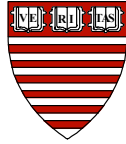


HARVARD UNIVERSITY
JOHN F. KENNEDY SCHOOL OF GOVERNMENT



**Implications of a Future Global Biofuels Market for
Economic Development and International Trade**

Report of the John F. Kennedy School of Government Workshop on Biofuels, May 9, 2007

Henry Lee, William Clark, Robert Lawrence, Gloria Visconti¹

On May 9th, 2007, Harvard University's John F. Kennedy School of Government brought together experts from academia, international institutions, government, and the private sector to explore possible implications of emerging global biofuels markets for economic development and international trade. The workshop was convened by the Sustainability Science Program² and the Environment and Natural Resources Program³ at Harvard University at the request of the Chair of the Global Bioenergy Partnership⁴ to advise GBEP and its members of present thinking on this topic and to inform future policy research efforts. To maximize discussion and debate, attendance at the workshop was by invitation only. Individuals were invited in their private rather than institutional capacity. Moreover, participants agreed that what was said at the workshop would be not be attributed to any specific individual. To convey the results of the discussion to a wider audience, the conveners have prepared the present summary report. It is our aim to use this report as a stepping stone to further policy dialogue and research. Comments from readers are therefore invited.

I. Background

The workshop was motivated by the extremely rapid rise of interest in biofuels around the world. This interest is reflected at the highest levels of policy, with the United States' President, George W. Bush, announcing a goal of a 5 fold increase in biofuel use by 2017 and the European Union establishing a 10% binding minimum target for the share of biofuels in overall EU transport liquid fuel consumption by 2020. Brazil, long a leader in the use of biofuels, is considering a major increase in its capacity, while countries as diverse as India, Peru, South Africa, Nigeria, and Indonesia perceive biofuel production as a means to address their national needs. Much effort has been devoted to exploring the goals for biofuel use, scenarios of its penetration into global and local energy markets, alternative biofuel technologies and their performance standards, and the possible impacts of biofuel development on other sectors and social goals.

The results of this ongoing debate constituted the background of the present workshop, but were not its focus. Instead, the participants concentrated on the strategic policy issues raised by the growing attention to biofuels. If the world were to dramatically ratchet up biofuel production and consumption as suggested by current pledges and plans, it will be asking development policy and regulatory frameworks traditionally concerned with food and fiber production to enter the

complex arena of global energy policy. This transition is unlikely to occur without substantial confusion and uncertainty. Similarly, major national and global commitment of land and water resources to biofuel production will almost certainly have major implications for other sectors that rely on those resources, from agriculture to ecosystem conservation. Once again, it is unlikely that present policy arrangements will be optimal for such a dramatic realignment of interests and incentives governing resource use.

The world will certainly be served by systematic thinking of how policy toward biofuels could best be developed, domestically and internationally, so as maximize the long-term benefits to society. To stimulate such thinking in our own group, we therefore simply assumed for the duration of the workshop that biofuels will become a significant component of the world energy system over the next decades.⁵ We then posed three groups of questions:

A) The policy environment: Which sectors and interests have what potential stakes in the biofuels debate? In particular:

- To which energy-related goals are biofuels most relevant? How big a contribution might biofuels make to those goals? Which interests have the strongest stake in how the energy debate develops?
- How are social goals for food and fiber production likely to be affected? Should these interactions be a concern? What policy measures could mitigate the potentially negative impacts of biofuels on food and fiber production, while taking advantage of opportunities and synergies?
- What are the most important environmental considerations? What can now be said about the relative advantages and disadvantages to the environment of different biofuels development paths?
- Under what conditions are international sustainability standards for biofuel production likely to emerge? How can the international community of nations insure that sustainability criteria are not used as a way for developed countries to protect

their domestic market against competition from lower priced biofuels produced in developing countries?

B) Economic Development: How might individual countries usefully think about the possible role of biofuels in their own economic development? In particular:

- Under what conditions and in what ways should developing countries seek to stimulate the development of domestic biofuel industry that maximizes the benefits to their population?
- Is it possible to develop a vibrant biofuel production industry without impacting domestic food prices and availability?
- How can countries shape their biofuel industry so that the poorer rural areas capture a portion of the benefits?

C) International Trade: How should the world community think about and prepare for significant international trade in biofuels? In particular:

- How is trade in biofuels likely to emerge? What type of trading regime would be desirable? What should be the role of the WTO, bilateral trade agreements, and domestic restrictions to imports (or in some instances exports)?
- In the context of WTO negotiations, should biofuels be treated as an agricultural good or as an “environmental good or service”?
- How might the tension between domestic agricultural and energy interests play out within the context of biofuels trade? How might countries deal with the GMO issue in a world in which cellulosic ethanol becomes plentiful?

The workshop participants engaged in a wide-ranging, and often overlapping, discussion of these and related questions. Several of the major themes that emerged are summarized in the remainder of this report.

II. The Policy Environment

An unusual number of policy agendas intersect over the biofuels issue, providing opportunities for novel partnerships and synergies to promote the common interest. But it also sets the stage for advocacy of policies wrapped in the mantle of the common good that actually promote only narrow interests. A strategic perspective on the biofuels issue requires recognition of these various agendas, where they intersect and – as importantly – where they do not.

The workshop discussions highlighted climate change and energy security as the foremost global problems to which biofuels might provide part of the answer. However, reductions in conventional pollutants associated with fossil fuel combustion, can also be achieved through the use of appropriate biofuels. Biofuels may also contribute to global goals of poverty reduction and rural development.

Biofuel producers see additional opportunities for themselves in contributing to such globally desirable solutions. In some cases, these opportunities are a relatively straightforward case of converting natural resource endowments into valuable products for sale on the global market. In other cases, the opportunities are more complex. For example, advocacy of ethanol production in the United States has been historically driven by a desire to support farm prices (particularly for corn farmers) and to meet air pollution standards for cleaner motor fuels.

Other policy actors see biofuels less as an opportunity to solve problems and more as a threat to their own agendas. Those primarily concerned with food security, for example, emphasize that populations, especially in the developing world, are continuing to grow, and that the world of tomorrow will require more food to feed its people. Biofuel production can compete with food production for land and water resources, potentially driving up the price or limiting the quantity of food produced, and altering international trade in agriculture products accordingly. The community concerned with the conservation of biodiversity and ecosystem services is likewise concerned that land pulled in to biofuels production is often land pulled out of conservation set-asides. In addition, high input processes for biomass production – whether to grow food or fuel

– have traditionally imposed additional stresses on ecosystems through fertilizer runoff, biocides, and changes in the species balance.

The trade-offs and complementarities among various objectives and concerns for increased biofuel production are complex and poorly delineated. Nonetheless, it is abundantly clear that the choice of technology and location for biofuels production has enormous consequences for what benefits would be accrued by whom in a serious biofuels future. There has been much confusion on *how much* such choices matter relative to the primary global goals of energy security and climate change due to selective accounting practices. Needed is full “life-cycle” accounting that identifies *net* gains once all inputs and outputs are accounted for. For example, bioethanol produced from sugar cane in Brazil produces a net energy gain several times higher than bioethanol produced from corn in the US. Looking only at US growing conditions, both corn and soybean feedstocks for transportation biofuels reduce carbon emissions relative to conventional fuels, but the reduction for soybean based diesel is more than twice that for corn based ethanol. More surprising is the fact that none of today’s principal feedstocks – not sugar cane or soy or corn – is carbon neutral, much less carbon negative. In other words, all result in a net release of carbon dioxide to the atmosphere, thus limiting their ability to mitigate the pressures for climate change.

To improve the environmental and energy performance of biofuels, and to relax potential pressures on food production, it is clear that a “second generation” of production crops and technologies will be needed. Billions of dollars have been invested into research on a wide spectrum of such options. The results of these efforts will become apparent over the next fifteen years, but not necessarily in the next two or three. Therefore the biofuel options available in 2020 will almost certainly be different than in 2007. Which particular options will emerge as successful cannot be predicted. The central contribution of the policy community at this point should be to refine the strategic evaluation metrics against which emerging biofuels options can be evaluated. The workshop discussed several goals for which such an evaluation framework should almost certainly develop credible and widely accepted indicators:

- Reduce carbon emissions (net)

- Improve energy security
- Achieve net energy gains
- Minimize impacts on the price and availability of food
- Minimize incremental demands for water and good land where these are limiting
- Maximize benefits to the poor in the countries in which the feedstocks are produced
- Create additional jobs (net), especially in developing countries
- Stimulate investments in the educational, technological, and public infrastructure, especially in developing countries

These goals may prove to be contradictory. Attaining one may make it difficult to attain another. Realizing the common interest in biofuel development will also require the global community move beyond the paradigms that have characterized past efforts and to explore new paradigms.

III. Economic Development

If the developed countries of the world are committed to significantly increase their use of biofuels, it might not be cost effective to meet that use entirely through domestic feedstocks and production. Under relatively undistorted price scenarios, countries in temperate climates with high population densities are not the least cost regions to produce biofuels in the volumes needed to substitute 20-30% of the world's motor fuels. For this to happen, substantial production may emerge in developing countries. This session asked the question, how can the development of a domestic biofuel industry be stimulated and how can producing countries retain a significant percentage of the benefits?

Biofuel production will be shaped by a wide spectrum of technological, economic, and environmental factors. For expositional purposes we will group the scenarios into three categories: the first would be characterized by small farms using substantial amounts of labor and appropriate technologies with most of the biofuels being produced and used locally. The second would be intermediate sized energy farms with production at a regional scale and the

product being consumed in the domestic market. Under this scheme, producing countries would back out oil imports and substitute domestically produced biofuels. The third model would be one in which larger agribusiness firms invest in large energy plantations and export the biofuels to large markets where their products will be sold at global prices.

Different scenarios will emerge in different parts of the world, depending on several key factors. Does the country have access to external capital, so that investments in biofuels do not mean less investment elsewhere? Will the investment affect wages? Different biofuel technologies will have different labor intensities. Is land available and if so at what price? If a country is using its most fertile areas for growing energy crops, food production will be affected, but if it uses marginal areas, there could be significant value added throughout its population. Will investment in biofuels stimulate investments in public infrastructure that can be used by others? Will there be spillover effects in the form of the development of other more sophisticated products that can provide huge social benefits?

The challenge will be to shape public policies so that the developing countries of the world that select to go down the biofuel production path can maximize the economic benefits and can equitably distribute those benefits. Many of the poorest countries are importers of both fuel and food and policies that result in increasing both will increase the disparity between poorest and richest countries. Potentially there will be substantial distributional impacts of how policy makers elect to stimulate biofuels markets and trade. There will be growing pressure on policy makers to weigh these impacts as they fashion policies and programs to respond to the growing need to reduce their use of fossil fuels.

The answers to these questions depend on country and country specific factors. However both the creation of value and the distribution of benefits will be shaped by the policies and programs adopted at the regional, national, and international levels.

IV. International Trade

Globalization and Trade

In the developed world, targets – both mandatory and voluntary – for increasing the share of bio-fuels in the domestic energy mix have been established at the national level. The scarcity of land could however present a problem for OECD countries seeking to meet these targets. This suggests a role for increased international trade in order to exploit the potential of production in sub-tropical countries where there are better climatic conditions, land and infrastructure. However, the need for more trade raises the potential for conflict, because, as was discussed in the workshop, national farm lobbies in the developed countries could seek to protect their domestic markets from import competition. In addition, the expansion of biofuels trade poses two other key issues for the global trading system:

A) There is no standardized classification of biofuels at WTO level: The Doha Round has been suspended but if it can be successfully concluded, it could potentially have important implications for trade in biofuels. These implications are unclear however, in part because of how biofuels are classified. While ethanol is generally classified as an agricultural product, biodiesel is classified as an industrial product. The difference is very important because the rules of the trading system relating to market access and subsidies generally treat agricultural products differently from industrial products. In addition the Doha Round is supposed to place a particular emphasis on environmental goods. In particular, the work program for the talks calls for “the reduction, or, as appropriate, elimination of tariff and non tariff barriers to **environmental goods and services**”. According to some countries, the definition of environmental goods does cover renewable energy products and could include ethanol and biodiesel and related products. But this interpretation has yet to be agreed upon by all, in part because of the need to evaluate the environmental effects of biofuels on the basis of a complete “life cycle” analysis. Nonetheless, there is some precedent for giving biofuels preferential treatment on environmental grounds in unilateral and bilateral trading arrangements such as the Cotonou Agreement and the EU’s preferences based on “Everything But Arms (EBA). It is also possible that the interest in promoting biofuels could actually help the Doha Round because agricultural liberalization has become the centerpiece of the discussions.

B) Lack of Internationally agreed Standards/Certification: A second major issue relates to standards. Fears that a rapid increase in production for exports could lead to environmental damage have led to calls for establishing standards and certification procedures to ensure that production has been undertaken in a sustainable manner. But participants expressed concerns that these might be difficult to develop, because the WTO treatment of product production methods (PPMs) are very controversial. Some participants were particularly concerned that such standards could become a pretext for trade protection and thus developing countries could be denied important export opportunities. There could also be problems, particularly for small poor producers in obtaining certification, and provisions need to be made to provide technical assistance so that this does not become yet another “non-tariff barrier”. Other concerns expressed at the meeting related to the feasibility of actually coming up with a single certification scheme, the consistency between biofuels and food certification systems as well as protectionist responses by farmers that benefit from current programs.

V. Conclusions

One workshop is unlikely to produce results of great novelty in an area as complex and intensely debated as biofuels. Several basic observations nonetheless emerged from our deliberations that, however obvious, have not always been incorporated in current policy debates about biofuels:

A) An unusual number of policy agendas intersect over the biofuels issue, creating the prospect of both complementarities and conflicts. Global concerns that might be affected by a major increase in the use of biofuels include climate change, energy security, food security, ecosystem conservation, economic growth, and poverty alleviation.

B) Biofuels are not likely to be major determinant of how any of these concerns play out over the next several decades. But they could have a large enough impact that it is worth getting public policy governing biofuels development as right as possible.

C) Presently available technologies for biofuels production all have significant shortcomings with respect to one or more of the global concerns listed above. But the most significant impacts of biofuel development will occur over multiple decades, during which the growing public and

private investment in biofuels research is likely to create options very different from what we have available today. The major public policy challenges in the short and medium run are therefore to:

- Avoid premature lock-in of existing, unsatisfactory technologies;
- Encourage R&D and experimentation on a wide range of options; and
- Develop widely accepted evaluation frameworks encompassing all the major concerns noted above to serve as a guide for the development of and debate about candidate technologies.

D) How biofuel industries emerge in developing countries will depend on multiple factors, many of which can be shaped by the policies and programs adopted by both the producing and consuming countries.

E) Barriers to biofuels trade have limited the emergence of an international market for ethanol and biodiesel. Pressure to reduce, amend, or even eliminate these barriers is likely to grow. The debate will emerge within the context of ongoing negotiations to liberalize trade in agricultural goods, which has been at the center of the recent Doha round of the WTO, as well as within the context of bilateral negotiations.

VI. Endnotes

¹ Comments on this summary report should be sent to Henry Lee at Henry_Lee@Harvard.edu

² <http://www.cid.harvard.edu/sustsci/index.html>

³ <http://www.bcsia.ksg.harvard.edu/enrp>

⁴ <http://www.globalbioenergy.org>

⁵ The World Energy Outlook 2007 suggests that a very serious commitment to biofuels might possibly bring them to supply about 7% of the world's consumption of road-transport fuels by 2030. Under this scenario, Brazil might cover as much as 30% of its road transport fuel needs with biofuels by that date.

FUTURE IMPLICATIONS OF A GLOBAL BIOFUELS MARKET ON ECONOMIC DEVELOPMENT, ENVIRONMENT, AND TRADE

**John F. Kennedy School of Government
Harvard University
May 9, 2007**

PARTICIPANTS LIST

William Clark
Harvey Brooks Professor of
International Science, Public Policy
and Human Development
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-495-3981
william_clark@harvard.edu

Corrado Clini
Director General
Ministry of Environment, Land and Sea,
and Chair, Global Bioenergy Partnership
Cristoforo Colombo, 44
Italy
+39 0657228102
clini.corrado@minambiente.it

Richard Cooper
Mauritus C. Boas Professor of
International Economics
Department of Economics
Harvard University
Cambridge, MA 02138
617-495-5076
rcooper@fas.harvard.edu

Kelly Sims Gallagher
Director
Energy Technology Innovations Project
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-495-1960
kelly_gallagher@ksg.harvard.edu

Kevin P. Gallagher
Assistant Professor of International
Relations
Boston University
156 Bay State Road, Room 402
Boston, MA 02215
617-353-9348
kpg@bu.edu

Ricardo Hausmann
Director, Center for International
Development
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-496-3740
ricardo_hausmann@harvard.edu

Jennifer Haverkamp
Consultant on International Trade &
Environmental Policy and
Principal Trade Expert, REIL
7901 Takoma Avenue
Silver Spring, MD 20910
301-585-6554
jhaverkamp@starpower.net

Noel Michele Holbrook
Charles Bullard Professor of Forestry
Department of Organismic and
Evolutionary Biology
Harvard University
16 Divinity Avenue, Room 3119
Cambridge, MA 02138
617-496-0603
holbrook@oeb.harvard.edu

Calestous Juma
Director, Science, Technology and
Innovation Program
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-496-8127
calestous_juma@harvard.edu

Melinda Kimble
Senior Vice President
United Nations Foundation
1800 Massachusetts Avenue, NW
Suite 400
Washington, DC 20036
202-887-9040
mkimble@unfoundation.org

Robert Lawrence
Albert L. Williams Professor of
International Trade and Investment
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-495-1118
robert_lawrence@harvard.edu

Henry Lee
Jassim M. Jaidah Director of the
Environment and Natural
Resources Program
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-495-1350
henry_lee@harvard.edu

Empedocle Maffia
Special Advisor to Executive Director
Italy, Portugal, Greece, Albania, Malta, San
Marino, Timor Leste
The World Bank
1818 H Street, NW, MC – 13-751
Washington, DC 20433
202-458-7660
emaffia@worldbank.org

Alexander Mueller
Assistant Director-General
Natural Resources Management and
Environment Department
Food and Agriculture Organization of the
United Nations
+39 06 5705 2630
alexander.mueller@fao.org

Robert Paarlberg
Professor of Political Science
Wellesley College
Wellesley, MA 02481
781-283-2193
rpaarlberg@wellesley.edu

Ambuj Sagar
Assistant Dean for Strategic Planning
School of Engineering and
Applied Sciences
Harvard University
Pierce 207B
Cambridge, MA 02138
617-495-2093
asagar@seas.harvard.edu

Daniel P. Schrag
Director, Harvard University Center
for the Environment
Professor of Earth and Planetary Sciences
Harvard University
Hoffman 309
Cambridge, MA 02138
617-495-7676
schrag@eps.harvard.edu

Andrew Shoyer
Sidley Austin LLP
1501 K Street, NW
Washington, DC 20005
202-736-8326
ashoyer@sidley.com

Noelle Eckley Selin
Department of Earth and Planetary
Sciences
Harvard University
Pierce 110G
Cambridge, MA 02138
617-496-9428
eckley@fas.harvard.edu

Antonio Simoes
Director of the Energy Division
Ministry for Foreign Affairs Brazil
Anexo 1 – 7 Andar – Sala 736
70170-900 Brasil DF
0055 6134118611
ajsimoes@mre.gov.br

Robert Stavins
Director, Harvard Environmental
Economics Program
Albert Pratt Professor of Business
and Government
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-495-1820
robert_stavins@harvard.edu

David Tilman
Regents Professor of Ecology
University of Minnesota
Ecology, Evolution and Behavior
1987 Upper Buford Circle
Room 511 Ecology
St. Paul, MN 55108
612-625-5740
tilman@umn.edu

Gloria Visconti
Research Fellow
Sustainability Science Program
Center for International Development
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-496-0426
gloria_visconti@ksg.harvard.edu

Toni Volpe
President and Chief Executive Officer
Enel North America
One Tech Drive, Suite 220
Andover, MA 01810
978-885-0693
toni.volpe@northamerica.enel.it

Rodrigo Wagner
Center for International Development
John F. Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, MA 02138
617-388-7296
rodrigo_wagner@ksg07.harvard.edu

Robert Watson
Chief Scientist and Senior Advisor, SDN
The World Bank
1818 H Street, NW, MSN MC4-408
Washington, DC 20433
202-473-6965
rwatson@worldbank.org

Kassia Yanosek
Manager, Business Strategy
BP Biofuels
1776 I Street, NW
Washington, DC 20006
+44 7917 594 890
kassia.yanosek@bp.com

Simonetta Zarrilli
Legal Officer
United Nations Conference on Trade
and Development (UNCTAD)
Palais des Nations, 1211 Geneva 10
Switzerland
+41 229175622
Simonetta.Zarrilli@UNCTAD.org