

Public Comment: OSTP Plan for a National Bio-Economy

We recommend that the Office of Science and Technology Policy establish “security, sustainability, and responsibility” as one of the central grand challenges in the emerging US blueprint for a national bio-economy.

By secure, we mean that the future national bio-economy must be safe from a variety of risks and vulnerabilities to critical systems that we rely on (e.g., food, health, energy) from not only military and terrorist threats but also unanticipated dynamics and normal accidents that accompany any complex system, natural disasters, etc. By sustainable, we mean a triple-bottom line calculus that insists that environmental and social sustainability are equally constitutive of the long-term success of the bio-economy and the country. By responsible, we mean that the bio-economy must accord with a democratically robust understanding of the public good, individual and family wellbeing, and thriving, economically just communities. Achieving these three goals will require careful attention from the outset of planning for the national bio-economy to two key considerations:

- (1) The potential biological, social, economic, and political outcomes of the national bio-economy, including, especially, attention to the systemic, multi-dimensional, and often contested nature of both benefits and risks and their distribution across individuals and communities.
- (2) The development of appropriate governance mechanisms for eliciting democratically robust perspectives on priorities, goals, and aspirations proper to a national bio-economy, which, in turn, can inform policies and parameters for defining, evaluating, and managing benefits and risks.

These dimensions of governance should not be treated as subsidiary or epiphenomenal to specific technological goals, but should be recognized as presenting a grand challenge in their own right.

Our approach reflects, in part, new convictions in science and innovation policy that focus on the ability of technological innovation to meet pressing social needs. For instance, the 2009 National Academies’ report on the future of the biosciences suggests that federal investment should encourage the development of a “new biology” that “would *enunciate and address* broad and challenging *societal* problems.” Importantly, this vision acknowledges that the needs of society can and should figure into science policy at its earliest stages. The effort to develop a bioeconomy blueprint reflects a similar vision.

This vision is not just one for the biosciences, but also one for governance. While the bioeconomy blueprint rightly sees the biosciences as poised to play a central role in *addressing* some societal problems, it should also acknowledge that the challenge of *enunciating* societal needs and preferences transcends the sciences. The bioeconomy blueprint should thus incorporate structures for governance that help cultivate – and are responsive to – public preferences, values and concerns. A secure, sustainable

and responsible foundation cannot be grounded on agenda-setting frameworks limited to narrowly defined technological goals. Rather, it must include diverse means for democratic engagement from the earliest stages—including finding ways to engage interested publics who might not identify as stakeholders or use traditional means of political engagement. A secure, sustainable, and responsible bioeconomy will therefore require innovations in governance to assure that uncertainties are collectively recognized, scientific aims are calibrated to public values, and (inevitable) technological failures can be transparently and responsibly handled without eliciting crises of confidence.

Over the past half century, the US has asserted itself as a leader in the global high technology economy. Yet, this development has not come without risks. As the past decade has witnessed, threats to high technology systems, from terrorist attacks, technological failures, risk mismanagement, natural disasters, and other causes, have the potential to create vast destruction and put significant numbers of human lives at risk.

In coming decades, the development of a national bio-economy will create further complexity in the socio-technological systems underpinning US economic prosperity and quality of life. This complexity will arise from a range of developments and will be systemic in character; it will pose far reaching challenges that are not circumscribed to specific domains of innovation, and thus are not amenable to incremental, technology-specific risk assessment and management. A national bio-economy, for example, will potentially further intertwine the manufacturing and agricultural systems, heightening competition for and further stressing the development of land and water resources (e.g., the development of soy and corn-based biofuels). A national bio-economy will also significantly encourage the integration of biological and engineered systems, potentially enhancing the complex dynamics of such systems, including significantly expanding the array of newly engineered organisms released into natural environments (e.g., the push for developing genetically engineered algae for the production of bio-diesel). Finally, the development of a national bio-economy will further accelerate the development of bio-based technological interventions into human and non-human biology that raise significant questions about both risks and values (e.g., human-animal chimera).

These challenges are multidimensional and far-reaching, but if anticipated and addressed in conjunction with programs of technological innovation, they can be potentially overcome. While some innovation along these lines has taken place—for example the ELSI program of the human genome project—too often such initiatives have taken the form of mitigating the downstream consequences of specific technologies, rather than building considerations of security, sustainability, and responsibility into the design and infrastructure of innovation itself. A comprehensive blueprint should integrate attention to these dimensions into the *enunciation* of societal problems and the programs of innovation initiated to address them. The more recent examples of the strategic goal of “responsible development” in the National Nanotechnology Initiative and discussions of governance alongside of research in early visions of geoengineering are thus better models than ELSI.

In its recent report, *New Directions: The Ethics of Synthetic Biology and Emerging Technology*, the Presidential Commission for the Study of Bioethical Issues suggested a strategy of “prudent vigilance” to address these concerns. While the tenor of this recommendation is correct, the Commission’s specific approach falls short of what is required to ensure a secure, sustainable, and responsible 21st century bio-economy. Although the Commission highlights the values of fairness and justice and the essential role of democratic deliberation in the governance of emerging technologies, its formulation of prudent vigilance nevertheless limits democratic consideration of security, sustainability and responsibility to reactions at the late stages of such technologies.

The Commission suggests that the scientific community alone is best positioned—and therefore responsible—for identifying emerging problems of risk, and thus of science governance. However, while technical expertise is without question indispensable to the tasks of governance, it has neither the competence nor authority to single-handedly define risks and benefits on behalf of society. Asking science to assume such responsibility places an unsustainable burden upon it, and with dire consequence. Insofar as the New Biology—of which the national bio-economy blueprint is unquestionably part—is engaged in enunciating societal challenges and practicing prudent vigilance, these tasks must be undertaken in partnership with the democratic public from the earliest stages.

We have seen the consequences of neglecting governance until problems emerge, such that society can do little more than react. Where innovation has not been transparent and accountable to public values, moments of technological failure also become crises of legitimacy and public trust. Governance must be proactive, rather than reactive. We must invest up front in not only understanding the nature of the challenges facing a 21st century bio-economy but also in acting in advance to ensure that future bio-innovation is secure, sustainable, and responsible. Like green chemistry, the goal for the national bio-economy blueprint must be to *design security, sustainability, and responsibility into the institutions and products that comprise the bio-economy from the outset*. This is a task that must involve biologists, national security experts, social scientists, political and business leaders, and the public at large in defining the goals and objectives, strategies, and metrics for assessing whether the national bio-economy meets these fundamental requirements.

At times, the call for a national bio-economy blueprint has the feel of merely another push for new investments in science and technology. It is not *and must not be*. At stake is the future of the US economy and the lives and livelihoods it engenders for American citizens over the next one hundred years. Genuinely prudent vigilance requires careful attention to the inevitable failures, externalities, and unpredictable social and environmental consequences of a national bio-economy; the blueprint must incorporate architectures for appropriate action—by governments, by companies, and by publics—to ensure that the bio-economy develops in a manner that is consistent with US security, with the sustainability of the global environment, and with the fundamental values of US citizens. Attending to this grand challenge is a *practical*

necessity for realizing a bio-economy, a *strategic imperative* for achieving policy goals, and a *democratic responsibility* for meeting obligations to society.

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