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BERC
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Biomass Energy Resource Center

BIOMASS ENERGY:
Efficiency, Scale, and Sustainability

Energy supply and use is a national priority and a major focus of national, state, and local policy makers across the United States. The impacts of climate change and the need to increase energy efficiency, reduce reliance on foreign oil, and address related international security threats are some of the issues driving the need for a new national energy policy and practice.

Biomass energy, harvested from the nation's lands and forests, has the potential to provide an important source of renewable, sustainable energy for the country. To develop this important energy sector successfully, however, public policy can play a critical role in addressing issues of scale, efficiency, biomass supply, environmental impacts, local economics, harvesting capability, and investment and financing. Using biomass for energy in ways that sustain the health of the nation's lands and forests and creates robust and resilient energy economies depends on several critical factors:

Efficiency. Used for heat or heat-led combined heat and power (CHP), biomass energy is approximately 75-80 percent efficient, while generation of electricity is only 20-25 percent efficient, and conversion to liquid fuels for transportation applications are even less efficient overall. This is true regardless of the type of fuel used—be it biomass, coal, or oil—but is a critically important factor when considering the sustainability of using biomass for fuel. Nevertheless, to date, national renewable energy policies have ignored thermal energy and focused on directing biomass energy into electric generation and transportation fuels, a direction that has the potential to overtax the energy potential of our country's wood resource, while diminishing its potential benefit, and raising issues of sustainable supply.

Scale. Biomass is a diffuse resource, growing over dispersed areas. Use in large central facilities requires consolidation and transportation of fuel over greater distances that can reduce the overall efficiency of the resource. The most energy efficient use for biomass in general is thermal energy at the community scale, where local wood resources are produced and used to provide local energy, fueling the local economy, and at heat-led CHP operations of a scale that can be accommodated by the resource. Directing biomass into appropriately scaled applications such as heat (or CHP) for schools, hospitals, office buildings, college campuses, and district heating systems is essential for creating a wood-energy economy that is flexible and resilient over time. Biomass also has the potential for high efficiency use at industrial applications that are large heat and electricity users. Producing biomass through an array of appropriately scaled and local chip and pellet plants is also a critical component of a wood-energy supply chain and a dynamic and resilient local wood-energy economy.

Sustainability. Sustainability of the biomass resource depends on wood and agricultural supplies on a macro level as well as harvesting methods and infrastructure. It also must be advanced in the context of air quality and climate change objectives:

- **Wood Supply.** Sustainable development of the country's biomass resource for energy depends on understanding the capacity of our forests and agricultural lands to supply biomass while preventing over-harvesting and associated ecological and economic consequences. It is essential to provide an accurate and ongoing assessment of the amount of low-quality woody biomass available from forests for energy on a sustainable basis that supports long-term forest health, soil productivity, water quality, wildlife habitat, and biodiversity.
- **Sustainable Harvesting.** In many instances, previously developed best management practices did not anticipate the increased removal of biomass associated with the expanded biomass energy industry and offer mixed guidance on the amount of removal that is consistent with long- term forest health and productivity. What are the long-term

nutrient cycle and soil productivity implications of expanded biomass harvesting? What types of forest and agricultural "biomass" will emerging markets prefer? Will biomass energy markets compete for traditional timber products or will they target previously un-merchantable forest biomass such as tops, branches, and even stumps? A review and update of harvesting standards is important to ensure sufficient post-harvest retention of fine and course crop and woody debris, standing and down dead wood for wildlife, biodiversity, and site productivity. In addition to harvesting standards, biomass fuel procurement guidelines for public and private facilities are important to ensure a sustainable supply chain.

- **Harvesting Infrastructure and Capacity.** While there are concerns about the ecological sustainability of biomass harvesting, there are also concerns about the sustainability of the harvesting infrastructure and workforce that will be needed to reliably supply wood fuels to markets. Strong, reliable, and local markets for low-grade wood such as wood fuel are essential to help keep a reliable supply chain intact.
- **Emissions.** Energy derived from biomass energy must minimize emissions and meet or surpass stringent public health and air-quality standards. Biomass energy projects should implement efficient combustion technologies and best management practices for emission control technologies, fuel quality, and operating conditions.
- **Climate Change.** Use of biomass for energy-efficient and appropriately scaled applications has tremendous potential to displace fossil fuels and, over the long term, lower atmospheric CO_2 emissions. Biomass energy used in this manner is a "low-carbon fuel," and, integrated with the sustainable fuel supply, has the potential to be a net carbon sequestering option, even when considering the fossil fuels used in production and transportation of wood fuel and agricultural production. The degree to which biomass energy systems can reduce carbon emissions compared to fossil fuels is directly related to establishment and management of harvesting regimes, forest types, fuel transport, and efficiency. National carbon sequestration and reduction policies such as carbon cap and trade regulations and voluntary carbon standards will also have an impact on forest management and agricultural decisions regarding carbon storage, forest adaptation, production of biomass for energy, and harvesting of traditional wood products. Policies must be put in place that optimize carbon storage, adaptation potential, biomass used for energy, and the harvest of traditional products.

Public Policy Recommendations for Efficient Biomass Energy

1. Develop a **National Thermal Energy Policy** that includes the following elements:
   - A Renewable Thermal Standard (comparable to the existing Renewable Fuels Standard and proposed Renewable Electricity Standard)
   - National and state carbon policies and greenhouse gas emissions programs that support the most efficient thermal uses of biomass
   - Federal and state incentives, grants, and loans to advance the utilization of high efficiency biomass thermal systems
   - Renewable Portfolio Standards that include thermal energy, provision of renewable energy credits for thermal applications and that promote efficient use of biomass
2. Fund and conduct accurate and ongoing assessments of sustainable biomass energy supply
3. Support biomass harvesting standards, sustainable forest management, and procurement guidelines to ensure a sustainable supply chain for timber and other biomass harvesting activities
4. Support harvesting and management infrastructure—including policies that encourage and promote the long-term economic viability of the supply chain to ensure forestry and logging capacity—and sound land stewardship and management practices necessary to ensure low-grade wood resource availability for sustained biomass energy use over the long term
5. Establish consistent federal and state air emission standards and regulations for biomass energy to minimize emissions and meet stringent public health and air-quality standards
6. To support the ability of biomass energy to help reduce climate change, support forest conservation efforts, provide offset credits and other incentives for increased carbon sequestration and storage, and address forest adaptation due to changing climate

Adopted by the BERC board of directors on August 14, 2009.