	(\$1.86)	\$ (1.46)	\$ (425)
2016	22	\$911,694	1,223,200	\$4,095,583	\$14,071	\$562,835	(\$2.62)	\$ (1.96)	\$ (415)
2017	29	\$1,201,778	1,612,400	\$5,510,646	\$18,548	\$741,918	(\$3.57)	\$ (2.53)	\$ (408)
2018	36	\$1,491,863	2,001,600	\$6,868,108	\$23,025	\$921,002	(\$4.46)	\$ (3.02)	\$ (391)
2019	43	\$1,781,947	2,390,800	\$8,300,844	\$27,502	\$1,100,086	(\$5.42)	\$ (3.49)	\$ (379)

2020	50	\$2,072,032	2,780,000	\$9,739,567	\$31,979	\$1,279,169	(\$6.39)	\$ (3.92)	\$ (366)
Cumulative Totals	50	\$8,743,974	11,731,600	\$40,028,667	\$134,952	\$5,398,095	(\$25.89)	\$ (17.70)	

Implementation Steps:

- Provide state leadership to encourage development of these projects as part of an energy independence strategy by maintaining the Pennsylvania Fuels for Schools and Beyond Working Group.
- Provide technical assistance to communities on project design and development and biomass procurement
- Address policy issues needed to ensure adequate and affordable procurement of biomass material for these projects
- Continue to or increase funding for capital financing programs through the Commonwealth.
- Facilitate communication between the school districts and USDA Rural Development regarding possible financing and other assistance programs.

Potential Overlap:

None