Office of Science and Technology Policy
Request for Information: Building A 21st Century Bioeconomy

Dear OSTP,

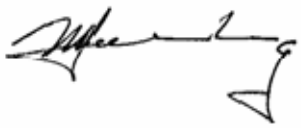
The Biomass Coordinating Council (BCC) would like to submit this document in response to the OSTP Request for Information: Building A 21st Century Bioeconomy.

The BCC is a Program of the American Council On Renewable Energy (ACORE), a 501(c)(3), non-profit organization based in Washington, D.C. The BCC has over 130 members and biomass stakeholders, including private sector biomass companies, trade organizations, universities, non-profits, financiers, and law firms. The BCC works to accelerate the adoption of renewable biofuels, bio-power, biothermal, biogas and bio-based products into mainstream American society through work in policy initiatives, convening, networking, and communications.

In working with our members, the BCC has prepared the responses below at the request of OSTP.

For questions or additional requests, please contact Taylor Marshall, BCC Program Director at marshall@acore.org or 202-507-4632.

Sincerely,



Bill Holmberg
Chairman, BCC

Taylor Marshall
Program Director, BCC

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(1) Identify one or more grand challenges for the bioeconomy in areas such as health, energy, the environment, and agriculture, and suggest concrete steps that would need to be taken by the Federal government, companies, non- profit organizations, foundations, and other stakeholders to achieve this goal.

To create the bioeconomy of the future, the United States must commit to something similar to a Sustainable Industrial Revolution (SIR), embracing many of the concepts and technologies advocated by Jeremy Rifkin's Third Industrial Revolution, Amory Lovins' Reinventing Fire, and scores of books and major pronouncements calling for dramatic redirections of our society.

The backbone of the envisioned SIR is the full range of biomass industries: Food, Feed, Fiber, Fuel, Fertilizers and Feedstocks for chemicals/bio-based products – the 6 Fs. Readily available and sustainable biomass resources in all forms are critical in meeting the full range of potential needs of the 6Fs. There is no question about major opportunities for affordable biomass, the availability of commercialized or advancing technologies, the creativity to develop new uses, and the need to replace fossil fuels to reverse the build-up of greenhouse gases.

Restraints are manifested in ineffective land use, poor soil vitality and water shortages. There are good models in Europe and elsewhere. New York City is developing a custom declaring that if "you can see dirt, plant something." Parks and gardens, including roof top gardens and greenery, are increasingly being used as means to limit storm water run off, increase the efficiency of wastewater treatment plants, and moderate temperatures in cities. These and other measures should be priorities in boosting the production of biomass, increasing the vitality (and CO_2 absorbing capability) of the soil and using water more effectively.

These are the challenges to the scientific community, as well as to better recognize the contributions of nature (microbes, earth worms, dung beetles, compost, etc.) and the protection of wildlife that should be orchestrated by OSTP.

These biomass industries harbor three building blocks to the SIR. They are:

1. "Reindustrialization" of America through the sustainable modernization of cities and towns, and the sorely needed development of a comprehensive infrastructure serving the nation;
2. Creation of "New Wealth," with major economic and job creating multipliers, by focusing on the use of natural resources (extracted and sustainable, provided by nature at no cost thereby generating New Wealth, as opposed to service industries that rely on New Wealth or money mostly borrowed by the U.S.); and,
3. Creative collaboration between the extractive industries (using oil, gas, coal, minerals, metals, etc.) and sustainable industries (involving agriculture, forestry, all the renewables [solar, wind, biomass in all forms, hydro and water power, geothermal, and renewable hydrogen]), energy efficiency, recycle/reuse, and human creativity (built upon education, the driving power of an enlightened society).

Creative collaboration between the extractive and the sustainable industries is absolutely essential to overcome or bypass the many obstacles forged by malfunctioning governmental and financial institutions, too often responding, in an unenlightened/unsustainable way, to the power of paper and digital money.

Although reindustrialization is initially envisioned as the production of important products for the home and international market, it is critical to look beyond conventional living and to start restructuring our way of life – a sustainable way of life. In doing so, we must understand the importance of generating New Wealth and job creation focusing on the use of natural resources. Too often, we focus on "products" – important or just sellable. Instead, we need to focus on homes, buildings, streets, roads, highways, bridges, railroads, mass transit, etc. They are all mostly made from natural resources; they generate New Wealth with major economic multipliers and create jobs – and are essential to our future.

When the generation of New Wealth is well balanced and our financial and governmental systems are in order, we can maintain the most powerful military in the world, assist other nations, provide services needed by the populace to maintain order, deal with fire and other emergencies, offer quality health care and education, and reduce poverty along with our national debt.

Modifying and tweaking the current system will simply take us further into debt and consternation.

We need to aggressively turn to rebuilding our municipal areas, cities, towns, and our infrastructure – and our countryside with all of the externalities fully in mind (health care, climate change, education, order, natural systems, etc.) with the industriousness, commitment, and integrity essential to the times. The following sections detail this reindustrialization more specifically.

Biomass to the Rescue

Every city, town and community needs food. There is a rising movement to grow food locally. This can be done in schoolyards, backyards, rooftops, communities, greenhouses, window boxes, etc, and on local farms, using organic practices when appropriate. This is being reinforced by understanding that processed foods containing excess fats, sugars, and salt are causing obesity and other health problems, whereas fresh fruits and vegetables improve health. In cities, this is reinforced by the planting and maintaining of trees, plants, flowers, and other growing things to reduce storm water run off, moderate temperatures, provide beauty and comfort, and reinforce the human/natural systems relationships – and grow more biomass for the 6Fs while absorbing more CO_2.

Biomass should be planted, grown and nurtured on lands that are contaminated, misused or underutilized involving optimized land management, soil vitalization, and water conservation. We must recognize that biomass is the basis for all three of the major carbon sequestering sectors – soil, biomass, and the oceans (through preventing run off by wetlands, watersheds, and riparian buffers). Biomass in all forms – food, feed, fiber, fuel, fertilizers, and feedstocks for chemicals/biobased products – are major business for domestic and international markets as well as big job-producing industries that lend themselves to small, community-based operations).

Experiential Education

Experiential education should begin in preschool and continue into K-12. Classes and activities will incorporate growing gardens in school yards, back yards, communities, roof tops, greenhouses, and window boxes; and, trees, bushes, and grasses would be planted and cared for wherever possible to beautify, shelter, save/produce energy, enhance the environment, and save water while reducing carbon footprints. Appropriately-scaled, wind, solar, geothermal (ground water heat pumps) technologies and energy efficiency, would also be incorporated; along with a good understanding of conventional forms of energy – oil, gas, coal, nuclear, etc – and their importance. The concept is to incorporate hands, eyes, minds, work, sharing/giving, and emotions into the study of reading, writing, arithmetic, science, social studies, etc. Physical involvement and creativity would produce food to eat and greenery to enjoy while understanding the benefits of good diets, and how to use and create methods and technologies to serve school, family, community, and country.

Prisons, Veterans, and Biomass

Prisoners working, learning, and being trained in conservation camps (along the lines of the Civilian Conservation Camps) instead of in jails and prisons will save an enormous amount of public funds, reduce recidivism, and build character; with workers benefiting from the therapeutic effects of outdoor living and working with natural systems. Veterans, with leadership skills and dedication to country can be retrained to lead in these nation-building (humans and nature) efforts.

Veterans and biomass can be combined to accelerate our race to the future bioeconomy. In the U.S., the farming population is aging, but the cost of land and equipment are major deterrents for startup conventional agricultural enterprises. However, there will be a plethora of opportunities stemming from modern science and technology to place veterans and their families in the food and energy business. School yard, backyard, roof top, community-based gardens; greenhouses; small biogas, biofuels, and composting operations; smaller solar and wind projects as well as ground water heat pumps; holistic farming and gardening; and many other connected opportunities are emerging to provide "hortatherapeutic" and financial opportunities for veterans and their families.

Transportation

The United States is primarily focused on over-the-road vehicles, planes, and trains (primarily for cargo – metros for passengers). Internal combustion engines and fossil fuels (with the emergence of alternatives) dominate our transportation sector. Fortunately, revolutionary changes in both engines and alternative fuels are underway. Ethanol and biodiesel have provided the foundation for alternative fuels in the U.S., producing over a million barrels of gasoline equivalent a day. Additionally, the biofuels industry is transitioning to waste streams, cellulosic materials, and algae. The efficiency of growing and converting grains and oil seeds to biofuel continues to advance at a steady pace. Distiller's grains, subject to cooking, enzymatic treatment, and high temperatures, more easily passes through the rumen of monogastric animals, leaving more energy for weight gain – a boost in efficiency in the production of ethanol from grains.

Tangentially, automakers are being required to advance existing technologies and pursue breakthroughs into new engine concepts to meet increasing mileage standards. This routinely requires higher compression ratio engines and higher octane fuels. Also, because of diminishing oil reserves, which are concentrated in nations not favorably inclined to the U.S., there are pressing requirements for more domestically-produced, efficient and cleaner burning, higher-octane transportation fuels.

After lead and then methyl tertiary butyl ether (MTBE) were banned, refiners turned to aromatics (BTX – benzene, toluene and xylene) at about 24% and ethanol at 10% to meet octane needs of today's vehicles. Depending on the cost of their respective feedstocks – oil/tar sands/oil shale; and corn for the near term and cellulosics/algae into the future – the cost between BTX and ethanol to the public should be roughly comparable. Therefore, national/energy security, environmental and healthcare costs should be the determining factors. BTX will mostly come from imported oil; ethanol is produced here at home. BTX is fossil based; ethanol is renewable, with a routinely smaller carbon footprint. In addition to comparably more ozone precursors in emissions from the combustion of BTX, there are also the most troubling ultra fine particulates (UFP). These minute bits of solid carbon coated with PAHs and quinones enter into the bloodstream through the lungs of people, particularly those living in high traffic congested areas. This is particularly alarming when these coated UFPs pass into the blood stream from a mother to the fetus causing disruption in genetic codes leading to diseases like asthma,

autism, cancer, and other dangerous maladies. It has been reported that UFP lead to about $100 billion a year in added health care costs.

Dr. Eddie Sturman, president of Sturman Industries, is advancing the internal combustion engine to a revolutionary stage. He is convinced that biofuels are the fuels of the future, with levels of efficient to fully offset the BTU content of ethanol (76,000 BTU versus 120,000 for gasoline). Ethanol is not toxic, with much cleaner burning and essentially little or no UFP.

Although higher levels of ethanol (say 30% to meet the octane needs of advanced engines while reducing evaporative emissions) somewhat increases aldehyde emissions, they are of little consequence compared to the deadly emissions of BTX. There is sufficient scientific information available to verify this information. What is needed now is a massive public information campaign to alert the nation to the economic, national/energy security, environmental, and public health choices now before the government and the congress in meeting the octane needs of the transportation sector.

Status quo transportation fuel advocates will claim the need for more information. Others state that there is more than enough data to justify corrective action by the EPA. The great importance of this issue warrants action based on existing facts, rather than more delays that seriously threaten our public health, national/energy security, our economy, and our environment. A recent Wall Street Journal article (November 8th, 2011) has shed light on the issue. There are floodlights of available information that must now enlighten the American people.

Federal Establishments Leading the Charge

The Department of Defense has made great strides in incorporating renewable energy into their operations, and their optimization of land for the production of biomass for biopower, biofuels, and other products can serve as a model for other sections of the US government. Their major contribution is their commitment to a cultural change that incorporates energy, humans, power and weapons systems as a top, interlocking priority.

The Sustainable Industrial Revolution is the vision for the bioeconomy of the future. Below, we have listed several other examples of specific steps that can be taken to accelerate the bioeconomy of the future.

(2) Constrained Federal budgets require a focus on high-impact research and innovation opportunities. With this in mind, what should be the Federal funding priorities in research, technologies, and infrastructure to provide the foundation for the bioeconomy?

Although a portfolio of solutions will be necessary to update our degraded, inefficient, and unclean transportation sector, "drop-in" fuels made from renewable biomass that can integrate with the existing energy infrastructure represent a particularly high-impact research area.

Research that aims to utilize, value, and care for our carbon / our resources most effectively would create the most impact by building a new foundation for the bioeconomy of tomorrow on the lessons learnt through our long agricultural history. For example, a national panel led by Iowa State University is launching an effort to research and develop technologies that capture, use and sequester carbon while enhancing food production, ecosystems, economic development and national security. A parallel effort should be increasing research and data analysis to determine the efficiency of replacement, minerals, microbes, macrobes, compost, and biochar to vitalize soil.

(5) What are the barriers preventing biological research discoveries from moving from the lab to commercial markets? What specific steps can Federal agencies take to address these shortcomings? Please specify whether these changes apply to academic labs, government labs, or both.

Allow government researchers, individually or in concert, to continue their lab work after hours to engender a private enterprise. In addition, the House has passed legislation (The Entrepreneur Access to Capital Act; H.R. 2930) to provide funds to support crowd-endorsed research and business start-ups. The legislation "creates a crowd funding exemption from SEC regulations for firms raising $5 million, with individual investments limited to $10,000 or 10 percent of an investor's annual income, whichever is lesser." Anything that the white house could to keep crowd financing from being prohibitively expensive could greatly aid technology in crossing over the first "valley of death" and into pilot stages. Bioenergy and biomass technologies, in particular, could benefit because many can be tested and implemented at a lower cost than non-biological projects.

(6) What specific changes to Federal Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs would help accelerate commercialization of federally-funded bioeconomy-related research?

The use of such investor funding criteria as listed below would accelerate commercialization:

•*Proof of concept*

–It is essential to have clear evidence of proof of concept on a pilot or demonstration scale 10% of full scale for example (as opposed to just lab scale)

–Investors ask about key performance metrics – yield, productivity, etc. – and how close current figures are to commercially required levels

•*Roadmap to profitability*

–Investors expect to see a credible and transparent roadmap to production scale-up and ultimately positive cash flow and profitability

–This entails, among other things, adequate detail on: (1) target production economics; (2) cost of capacity expansion and how it will be funded; and (3) timing of scale-up and cost reduction plans

•*Strategic partners*

–Industry partnerships serve one or more of these purposes: (1) direct financial support for capacity expansion; (2) off-take agreements; and, in a more intangible sense; and (3) "a blue chip seal of approval"

–Given that partnerships can also limit room to maneuver, investors should ask about exclusivity provisions in partnership agreements

•*Access to feedstock*

–If it is conventional feedstock, can it be obtained at preferential pricing, and are long-term supply contracts a viable option?

–If it is cellulosic feedstock, is the pricing structure clear?

(7) What high-value data might the government release in the spirit of its open government agenda that could spur the development of new products and services in the bioeconomy?

The biomass industry faces a major challenge over issue of indirect land use change (ILUC). More ILUC information can heighten sustainable practices in the biomass industry while informing the public about realistic, not uncertain and alarmist, environmental impacts. The following statement is from an ORNL/CBES workshop report: "In most cases, the uncertainty in the land-use databases themselves is tremendous. For example, differences between baseline measures for the same time and place in different databases may be larger than the observed changes. Therefore, the quality of input data to scenario studies is an issue of considerable importance, because it could have a potentially large effect on the scenario outcomes. To complicate the situation further, some data sets necessary for validation are available only at high cost, some are not publicly available, and the most useful information, such as causal factors of deforestation, simply has not been collected."

(8) What are the challenges associated with existing private-sector models (e.g. venture funding) for financing entrepreneurial bioeconomy firms and what specific steps can agencies take to address those challenges?

Existing private-sector models of venture funding typically seek to maximize financial profits and return on capital in contrast to forms of social and environmental entrepreneurship pursuing a triple bottom line (with people, planet, profits or economic, social, and environment as criteria) or "entrepreneurship in service of the whole" which seeks to realize a quintuple bottom line by growing natural, social, economic, cultural, and spiritual capital. A thriving entrepreneurial bioeconomy fundamentally requires

entrepreneurs and their financiers to commit to a triple, or better yet, a quintuple bottom line thereby addressing the fundamental and systemic failures of an economic system which usually excludes the bios, or that which gives life and sustains us. The challenges of financing an entrepreneurial bioeconomy are thus related to the design and implementation of an enabling financial infrastructure that provides bioeconomy entrepreneurs and their investors with sufficient incentives, rewards, and opportunity to provide authentic and creative leadership to enterprise development which focuses on balanced growth of multiple forms of capital and is not limited to the pursuit of short term economic profitability. A bioeconomy financial infrastructure also needs to recognize the importance of community and engagement of the crowd as a critical success factors for its emergence and long-term sustainability.

Specific steps agencies can take to address the above challenges are the following:

- *Define* entrepreneurial bioeconomy enterprise as "entrepreneurship in service to the whole" i.e. any and all activities seeking to meet the needs of the present generation without compromising the ability of future generations to meet their own needs by creating organizations as living systems in alignment with nature so all life will flourish forever; and, by generating Profits4Life – flows of positive natural, social, economic, cultural, and spiritual capital
- *Jumspstart and mainstream* the entrepreneurial bioeconomy by supporting entrepreneurship in service of the whole with an enabling set of fiscal, financial, and regulator incentives designed to lower perceived risks (early stage enterprise risks in particular), including but not limited to:
    - *Establishing* sound regulatory frameworks by creating incentives and removing barriers.
    - *Prioritizing* government investment and spending in areas that stimulate the entrepreneurial bioeconomy.
    - *Limiting* spending in areas that deplete natural and other forms of capital
    - *Employing* taxes and market-based instruments to shift consumer preferences and promote investment and innovation in the bioeconomy.
    - *Investing* in capacity building and training.
    - *Strengthen* international governance.
- *Stimulate* entrepreneurship in service of the whole as well as community engagement and wisdom of the crowd by means of public sector matched-funding mechanisms which amplify and leverage sponsorships, donations, and investments provided by people and organizations to initiatives of their choice through emerging crowd funding mechanisms and legislation.
- *Launch* whole system enterprise development zones throughout the nation as pilot initiatives of the emerging bioeconomy and linking them to existing centers of excellence of technological, educational, industrial, agricultural and community revitalization.

(13) What specific regulations are unnecessarily slowing or preventing bioinnovation? Please cite evidence that the identified regulation(s) are a) slowing innovation, and b) could be reformed or streamlined while protecting public health, safety, and the environment.

A unified, liquid energy "molecules are molecules" chemical view needs to be adopted by regulating agencies such as the EPA. For example, a Biomass Coordinating Council member company that makes a renewable gasoline from biomass has applied to the EPA for a "substantially similar" certification. However, the company has not yet received approval to move forward due to the fact that ASTM specifications require gasoline to be derived 100% from petroleum. The company is denied because they are biomass-based, although their product is chemically identical to petroleum (99.98%) as shown by both mass spectroscopy and gas chromatography.

(14) What specific steps can Federal agencies take to improve the predictability and transparency of the regulatory system? (Please specify the relevant agency.)

Transparency is necessary with regards to where a new company request sits in the queue for being evaluated as a technical priority. "Black hole" timing at agencies like the EPA is impeding progress. Additionally, improving patent protection and timing with the USPTO is critical so that U.S. innovation can make a comeback in a global environment.

(16) What are the highest impact opportunities for public-private partnerships related to the bioeconomy? What shared goals would these partnerships pursue, which stakeholders might participate, and what mutually reinforcing commitments might they make to support the partnership?

The US has a long history in enabling break-though innovations and lasting prosperity by means of an enabling environment for creativity and entrepreneurship. By 2025 fifty percent of the world population will be 25 years old or less. Their future is ours. The bioeconomy is an emerging sector within the world economy that will define humanity's success or failure in meeting the needs of present generations without compromising the needs of future generations. Successful development of the entrepreneurial bioeconomy and US leadership with respect thereto will require the coming together of public and private sector partners from the local to the global to collaborate within an overarching framework that enables investment and entrepreneurship in service of the whole. The highest impact opportunities are those partnerships that reinvent and realign the prevailing economic, business, and financial model from an integrated systems perspective and enable the fast emergence of the entrepreneurial drive and creative solutions that will provide a solid foundation for a thriving bioeconomy. There is no need to pick winners other than to create the enabling conditions for winners to emerge along the lines proposed in 5 and 8 above. Of all imaginable public-private partnerships, potentially the most influential one is a public-private partnership between government, business, and the community of citizens (a crowd sourced for talent, matched funding, and collective wisdom).