

**International Agricultural Research
on BioFuels: The Way Ahead**

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My task is to reflect on the foregoing wide-ranging and informative presentations and discussions, and address the question of what they mean for international agricultural research — research that will benefit primarily developing country partners.

Thinking about the question of an appropriate research agenda has been a difficult assignment in the absence of today's dialogue and the lack of any clear international framework or engagement. As an international issue, biofuel has only really emerged in the past decade and has really been prompted by high oil prices, concerns about oil supply security and, to some extent, a recognition of the role of fossil fuels in the emergent greenhouse and climate change debate.

Let me share with you a very brief summary of the key points to emerge from my reflections of the literature — and today's conference — that have driven my thinking about possible key points for an international research agenda for biofuels.

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The summary goes like this:

- Global energy consumption is likely to double over the next thirty years, with much of this increase in demand coming from Asia, primarily China and India.
- Given this demand growth, the constraints on oil supplies and the instability in major oil-producing countries, oil prices are unlikely to fall much in the near to medium term while global economic growth continues to be positive.
- Biofuels are competitive with petroleum at prices between \$US60 and \$US100 a barrel, but this competitiveness depends just not on the oil price but agricultural feedstock prices. Recent higher agricultural prices would mean that the competitiveness of biofuels has slipped.
- Higher oil prices, sustained into the medium term, will open up a number of new technologies that biofuels will have to compete with.
- The emergent global greenhouse debate will inevitably mean that pricing signals will become more inclusive and should, over time, favour potentially greenhouse-friendly energy sources like biofuels.

With respect to biofuels, two technology pathways are being pursued:

- first-generation technologies involve bioethanol and biodiesel from food crops — crops like maize, sugarcane and beet, cassava and wheat in the case of bioethanol and various oilseeds plus soybean in the case of biodiesel
- second-generation cellulosic technologies that rely on the by-products of food and feed production and feedstock produced on non-food-producing marginal lands.

Having set that architecture, I now want to turn back to the centrality of the task put to me in this closing session — the way ahead for international agricultural research on biofuels.

There are many options, but they can be clustered around the four following themes:

Theme 1

Research that will strengthen sustainable production systems of those crops used in first-generation technologies — crops like maize, sugarcane, cassava, wheat and the various oilseeds

We have heard a lot today about turning food into fuel and its implications for existing production systems. Speakers have referenced higher food prices and its impact on low-income consumers, pressures for greater deforestation, the higher likelihood of land degradation, and greater water usage.

It is a little unfashionable today, but my view is that a significant component of any biofuels research agenda should be the continued search for sustained productivity improvements of our field crops.

I say this for two reasons. The first is that such research-based productivity improvements will be vital irrespective of whether you think biofuels are a transformational development. Second-generation cellulosic technologies are still under development, but we do know for certain that basic food staples are the cornerstone of a world that will need to support 8–9 billion people and a rising demand for animal protein. Strengthening our field crop systems and doing it in a way that does not increase the environmental footprint, doing it in a way that makes farming systems less vulnerable to climate change and providing an opportunity for agriculture to deliver more environmental services should be seen as key components of the food-for-fuel debate. And here the centres of the Consultative Group on International Agricultural Research (CGIAR, <http://www.cgiar.org/>) have a vital role to maintain and, in my view, expand their contribution to securing adequate food supplies.

More broadly, I am not saying that this research should not have a biofuels dimension but most of these crops will have a number of alternative end uses — direct human consumption, animal feed-

stock and/or biofuels — and it will be very important that our international efforts focus around their production systems.

A small CG example of this work is at the International Crop Research Institute for Semi-Arid Tropics (ICRISAT), in India, which is working to improve the feasibility of producing ethanol from sweet sorghum. Sweet sorghum is a well-known forage crop in Australia, and can be grown without irrigation on tropical land that is marginal for other food crops. It produces grain for human consumption, fodder for cattle and sugar for ethanol production. ICRISAT is developing new varieties of sweet sorghum that contain more sugar (and hence can produce more ethanol) without sacrificing grain yield. Farmers using these new varieties will have greater incomes. Already an Indian company, Rusni Distilleries, has teamed up with ICRISAT to produce ethanol from sweet sorghum on a commercial basis. And ICRISAT and the International Livestock Research Institute (ILRI) are working together to improve the value of the crop residues for cattle production.

In terms of these energy balances, there are wide variations in greenhouse gas savings from biofuel use depending on feedstock, cultivation methods, conversion technologies and energy efficiency assumptions. For example, maize-derived bio-ethanol has a much higher greenhouse gas (GHG) emission than sugarcane, and this variance needs to be factored into any consideration of biofuels, given that a prime consideration is the net carbon balance.

Theme 2

Research that leads to public policy of better quality

The second element of our international research agenda for biofuels that I would want to foster is an informed public dialogue, not just on biofuels but on the range of emerging technologies being encouraged by sustained higher oil prices and restraints on GHG emissions.

Here I would see significant merit in CG centres like the International Food Policy Research Institute (IFPRI) being funded to contribute to the debate about appropriate policy approaches to reducing greenhouse gas emissions. ‘Cap and trade’ schemes will inevitably change the relative prices of fossil-fuel-based energy sources and should enhance the competitive position of biofu-

els without, hopefully, resorting to mandated quotas. As Lord Oxburgh said this morning, *'biofuels cannot rely on preferential treatment and must become the fuel of choice not only in sustainability terms but on cost as well'*.

It is always difficult to trace the direct impact pathway of policy research, but you only have to reflect on the role of the Australian Bureau of Resource Economics (ABARE) and the Productivity Commission and its predecessors here in Australia to know that public policy of high quality is a necessary first step to sustainable economic development.

Good policy decision making and implementation depends crucially on the availability of high quality scientific and economic data and analysis. A scan of available bioenergy literature will demonstrate, for example, a wide array of economic assessments that need clarification and refining. They cannot all be right! The first- and second-tier environmental impacts of biofuels in their various manifestations is also a matter on which there has been considerable qualitative discussion, but there remains a deficiency of hard data on which to make informed decisions and investments.

Supportive government policies have been essential to the development of modern biofuels over the past two decades, including for example blending mandates, tax incentives, government purchasing policies and support for biofuel infrastructure. Countries seeking to develop domestic biofuel industries could be well advised to draw important policy lessons — both positive and negative — from world leaders such as Brazil, USA and the European Union. Adapting such experience to national conditions will be an additional challenge, but it is useful to have a base on which to start.

Theme 3

Unlocking second-generation cellulosic technologies

Much research is already being undertaken here but, as we heard this morning from Lord Oxburgh, it is the next generation of biofuels that will come from non-food sources.

I think there is a very legitimate place for public-funded research to contribute to the basic and strategic research agenda of second-generation

biofuels. At the international level the CG centres are not geared to make a material contribution, but there is a very valuable role to be performed by networking national efforts including CSIRO's Energy Transformed Flagship. A CG Challenge Program could be one funding option, and it would highlight that this funding mechanism is not the exclusive or predominate province of the centres.

Theme 4

Support for demonstration of the next generation of biofuels

In terms of the international research agenda, there is a case for public research funding to 'prove-up' prospective technologies, but given the pressure on donors we do need to recognise that efforts in this area should be focused. There are many examples of replicated pilot technologies that did not have a strong business case at their inception. We could all learn much from others without actually encouraging a proliferation of pilots. In these pilots, it will be important that partners reflect on IP constraints and the scope for the results of these pilots to be applied at a range of scale options.

Let me give two examples from the recent past that could provide insight for future engagement.

The first is the Energy and Resources Institute (TERI) of India that announced in February 2006 that it was undertaking a 10-year project, in conjunction with BP, to cultivate 8000 ha of wasteland with jatropha and install the equipment necessary to produce 9 million litres of biodiesel annually. Jatropha is a crop that is being pushed but it is not one that should be field tested extensively under semi-commercial conditions. I would be much more interested in partnering with a pilot such as this than being pushed into another pilot before 'lessons learnt' are documented.

The other example is one in Australia and heard about earlier this afternoon from Dr John Wright of CSIRO for algal oil production. The Biofuels Group at the South Australian Research and Development Institute has been allocated \$5 million to develop a National Photobioreactor Facility that will enable lab-scale photobioreactor results to be validated at pilot and demonstration scale, an essential step in taking new non-food feedstock technologies towards full commercialisation.

My point in referencing these two examples is to highlight that much research is already being commissioned, and that the last thing we should do is to impose demands for replicated research on existing stretched staff in developing countries, pulling them away from their current important agendas. The lack of a coordinated international research agenda is leading both to duplication and to unnecessary expenditure of scarce resources by governments that are already short of funds. In this context, the best means of stimulating critically important public and private sector partnerships — necessary to achieve important technological breakthroughs — is also an undersubscribed aspect of policy research.

Choosing a research agenda

I have just sketched four themes that I would think about as a research investor. Clearly ACIAR would need to do much more preparatory work with its partners if it was to seriously contemplate a direct engagement in biofuels. All our current efforts are centred on Theme 1. I do think, however, there is a good case for expanding our efforts in Theme 2 — better quality public policy. At this stage I would not advocate ACIAR funding Themes 3 or 4. This resistance comes from not wanting to down-size our research efforts that will strengthen crop production systems in developing countries — these efforts will make a positive contribution to first-generation biofuels while not walking away from the real current and future needs of food systems. My point here is to stress that every research dollar has an opportunity cost, and shifting the focus could come at a significant cost to fragile food systems in the developing world.

Conclusion

We have heard reference to world agriculture being at a turning point, with energy and climate change redefining the global food situation. Others have talked about transformation. I think that is true, but I don't think it is related to biofuels in a direct sense. I think it is much more about the 'tragedy of the commons' — whether it is our atmosphere, our water sources or our

marine environment. We as a people are making very slow progress in overcoming some of the failures that are now obvious. As an example, if you could price carbon — cap-and-trade is one mechanism — it would go a long way to opening up other energy sources, including biofuels.

Further reading

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