PLANT RESEARCH INTERNATIONAL
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Bio-fuels and food security

Dialogue among stakeholders on dilemmas about biomass for food and/or fuel

Prem S. Bindraban & Robin Pistorius (eds.)

Cartoon by Auke Herrema

Report 167

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Prem S. Bindraban & Robin Pistorius (eds.)

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Plant Research International B.V., Wageningen
March 2008

Report 167

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Table of contents

Preface

The Dutch Comitée on World Food Security (Stichting Wereldvoedselvraagstuk/ FAO Comité Nederland) organises yearly two expert meetings preceding the World Food Day that was launched by the FAO in 1981. The World Food Day is meant to give continued attention to improve the food security of almost a billion malnourished people.

For 2007 the theme "The right to Food or Fuel" was elected. Bio-fuel production is a delicate development as it will further increase the already high demand for natural, social and financial resources. At this moment the bio fuel production (first generation) is strongly supported by the policies of rich countries, like the USA and the European Union to meet the discussions on global warming. However also the global demand for food and feed increases drastically and will continue to do so in the coming decades resulting in low stocks and high food prices. The full implications of the additional demand for feedstock for bio-fuel on the resource base, economic power structures, price development of foodstuff and social changes are mostly unknown.

For the Dutch Committee the direct question was: What can be the impact of our bio-based policy on the food security in the world as well on short (first generation bio-fuels) as on long term (second generation bio-fuels)? How does our policy converge with the millennium goals?

On World Food Day of October 16th 2007 a very well attended public discussion was organised based on the founding's of the expert meetings resulting in a petition for more reflection and a standstill of the political stimulation of the EU above the goal for 2010 of 5.75 % bio-fuel.

In this document the editors do not conclude with a reflection on the issues raised by the actors as they like to inform readers who can make their own judgment. The aim of this document is to stimulate the continuation of the scientific, economic and political debate on bio fuels.

The Dutch Committee on World Food Security thanks all the experts for their contributions. Special thanks goes to Bram Huijsman of Wageningen UR for his excellent chairmanship of all the meetings. We further appreciate the support of the Dutch Ministry of Agriculture, Nature and Food Quality for funding the support of Wageningen UR to these meetings.

Prem Bindraban and Robert Pistorius (editors)
Eisso Woltjer (Chairman of the Dutch Committee on World Food Security)

1. Introduction

The aim of this document is to outline the most important issues in the public debate on the role of bio-fuels on food security, as perceived by actors from various public and private institutions, government and academia. They look at this matter from their perspective which creates a panoramic view of the social, economic and political dimensions.

The call for sustainable alternative and renewable sources of energy is larger than ever. A brief background on the relevant issues is provided in chapter 2. The focus is on bio-fuels, but also alternative sources, such as wind-, solar-, and water energy, might offer alternatives to fossil energy. An objective discussion bio-fuels, requires an inventory of the pro's and con's of various energy sources, including bio-fuels. Chapters 4 to 7 offer four diverging opinions on this issue based on the first four presentations during the first expert meeting titled: “Bio-fuels digestible as source of energy?”.

The growing demand for bio-fuels raises the question whether its production fits sustainable agriculture, and whether an increase of scale leads to loss of biodiversity, soil and water degradation and poverty. Is this fear grounded, or lead by emotion? Does the extra demand for agricultural crops mainly offer advantages for the agricultural sector, and is it therefore a welcome impulse for economic development? Four experts address these issues from their point of view in chapters 8 to 11 during a second expert meeting titled: “Bio-fuels: a good harvest?”.

In this context, bio-fuel production is a delicate development as it will further increase the already high demand for natural, social and financial resources. And, as we know, the global demand for food and feed will increase drastically in the coming decades. Still, the full implications of the additional demand for feedstock for bio-fuel on the resource base, economic power structures, price development of foodstuff and social changes are unknown. There are gaps in our knowledge regarding virtually all aspects of bio-fuels on development.

Taking the input of the actors at the expert meeting into account a final debate took place at the final event on the World Food Day itself. Here, recommendations to the Netherlands policy were formulated to secure that adequate attention is paid to food security within the current debates on renewable bio-fuels. These recommendations, as have been offered to members of the Netherlands parliament are presented in chapter 3.

2. Background

Developments to reduce food insecurity, to contain climate change, to reduce over-fishing, to bring a hold to degradation of land, to prevent pollution and overuse of water, and to improve poorly managed animal production have not dramatically improved over the past decades indicating that the effectiveness of the exploitation of the natural, social and financial resource base has been excessive and not sustainable. A sustainable living environment and socio-economic development are strongly related to optimal and fair management of natural resources such as land, water, and minerals and the distribution of the products based upon them. The Millennium Development Goals address these issues aiming to increase benefits from the earth's resources for people living in developing countries, including the food insecure.

The demand for agro-energy has abruptly increased during the past years because of policies for compulsory blending of transport fuel and subsidies for the production of biomass for energy. A number of concurrent global problems have fuelled the sense of urgency for agro-energy. CO_2 neutral energy from biomass would be a perfect answer to curb climate change. Use of agro-energy would allow countries to comply with the Kyoto agreements of reducing CO_2 emissions. The dispersed production of energy throughout the world suits the current geopolitical strategies to reduce the dependence on few and unreliable suppliers of energy. In several instances, agro-energy is seen as a way out of misery for the rural population due to the dwindling agricultural sector, primarily in some developed nations.

Presently several millions of hectares are already dedicated to the production of feedstock for bio-fuel. The use of first generation feedstock basically is a diversion of commodities for food and feed to fuel. They consequently put the same demand on natural resources as food and feed production, already leading to increasing prices and reducing availability of certain commodities such as sugar, corn, palm oil and soybean. Industries are substituting the use of these commodities, such as soybean oil, for other – often less healthy – edible oils which in turn raise the price of related and even un-related agricultural commodities. Farmers for instance increasingly refrain from growing their traditional crops and change to crops for the energy market. These increases in price already manifest the adverse implications for the purchasing power of poor buyers of food jeopardizing their livelihood. Investments in processing plants for bio-fuel are capital intensive and are done by large scale enterprises. They will put a dominating demand on feedstock as the investments will have to be recovered in the short term. The social implications of these developments are unknown, but small-holders may not be able to supply feedstock at competitive prices. It is for this particular reason that, for instance, the Brazilian government has developed a bio-diesel program with a "social label". Progressively increasing federal tax exemption is given to producers of feedstock depending on the crop, region in Brazil and the size of the holding.

Clearly the introduction of bio-fuels will have worldwide implications for resource allocation and will affect livelihoods of many people. It should therefore be adequately managed through appropriate policies and private initiatives that need the guidance and involvement of multiple stakeholders to deliberate on the potential benefits and threats.

3. Recommendations to the Dutch Government

These recommendations were formulated on the basis of the meetings in the context of the World Food Day 2007. During these meetings, around 250 experts from the energy-, food-, agro-sector, science, non-governmental organisations and government discussed the worldwide production of biomass in relationship to food security. These recommendations have been presented to members of the Netherlands parliament.

1. The Netherlands should not allow biomass production at the expense of food security

Comment
The Netherlands is committed to increase food security and diminish hunger, amongst others through their commitment to the Millennium Development Goals.

2. The EU target of obligatory blending of 5, 75% bio-fuels to transportation fuels, should not be raised before more information is available about the negative impacts of bio-fuels production on food security and the environment

Comment
There are several reasons to reduce the dependence on fossil fuels, but as the ecological, social and economic implications of the growing demand for bio-fuels are not clear, more research still needs to be done. By not obliging blending of bio-fuels to transportation fuels or not raising the blending ratio, we create time to map out the implications for man (hunger) and the environment (sustainability). Preliminary research and recent developments suggest possible large negative impacts on food security and the environment, particularly when production- and transport-volumes will further increase. A well prepared and rational decision-making process on the basis of reliable cost-benefit analyses is key to this process.

3. Government should first and foremost focus on energy saving strategies for consumers and industry

Comment
Knowing that there is still much uncertainty about the negative impacts of the production of bio-fuels, emphasis should be placed on energy saving. High savings are attainable especially in the car-industry. A strong and long-term government policy with crystal-clear targets, for the commercial sector to navigate on, should be enforced.

4. In stimulating the use of alternative sources of energy, the Dutch government should seriously consider the use of solar, wind, and water energy. In its considerations, the government should explicitly take into account its pursuit for food security, poverty eradication, and a clean environment

Comment
Bio-fuels are not the only option to realize a more sustainable energy supply and a decrease of the CO_2-emmissions. The use of sun, wind and water are also viable and possibly better options, as they are also less competitive with food in terms of price, acreage, and agricultural inputs.

5. When bio-fuels or feedstock for bio-fuels are imported, The Netherlands carries the responsibility to monitor potential negative impacts on food security and the environment, and to take appropriate measures. This can be implemented, amongst others, by collaborating with producing countries in the South by means of knowledge transfer, the development of sustainable production systems for biomass, and investments in new technologies

Comment

A large share of the required bio-fuels, or feedstock for bio-fuels, will be imported from outside the European Union. The Netherlands can not neglect the impact of biomass production for bio-fuels on food security and the environment in those counties. Possible positive effects of biomass production for strengthening rural development and poverty alleviation should be exploited and supported with special care. The criteria for sustainable biomass production as formulated in the 'Cramer Framework for sustainable biomass production'1 provide a first indication to this aim, but should be further elaborated and put into practice.

6. The Dutch government in its negotiations on the Common Agricultural Policy (CAP) of the EU and the trade negotiations of the WTO, should stay alert to prevent any negative impact of biomass production and biomass trade on food security and sustainability

Comment

The stimulation of bio-fuels leads, together with a number of other factors, to scarcity of agricultural products resulting in higher prices of agricultural commodities. For farmers, this may result in higher incomes and poverty reduction. However, for the poorest consumers in developing countries, such as the poor urban dwellers and landless rural population, higher food prices will cause hunger, simply because these people can not afford higher food prices. It is therefore important that the Dutch government, within the context of CAP and WTO, strikes a balance between trade liberalization of agricultural commodities on the one hand, and food security and sustainability on the other.

7. The Dutch government should stimulate innovation in second generation bio-fuels to such extent that optimal use is made of all biomass, without it being detrimental to food security

Comment

In contrast to the 'first generation' bio-fuels which are based on food and feed agricultural commodities (such as cane sugar, maize, and rapeseed), 'second generation' bio-fuels offer opportunities for the optimal use of biomass. However, due to the demand for (fertile) soil, water and fertilizers, the production of non-edible biomass may be equally competitive to food and feed crops, as is the case with first generation biomass production. Therefore, the focus should be on the production of non-competitive biomass production which is acceptable in terms of biodiversity conservation and the use of natural resources.

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1 Commissie Cramer, 2007, Toetsingskader voor duurzame biomassa Eindrapport van de projectgroep “Duurzame productie van biomassa”. http://www.lowcvp.org.uk/assets/reports/070427-Cramer-FinalReport_EN.pdf

4. The advantages of solar energy over bio-fuels

Chris Westra
ECN, Energy Research Centre, The Netherlands

Not all forms of alternative energy are equally viable for our future needs. In The Netherlands, various research projects and investments have focused on tidal-energy, geothermal- biomass-, hydro-, wind- and solar energy. Part of this research has been conducted at the ECN. My conclusions are rather superficial, but the global picture that emerges is that bio-fuels, in spite of the current hoaxes, scores lower than wind-energy and solar energy. Especially the latter scores high in terms of durability and efficiency.

Solar energy: advantages

1. Solar energy can be harvested without expensive investments in mechanical parts. Mechanical parts degrade over time (think about the rotating parts in a windmill), have to be replaced, and are therefore less sustainable. Solar energy harvesting requires non-mechanical, mainly electronic devices. These are cheap, do not move, and degrade extreme slowly.
2. Solar energy can be harvested in a decentral mode allowing for 'smart grids' and minimal investments in infrastructure (for transport and storage of the harvested energy).
3. The harvesting factor (defined as the ratio of energy produced during lifetime and energy invested during construction) of solar energy is much higher than of conventional (coal and gas) power stations. About 8-18 times (depending on their location, see Figure 2) vs. 0.3 to 0.4 for conventional stations, since the operation of conventional stations requires continuously energy in the form of their resources. Wind installations require a relative small energy investment, and offer a harvesting factor of 20–100, over a lifespan of 20 years.

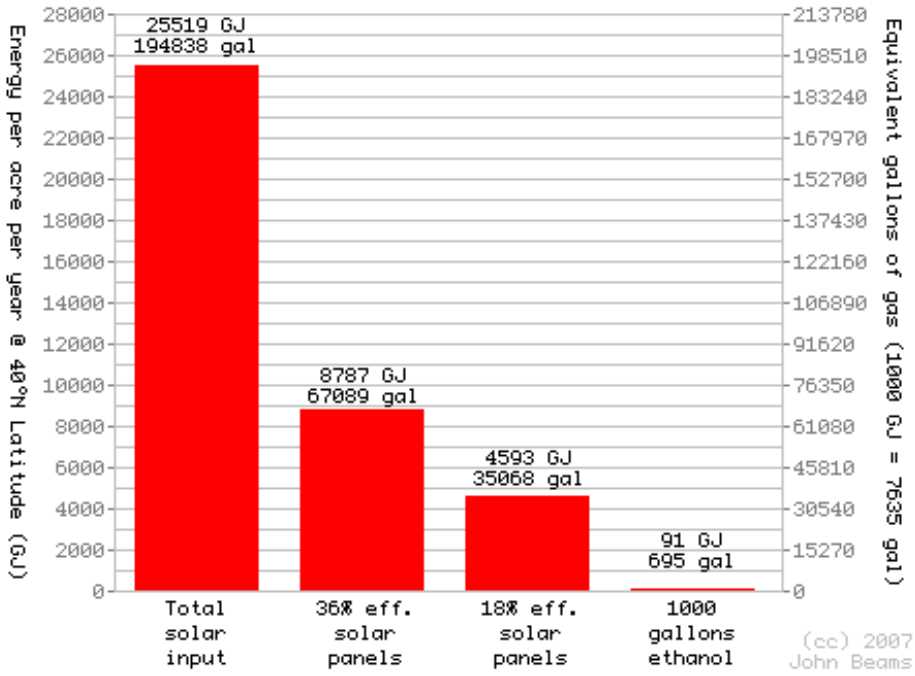

Figure 1. Solar input compared to captured energy (solar panels vs. ethanol.

Figure 1 shows that one acre of switch grass cellulosic ethanol yields 91 GJ of energy, while one acre of solar panels with an efficiency of 18% yields over 4,593 GJ, which is over 50 times more energy from the solar panels than from the plants. With 36 percent of the agro-energy reaching the consumer, it will be over 100 times more energy than we could get from ethanol. Dividing the energy from ethanol by the total solar energy that area receives, then multiplying it by a very generous efficiency of 35 percent for an ethanol-fueled vehicle, we get a sun-to-wheels efficiency of 0.125 percent for ethanol vehicles (Blanco, 2007).
So, in general the low energy density of biomass derived fuels must be taken into consideration when assessing the global technical potential of agro-energy. Power density refers to the rate of energy production per unit of the earth's area and is usually expressed in watts per square meter (Wm^{-2}). Biomass has a low energy density that ranges from only 0.01 Wm^{-2} for burning wood through to a maximum 1.2 Wm^{-2} for intensively managed tree plantations. Of all renewals the power density from biomass via photosynthesis offers the lowest power density and thus requires the largest areas of land. Harvesting electricity from sunlight with PV modules is more efficient (10 Wm^{-2}).

4. The space required to harvest solar energy is relatively small. In the Netherlands, a standard house with its roof covered with solar panels would deliver sufficient energy year-round for its own consumption.

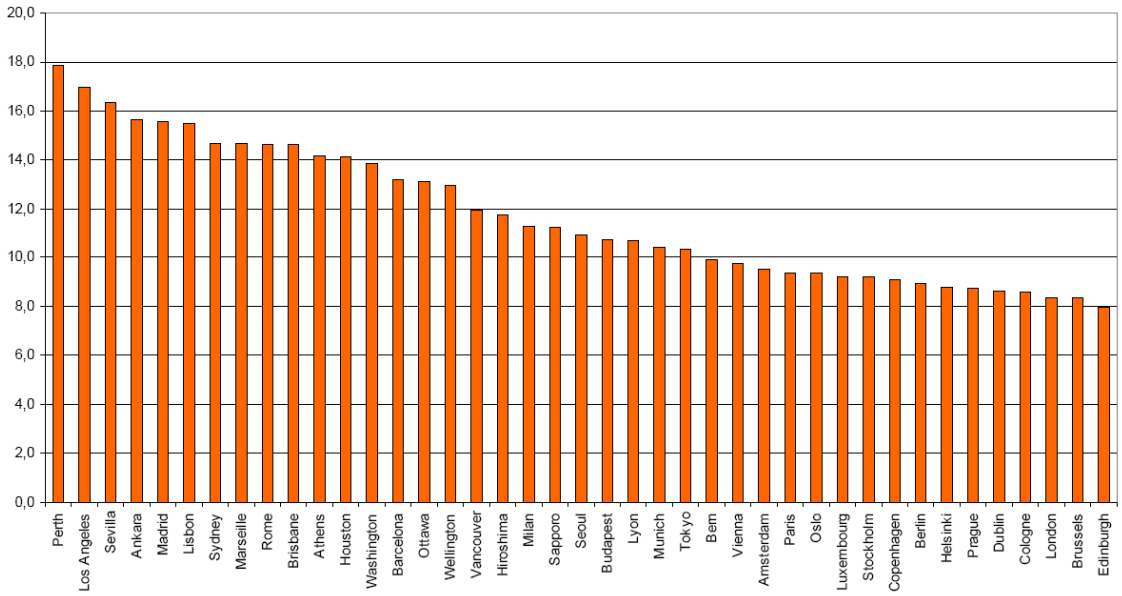

Figure 2. Energy return factor of solar energy depending on selected locations of PV cells, worldwide (IAE 2006).

Bio-energy, drawbacks

1. Biomass has to be transported in heavy, relatively big volumes (often due to the moist it contains).
2. Biomass processing (drying, cleaning, upgrading) is an important cause of pollution.
3. The large volume involved in biomass production is also reflected in the acreage of land required for production.

Implementing solar energy, constraints and opportunities

Technology as such is not the main constraint for implementing sustainable forms of energy. Instead political will, social acceptance, adaptation of social behavior and last but no least adaptation of political decision-making processes are equally important. A convincing political agenda in itself invites the industry to come with good technical solutions. Political urgency will, in due time, be created by rising prices for electricity production, while at

the same time more and more cost reductions are within reach for wind- and solar energy. It should be noted that in some European countries studies are conducted which target at a 100% replacement of fossil fuels by solar- and wind energy such as by very large-scale solar-parks in the Sahara desert, or major strings of windmill parks, like from the shores from Great Britain to Denmark for windmills (Degner *et al.,* 2006).

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IEA, 2006.
Photovoltaic power systems programme compared assessment of selected environmental indicators of photovoltaic electricity in OECD countries. IEA PVPS Task 10, Activity 4.4 Report IEA-PVPS T10. May 2006.

Further reading

http://www.autobloggreen.com/2007/06/25/reader-essay-the-origins-of-power-cellulosic-ethanol-vs-sola/
http://thefraserdomain.typepad.com/energy/biofuels/index.html
http://i-r-squared.blogspot.com/2007/07/future-is-solar.html

5. Biomass: sustainable source of energy, or phoney solution?

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Friends of the Earth, The Netherlands

Bio-fuels and biomass are hot. The aim for less dependence on fossil fuels and less emissions has created a true biomass hype. For the better or the worse, that is the question. Often the advantages of these crops are dubious and in some cases even outright detrimental to climate. For example, oil-palm- and cane sugar-plantations threaten tropical ecosystems known to be CO_2 sinks. The large-scale import of bio-fuels inhabits unnecessary risks. The transport- and energy-sector have sufficient alternatives to reduce the emission of greenhouse gasses.

Palm oil

Palm oil is one of the most important biomass crops and also one of the most harmful. It is cheap and multifunctional, and highly popular in the food industry. On top of this, the energy sector has discovered its advantages. Consequently, plantations in tropical countries rapidly expand at the expense of rainforests and wetlands. In Malaysia and Indonesia the acreage of oil palm will double within the next 10 to 20 years[2].

Europe is one of the most important users of palm oil, with a 100 percent growth rate between 2001 and 2005. Within the EU, the Netherlands is known to be the largest importer. In recent years, oil palm production has been increasingly criticized for its harmful effects on tropical forests, violation of human rights and environmental degradation. The expansion of plantations in Indonesia has gone at the expense of about 18 million hectares of forests[3]. Also swamps and peat moors are sacrificed for oil palm plantations. The soil drying process necessary for the transition of swamps and peat moors into plantations produces massive amounts of CO_2 and methane. Research carried out by Wetlands International revealed that Indonesia, due to these transitions alone, ranks third on the global list of greenhouse gas emitters.[4]

Several countries have protested against the illegal burning of forests, conflicts on land rights,[5] and adverse, slavery-like, labour conditions. In Colombia, plantation owners often collaborate with local paramilitary groups in order to force farmers of their land[6]. Furthermore, the abundant use of pesticides on plantations often causes health problems (notorious is *paraquat*, a herbicide forbidden in four European countries).

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2 Malaysia Targets Europe in Bio-fuel Push: http://www.planetark.com/dailynewsstory.cfm/newsid/32027/story.htm
Malaysia sets store in biodiesel: http://www.atimes.com/atimes/Southeast_Asia/HA31Ae02.html

3 Marcus Colchester, Norman Jiwan, *et al.* (2006). Promised Land, Palm Oil and Land Acquisition in Indonesia: Implications for Local Communities and Indigenous Peoples, Forest Peoples' Programme, Perkumpulan Sawit Watch, Moreton-in-Marsh and Bogor. p.11.

4 Hooijer, A., M. Silvius, H. Wösten & S. Page, 2006. PEAT-CO2, Assessment of CO2 emissions from drained peatlands in SE Asia. Delft Hydraulics report Q3943 (2006)

5 "In Riau in Sumatra, of the 654 conflicts over land use that occurred between 1998 and 2003, over 70 percent was related to oil palm developments." Spatial Conflict in Riau 1998 - 2003, Rully Syumanda, 2004.

6 70 percent of the export of palm oil from Colombia is shipped to Europe. Coordination Belge pour la Colombie, Nov 2006, www.cbc.collectifs.net/doc/informe_en_v3-1.pdf, pag. 26

Government fosters growth

An important engine of the growing demand for palm oil and other feedstock for bio-fuels are policies of the European Union (EU) and its member states. The mandatory blending of bio-fuels[7] with standard fuel and the subsidies for biomass for the production of energy stimulate the use of bio-fuels.

Given the fact that environmental arguments related to global warming drive the policies on bio-fuels, one would expect the government to also call for sustainable biomass production standards. Unfortunately this is virtually not the case. The criteria laid down by the Dutch Minister of Environment, Mrs. Cramer, do not offer sufficient guarantees. They fail in three respects:

1. The criteria are volatile while no sanctions against companies violating the rules are in place.
2. The flow of natural resources is insufficiently traceable. The Minister has chosen for a book-and-claim system which is easily subject to fraud. The control system relies on a system of tradable certificates, disconnecting and obscuring the linkage between the subsidized product and its place of origin. It would have been better to opt for a track-and-trace system, which has already proven its value in the organic food sector. This system follows the product from plantation to end user.
3. The proposals offer insufficient answers to macro-effects (also called leakage effect, or displacement effects). The growing demand for energy-crops comes on top of the existing demand (such as palm oil for food, cosmetics, and feed, cane sugar for sugar, maize and soy for feed and food) causing deforestation and environmental degradation. The macro-effect can occur in different ways: the expansion of plantations comes at the expense of nature, cattle grazing areas expand and farmers expelled from their lands create new agricultural frontiers. The impacts of are often indirect and therefore difficult to trace, for instance in Brazil: *"The Ministry claims, "There is absolutely no relation between the production of ethanol and the deforestation of the Amazon region." While it is true that climatic and soil conditions of the Amazon are generally not conducive to growing sugarcane, the Ministry failed to acknowledge that expansion of sugarcane for ethanol production in Brazil is contributing to deforestation in the Amazon through the expansion of the agricultural frontier. As the prime lands in the centre-south are planted to the monoculture of sugarcane, soy production and cattle ranching are driven further into the Amazon. […] expansion of sugarcane in the centre-south is threatening the few remaining areas of Atlantic rainforest, another important, biodiverse-rich biome in Brazil.8"*

This macro-effect is also relevant on a global level. *Green4Sure*, the green energy plan of CE Delft and the Dutch environmental movement illustrates this point with an example of bio-fuels based on rapeseed:
"(…) in the past 5 years, Europe changed from a net exporter to a net importer of edible oils. The production of biodiesel therefore is not totally additional. This means that the demand for biodiesel in Europe will result in an extra import of oils (especially palm oil) for food to Europe, and therefore causes a risk for indirect deforestation."[9]

Certification, even *track and trace*, does not mitigate problems in this area. Most likely some 'show plantations' will be used for export to the Dutch market, covering up ongoing deforestation. The demand is simply too big.

Covering up emissions

The benefits to the climate due to biomass for bio-fuels are often virtual. The greenhouse emissions released during production (through deforestation, forest fires, land reclamation, production and use of fertilizers, etc.) are actually not included in the Kyoto emission quota of the country that burns the biomass, but is included – sometimes, not always – in the emissions of the producing country. So the Netherlands can try to cut a dash with arrangements that leave a giant ecological footprint on the other side of the world. We therefore should ask whether we would like to reach our Kyoto targets only cosmetically or whether we want to achieve real emission reductions.

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7 Agrofuels is a better naming than bio-fuels as they are produced by the agricultural sector where biological production is rare.

8 Brazilian Forum of NGOs and Social Movements for the Environment and Development (FBOMS), 550 NGOs: Letter in response to the Brazilian Ministry of Agriculture, Livestock and Supply's statement that "Biofuel is no threat to Amazon forests". 04-04-2007.

9 http://www.green4sure.nl/pdf/3189_achtergrondrapportdef_scherm.pdf, p. 226. See also: Biofuels and Commodity Markets: Palm Oil Focus, P. Thoenes, FAO, http://www.fao.org/es/ESC/common/ecg/110542_en_full_paper_English.pdf

Traffic

The rapidly growing use of bio-fuels in traffic and transport is particularly remarkable because there are many other possibilities to reduce CO_2. It seems that bio-fuels have become a good political excuse to refrain from other policy measures. This idea is confirmed by a press release of the Ministry of Housing, Spatial Planning and the Environment (VROM): *"A recent study of the Environment and Nature Plan Bureau indicates that traffic emissions will be 1.8 Million tons higher than assumed so far. This is due to the fact that more and bigger cars will be sold that produce more CO_2. To compensate for this, Government has decided that the share for bio-fuels in total fossil fuel use should be 5.75 per cent in 2010."*[10]

The transport sector causes the biggest problems concerning the Kyoto targets: while many sectors were able to achieve some emission reductions, this sector produced 32 percent more CO_2 emissions between 1990 and 2004. Already since 1993 the EU attempts to reduce CO_2 emissions of personal cars, but this file is subjected to endless delays, procrastinations, and 'toothless' agreements. In 1998, the European car industry promised, in the so-called ACEA-agreement, to reduce the CO_2 emission level of cars to 140 grams per kilometre in 2008. But the emissions of new cars, in 2006, still were 160 grams per kilometre[11], half a gram less than the year before. The car industry will not achieve the target of 140 gram in 2008 in spite of the fact that there are no technical constraints. The car-lobby in Brussels has successfully managed to weaken new regulation, or to delay it.

There are many additional measures to reduce transport emissions. One might think of:

- a CO_2-budget for the transportation sector, with tradable emission rights[12];
- more differentiation in mileage charges;
- less car ownership and –use in cities;
- more and better public transportation;
- better spatial planning, living and working closer to each other;
- lower maximum speeds.

And last but not least, research indicates that the use of biomass in other sectors (such as the electricity sector and the bulk chemistry sector) is more cost-effective, also in comparison with second generation bio-fuels.

Volume approach: an old-fashioned instrument

This government attempts to increase the mandatory blending rate of bio-fuels from 10 percent in 2010 to 20 percent in 2020. This 'volume targeting' is a rather outmoded approach based on the assumption that bio-fuels will reduce CO_2 emissions of fossil fuels. The Fuel Quality Directive which is currently under negotiation in the EU shows a more subtle approach: it is based on CO_2 targets for the entire well-to-wheel lifecycle of any fuel type. Euro-commissioner Dimas wants to enforce a yearly reduction of 1 percent, implying an emission reduction of 10 percent in the period 2011-202013. This regulation will cover fossil fuels, natural gas, bio-fuels and any future transportation fuel.

Conclusions

Massive use of first generation bio-fuels is like opening Pandora's Box; we do not oversee the consequences. Policies for biomass should be part of an overall energy-saving strategy, with policies that target the reduction of emissions and mobility by cars. Biomass and bio-fuels should not be used to meet the growing demand for energy.

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10 Press release, Netherlands Ministry of Housing, Spatial Planning and the Environment, April 13, 2006.

11 http://www.transportenvironment.org/Article459.html

12 http://www.green4sure.nl/

13 Disadvantage of this approach is that the baseline-year lies in the future (2011), possibly offering a perverse incentive to oil companies to increase emissions till 2011.

Unless substantial advances are made with second generation biomass production, agro fuels will have a very limited role in the future, simply because they consume too much nature and forests, and compete with food production.

There are many policy options to save energy and reduce traffic emissions. Focusing on these alternatives is better than betting on bio-fuels which, to a large extent, have to be imported. There are indications that biomass can be produced from rest materials, for example in the agricultural- and food production.

It would therefore be wise to stop mandatory blending of bio-fuels and subsidies for biomass until:
1. The macro-effects are thoroughly researched;
2. There are solid guarantees that imported feedstock for bio-fuels meets social and ecological criteria of sustainability.

Considering the fact that in future years most biomass will consist of crops that are not grown in a sustainable way (cane sugar, maize, oil palm, and soy), it would be wise to stop subsidizing imported biomass and first install proper instruments to guarantee its sustainability, before the costs (in terms of human rights violations, extra greenhouse emissions, and other negative externalities) become too high.

Further reading

www.milieudefensie.nl/klimaat/visie/duurzame-energie/biomassa/
www.milieudefensie.nl/globalisering/activiteiten/palmolie/index.htm
www.foeeurope.org/agrofuels/index.html

6. Why not the Right for Food *and* Fuel?

Daan Dijk
Senior Manager Energy and Climate
Rabobank, The Netherlands

My argument concentrates on a non-excluding scenario assuming that global biomass production combined with technology driven productivity improvements, both in the food and agrisector, the bio-fuel industry and energy end use sectors, may offer good arguments to invest in sustainable biomass production for food, feed and fuel. I use three arguments to support my thesis: the need for integration of sustainable practices in current and future global agricultural production; the need to accelerate agricultural productivity, and the many benefits of biomass production for rural development in the South.

Fuel versus food?

The overall image put forward by many antagonists that large-scale biomass production for bio-fuels will be at the expense of agriculture and nature, is not necessarily correct. I first would like to refer to the long-term historical trend since World War II showing that the available calories per person increased by 25 percent in spite of a tripling of the world population. This trend is attributed to increased efficiencies in use of land, water, labour and other inputs. It has even led to overproduction in some parts of the world and to a more general trend of price erosion for agricultural commodities. Predictions based on this trend indicate that agricultural production will double by 2030, assuming arable land will not exceed the current 1.6 billion hectares. To date, 70 percent of the global poor live in areas with very low agricultural productivity. If they were using more productive cultivation methods this could further push up agricultural production rates.

Only 1 percent of global arable land is currently used for bio-fuels. This alone illustrates that the recent price increases in agricultural commodities cannot be the result of substitution between biomass for food and biomass for fuel. It is far more likely that this is the result of a more complex dynamics.

First, it should be noted that the price of many commodities including energy, metals, minerals as well as agricultural commodities have increased over the last five years as a result of population- and continued global economic growth. Food demand is growing with about 1 percent per annum. Next it should be noted that the agricultural sector uses 15 percent of global energy supply (for a.o. fertilizer production, traction etc.). It follows that energy price increases have an impact on agri-commodity prices. The same holds for increasingly scarce agricultural inputs, such as phosphorus and water. Thirdly, we witness a growing competition between biomass for food and feed. With growing income levels dietary patterns shift rapidly in favour of animal proteins. And finally, we should recall a number of bad harvests in various parts of the world as a result of which food stocks have dwindled. Add to this the strong incentive programs for the bio-fuel sector pushed by politicians (in an attempt to curb the increasing dependence of the North on mineral oil resources), and all ingredients for more volatile food prices are in place. On a more structural level the developments point to the fact that food and feed markets are getting tighter. But rather than blaming the bio-fuel sector for burning the poor's food, it is probably more productive to see what the real causes are, and what can be done about it.

The trend is bio-energy

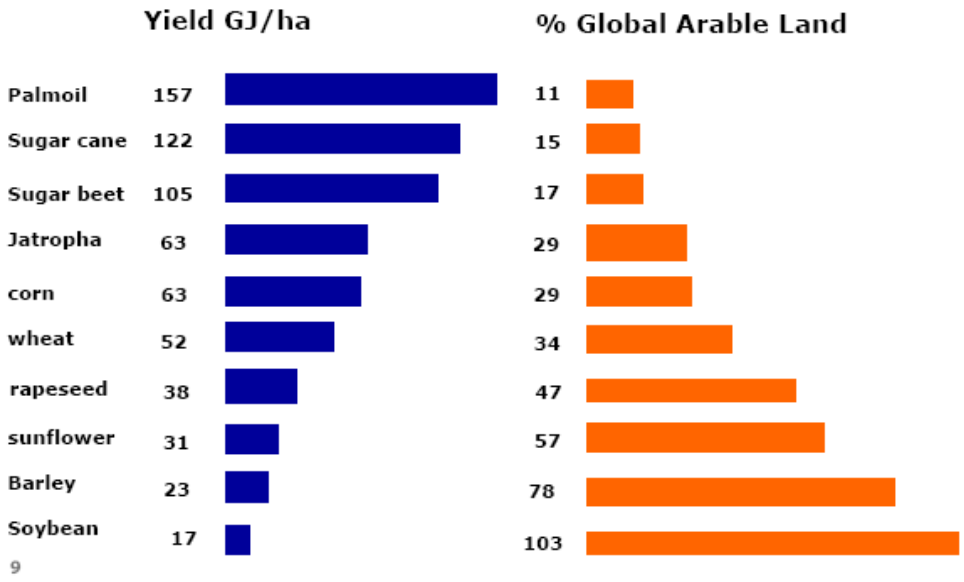
Currently, modern bio-energy provides only about 2 percent of global energy demand. As for the future, most experts, including the International Energy Agency (IEA), predict a strong growth of demand. The private sector invests heavily in bio-fuel production both for transportation fuels as well as for heat and power production. Overall investments, including those of the petrochemical industry, are about US$ 3.9 bn (vs. 1.8 bn for solar energy). One of the reasons why the petrochemical industry and the automotive industry invest in bio-fuel related R&D is that bio-

fuels can be relatively readily integrated in their current business (i.e. downstream activities of oil majors and existing car engines). Since the downstream business for bio-fuel is very similar to that of petrols, bio-fuels provide the oil majors the option to continue business with other means in case more stringent environmental policies were enacted, or in case earlier depletion of mineral oil reserves would occur. Another reason for the industry's investments is the steep rise in energy demand combined with dwindling reserve production ratios. Research indicates that the predicted rise of 50 percent of global energy demand (from the current 470 EJ to more than EJ 700 in 2030, particularly in the transportation sector) cannot be covered by fossil fuel production only. Bio-energy can compete with fossil fuels in many end-use markets, including heat and power production. Of course, bio-energy options will have to compete with efficiency improvements in energy end-use which may lead to system changes, e.g. electric cars, as well as with other renewable energy options, such as wind and solar energy.

The poor can benefit from biomass

About 70 percent of the world's poor live in rural areas, while 50 percent the global population depends on traditional biomass for basic, albeit often very unhealthy energy services (such as wood and coal burning for cooking). When properly processed, the benefits of biomass production for developing countries are many. As an example I refer to cassava which can be used for both food and for the production of bio-ethanol, when properly processed. The residues for bio-fuel can be used as feed for livestock. Last but not least, large scale production of cassava for bio-fuels can also generate income through the sale of carbon credits under the Clean Development Mechanism of the Kyoto Protocol.

At this point I would like to counter the argument that bio-fuel production will necessarily be at the cost of pristine forests in, for example, South-East Asia. The graph below shows that there are huge differences in energy productivity between the most popular energy crops in use for biomass production. In particular perennials or semi-perennials such as palm oil, sugar cane and jatropha, would take a far smaller percentage of global arable than crops such as wheat and maize. We may expect that new species, such al algae can substitute today's energy crops long before say 10 percent of global arable land is used for bioenergy cropping.



Land Requirements for 25% substitution of transport fuels.
Source: Fresco, Louise O., 2006, Biomass for Food or Fuel, is there a dilemma?

Of course, any large scale cultivation of energy crops should be consistent with broadly accepted criteria for sustainable biomass production, such as developed by the De Roundtable on Sustainable Palm Oil (RSPO) or the

Cramer 'Framework for sustainable biomass production in the Netherlands'[14]. Production of palm-oil at the expense of tropical forests or on peaty soils such as in large parts of Indonesia and Malaysia should obviously be prohibited. It should be noted however, that the need for sustainability criteria is not uniquely tied to the production of biomass, but relevant for all agricultural production, whatever the end use. Hence it should include biomass for food and feed, as well as for energy.

Provided biomass production for energy is done in a sustainable way, the socio-economic benefits can be substantial. Income from bioenergy can increase agricultural productivity, and free up land for food, feed and fuel. Furthermore, the development of bioenergy supply chains will provide access to energy for many, and could serve as a stepping stone to a bio-based economy.

Key success factors

The production of bioenergy is a delicate business because just as with biomass production for food and feed consumers in end-use markets will ask critical question about the origin, safety and sustainability of the feedstock. As with food and feed, bio-fuels cannot be introduced successfully without meeting sustainability criteria.

Ultimately it all depends on making well informed, clever choices. First, I would like to mention the choice of the energy crop, which should be high yielding in terms of energy, and be suitable to the soil and water conditions in the area of cultivation. Expansion of biomass cultivation for energy should not take place at the expense of food production, nor threaten natural forests. Alternative options are biomass production on surplus land or areas with low agricultural productivity. Secondly, these high yields per hectare should be realized at sufficiently low production costs in order to be competitive. Finally, I would like argue for a 'civilization' in the value chain; meaning that farmers, retailers and producers should all commit to sustainable production methods and benefit from the production of bio-fuels in an equitable and fair manner.

The Dutch Government has summarized several important criteria for bio-fuel production in the so-called 'Cramer Framework for sustainable biomass production'. I would like to highlight the following criteria:

- Biomass production should not compete with local food production and/or biomass production in developing countries;
- Protected areas and areas with vulnerable biodiversity resources should be excluded;
- Biomass production should have a positive impact on the local economy;
- Biomass production should improve the well being of labourers and the local population;
- Biomass production should not negatively influence soil-, water- and air quality.

To secure that these requirements are met, one should introduce a number of checks and balances in the biomass supply chain: First, companies throughout the production chain should provide evidence showing that they are in compliance with the above criteria ('value chain responsibility'). This can be done by implementing a certification system that is adopted by private sector parties in both importing countries as well as by producers in the countries of origin. Second, at the macro-scale governments should closely monitor any changes in land use (including protected areas) and food prices, and should support international monitoring initiatives. Finally, governments, business and Ngo's should collaborate in implementing the criteria. Last year a Dutch *Coalition of the Willing*, consisting of 20 companies, Ngo's and two universities have decided to implement sustainability criteria in the bioenergy supply chain through a number of pilot projects around the world.

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[14] Commissie Cramer, 2007, Toetsingskader voor duurzame biomassa. Eindrapport van de projectgroep “Duurzame productie van biomassa”. http://www.lowcvp.org.uk/assets/reports/070427-Cramer-FinalReport_EN.pdf.

- BIOX
- Cefetra Groep
- Control Union
- ECN
- Electrabel
- EPZ
- Essent
- Havenbedrijf Rotterdam
- IMSA-OASE
- LEI
- Maris Group
- NUON
- Oxfam Novib Probos
- Peterson Bulk Logistics
- Rabobank
- Shell Nederland
- Universiteit Utrecht
- VNPI
- Wereld Natuur Fonds
- WUR

Coalition of the Willing.

Conclusions

As a cooperative food and agribank we, at Rabobank, are aware that the core business of our clients is in natural resource development. Their long term business depends on sustainable natural resource use. Environmental research and growing international evidence on climate change, further accelerated by documentary films such as *'An Inconvenient Truth'*, remember us that nature is unforgiving, and that we need to play by the "rules of the house" if we want to live in a secure world. It is therefore that I support a further growth of biomass production, but on the strict conditions formulated above. Summarizing the arguments in favour I would like to mention the following points:

1. Bioenergy offers a potentially sound solution for the rapid growing demand for energy;
2. Bioenergy recourses are geographically more equitably distributed, and provide easy access to energy to hundreds of millions who are currently without prior access to energy;
3. Bioenergy can enhance energy security, is not harmful to the climate, and has positive impacts on rural development;
4. There are serious concerns about the possible adverse impacts of large-scale biomass production by consumers and Ngo's. The integrity of the bioenergy value chain is a key success factor. Both producers and the financial sector should not neglect these concerns.
5. Biomass production should take place under strict conditions to prevent that the cure becomes worse than the disease.

Further reading

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7. Bioethanol: part of the solution

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Research on lignocellulosic ethanol is at the core of Nedalco's bioethanol strategy. Based on the potential improvements in current production technologies, the mid-term potential of converting lignocellulosic residue streams into bio-fuels (second generation) and limited number of alternatives for fossil fuels in the transportation sector, Nedalco believes that this source of energy has a future.

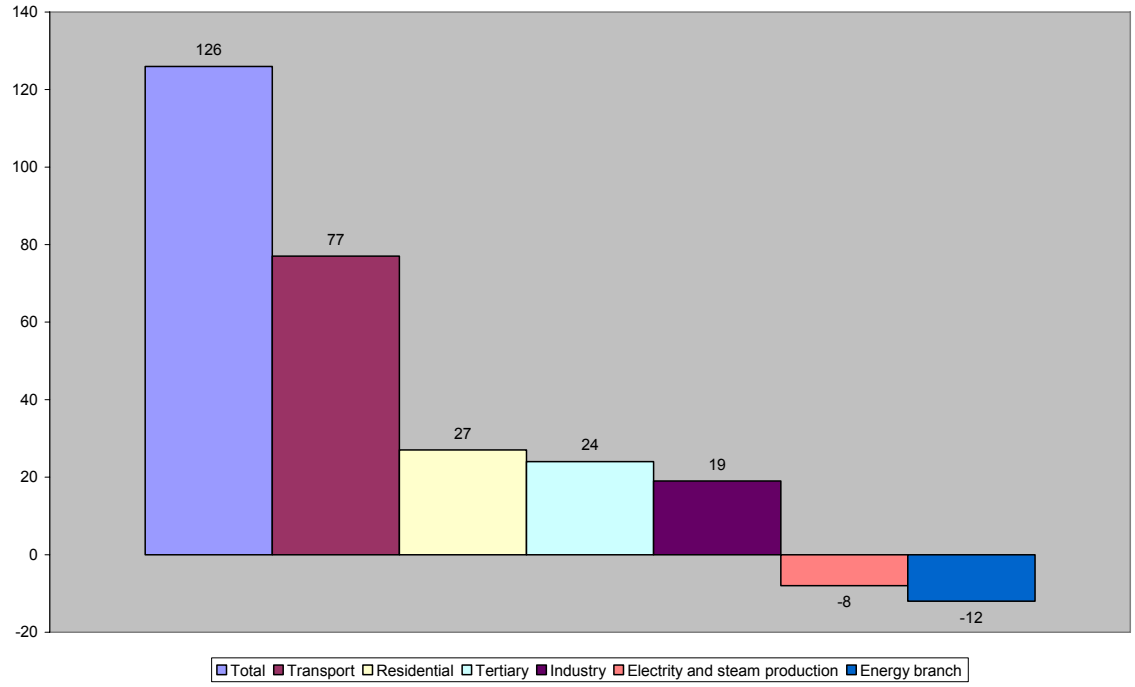

Figure 1. Forecast change in greenhouse gas emissions, 2005-2020 (MT per year, CO_2 only, EU25). Source: European Commission, DG Environment (PRIMES model).

In terms of CO_2 emissions the transportation sector is responsible for more than 60 percent of the growth in greenhouse gas emission up to 2020 (Figure 1). In the short- to medium-term bio-fuels are the only large-scale alternatives for fossil-fuel based transportation systems. Research indicates that in the transportation sector, CO_2 emissions can be reduced through a number of alternatives such as better engines, better tires and better lubrication (Table 1). Bio-fuels do not exclude such alternatives and improvements. In fact, attention must be given to all these options. It should be noted bioenergy doesn't have the potential to fulfil the current global energy demand of ~ 460 EJ completely, but this is true for all renewable energy sources. In developing a new sustainable energy matrix, bio-fuels are equally important as wind and solar energy.

Table 1. Options for potential savings in the transport sector (European Commission SEC, 2006).

	Potential for savings (Mtoe)	Cost of savings (€/toe)
Estimates from impact assessment for action plan on energy efficiency		
Measures to make driving costs more km-dependent	3 to 15	
Limitation of maximum speed, acceleration of power-to-weight ratio of new cars and trucks	11	
Fuel efficient tires and measures for fuel efficient tire pressure	15	
Fuel price increase	22	
Maximum emission standards for new cars plus more stringent voluntary agreement for the fuel efficiency for new cars and lorries after 2008/2009	28	
Estimates from impact assessment for forthcoming communication on CO_2 and cars		
Fuel efficient mobile air conditioning systems	1	36
Low rolling resistant tires	2	4
Tire pressure monitoring systems	3	- 273
Low friction lubricants	4	284
Reducing fuel consumption in light commercial vehicles	5	557
Reducing fuel consumption in passenger cars	20	71 to 505
Estimates from the present staff working paper		
Promotion of bio-fuels	43	120 to 399

Nedalco has investment plans in industrial lignocellulosic bioethanol production. One of the reasons for this investment is to get access to lower cost residue streams. Residue streams not only have a lower cost, bioethanol production based on lignocellulosic biomass also has a better sustainability profile. In comparison with most current productiontechnologies, the net greenhouse gas reduction is higher (< 70 percent), the impact on land use and food markets is lower, and a wider variety of feedstocks can be used for production. Abundant alternative feedstock sources such as food processing residues, straw, wood chippings from forest waste, residues from wood processing, woody biomass crops such as short rotation coppice and switchgrass, can have a significant potential for fulfilling the world's growing energy needs (Table 2).

Nedalco's investments depend to a large extent on public policy, which is strongly influenced by public perception. For that reason Nedalco is closely involved in the debate on sustainability of bioenergy and the 'food versus fuel' discussion. It experiences this discussion as highly political and sometimes even emotional with a wide variety of stakeholders: not only Ngo's but also the food industry and oil industry.

In the food-versus-fuel debate for instance the effect of higher commodity prices needs to be discussed in a less politicized way. Is such trend by definition negative? For decades the EU and US agricultural policy has been severely criticized for dumping surplus production on the world market and thereby forcing farmers in developing countries out of production. The current growth of the bioethanol industry in the EU and notably the US provides new outlets for these grain surpluses and reduces the risk of dumping subsidised grain in developing markets. This will have a positive effect on world commodity prices, which for most regions in the world have been below cost of production for a long time. In turn, this will encourage farmers in both the developed and the developing world to produce more grains. The result will be a renewed viability of food production in developing countries and a boost for the rural economy.

Table 2. Overview of the global potential of biomass for energy (EJ per year) to 2050 for a number of categories and the main pre-conditions and assumptions that determine these potentials (IEA Bioenergy, 2007).

Biomass category	Main assumptions and remarks	Energy potential in biomass up to 2050
Energy farming on current agricultural land	Potential land surplus: 0-4 Gha (average: 1-2 Gha). A large surplus requires structural adaptation towards more efficient agricultural production systems. When this is not feasible, the bioenergy potential could be reduced to zero. On average higher yields are likely because of better soil quality: 8-12 dry ton/ha/yr* is assured.	0-700 EJ (more average development 100 – 300 EJ)
Biomass production on marginal lands	On a global scale a maximum land surface of 1.7 Gha could be involved. Low productivity of 2-5 dry tonne/ha/yr*. The net supplies could be due to poor economics or competition with food production.	<60 – 110 EJ
Residues from agriculture	Potential depends on yeld/product ratios and the total agricultural land area as well as type of production system. Extensive production systems require re-use of residues for maintaining soil fertility. Intensive systems allow for higher utilisation rates of residues.	15 – 70 EJ
Forest residues	The sustainable energy potential of the world's forests is unclear – some natural forests are protected. Low value: includes limitations with respect to logistics and strict standards for removal of forest material. High value: technical potential. Figures include processing residues.	30 - 150 EJ
Dung	Use of dried dung. Low estimate based on global current use. High estimate: technical potential. Utilization (collection) in the longer term is uncertain.	5 – 55 EJ
Organic wastes	Estimate on basis of literature values. Strongly dependent on economic development, consumption and the use of bio-materials. Figures include the organic fraction of MSW and waste wooed. Higher values possible by more intensive usof bio-materials.	5 – 50 EJ
Combined potential	Most pessimistic scenario: no land available for energy farming; only utilization of residues. Most optimistic scenario: inte4nsive agriculture concentrated on the better quality soils. In parentheses: average potential in world aiming for large-scale deployment of bioenergy.	40 – 1100 EJ (200 – 400 EJ)

Current spikes in agricultural commodities have numerous causes. Short term food price rises as we currently experience in the world grain markets are mainly caused by a combination of adverse weather conditions, increased demand from emerging markets such as China and India for meat production, trade restrictions, energy prices and exploding marketing costs incurred by processing companies and speculation. According to the European Commission, all of the food inflation since 2000 has happened off-farm.[15]

If we take a closer look at the European situation, we see that in 2006 only 1.4 percent (less than 5 mln. tonnes) of the EU cereals market was absorbed by the bioethanol industry (Graph 4). Furthermore, current high wheat prices have affected the profitability of the EU bioethanol industry severely as feedstock costs make up more than half of total production costs. In several EU countries (Germany, Spain, Austria) processing plants has been shut down in anticipation of lower wheat prices.

[15] "The impact of the rise in agricultural prices on European food consumption and prices", presentation by Russel Mildon (Director DG Agriculture, European Commission) at F.O. Licht's conference *The impact of biofuels on commodity markets* (Brussel, 25-26 September 2007).

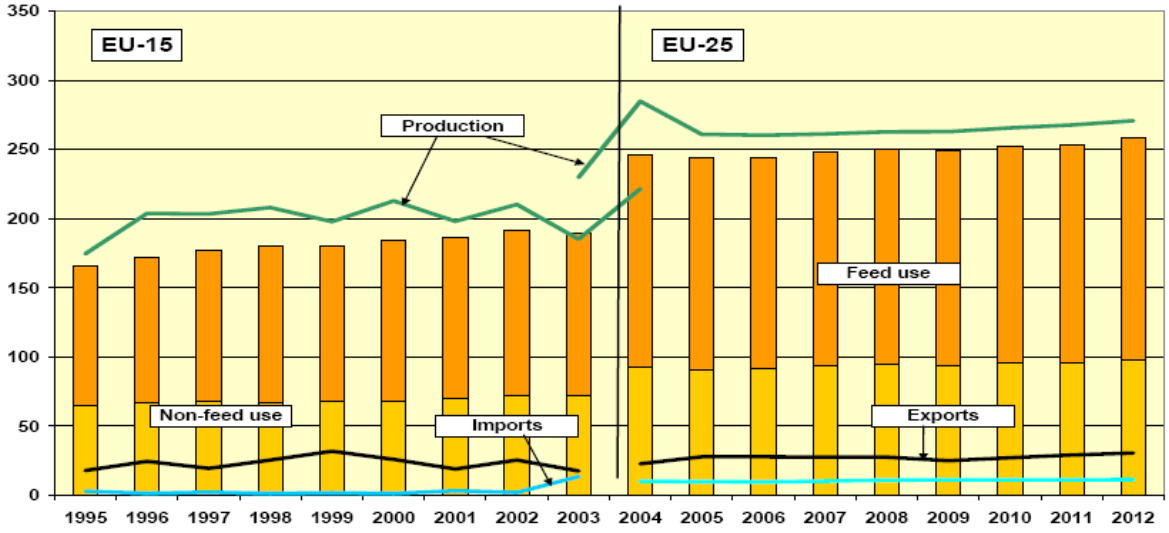

Figure 2. *Prospects for agricultural markets and income in the European Union 2005-2012 Source (European Commission, 2005).*

Having said that, Nedalco believes sustainability to be one of the key factors determining the future of bio-fuels. Sustainability criteria will increasingly dominate the political framework and policy. Simultaneously, complex certification schemes will – in the short term – probably not yield sufficient control over the sources of the inputs. This is being acknowledged by the Dutch Ministry of Environment. In the meantime Nedalco believes more attention should be given to pragmatic alternatives for sustainability criteria. A more regional focus on production is one of them, as this will provide more grip on production processes. But more important is that governments need to invent 'positive' policy instruments which stimulate the production of second generation bio-fuels. Examples are research grants, investment subsidies, excise duty exemptions or other market measures. Setting criteria will not help bringing a new generation of better bio-fuels to the market since criteria do not provide incentives to overcome the initial higher costs of next generation bio-fuels such as lignocellulosic ethanol.

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8. Opportunities and threats bio-fuels for agriculture and rural development

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Introduction

As the introduction to the meeting indicated, world demand for bio-fuels is booming and could be regarded as a way out of misery for the agricultural sector. The main question is whether and how bio-fuel production suits sustainable agriculture. Does it lead to upscaling/monoculture, soil degradation and more rural poverty? Or is the new bio-fuel demand benefiting the agricultural sector boom and driving economic development?

The preliminary conclusion in the World Development Report 2008 on agriculture is that *'Bio-fuels offer a potential source of renewable energy and possible large new markets for agricultural producers. But few current bio-fuels programs are economically viable, and most have social and environmental costs: upward pressure on food prices, intensified competition for land and water, and possibly, deforestation. National bio-fuel strategies need to be based on a thorough assessment of these opportunities and costs.'* In short: yes, bio-fuels offer an opportunity for agriculture, but there are some doubts and pitfalls.

In the meanwhile, irrespective of these considerations, Europe has already decided on an obligation to include bio-fuels in the fuel for transport as a replacement of fossil fuels. In deciding upon the obligation, special reference is made to the need to reduce Green House Gas emissions and redressing climatic change. The aim is to include 5, 75 percent (energy content) bio-fuels by 2010 and 10 percent in 2020, provided these percentages can be achieved in a sustainable and affordable way (EU policy) and do not negatively affect the chances for small scale producers (Netherlands policy).

The attention to fuel for transport is understandable considering that almost half of total (fossil) fuel consumption is related to transport. When considering total emissions of Green House Gases from fuel combustion the transport sector is the only one that shows growth. Whereas all the other sectors (e.g. energy, industry or construction) show declining emissions compared to the index 1990.

In short, the increasing demand for biomass -among others as a result of the use of bio-fuels- offers an opportunity for agriculture. The question remains which part of agriculture is going to profit from it and how it will develop within the competing claims of the dimensions of sustainability: profit, people and planet.

What will not (or insufficiently) be touched upon in this contribution is the complex relation between food production, food prices and food security. Experience over the last decades has shown that an increased availability of food does not automatically lead to increased food security, especially not among the poor. Neither the reverse is true. In addition, food prices on the world market are only to a limited extent related to food prices on local markets, especially in developing countries and are not affecting, in a straightforward way, the access to food and food security of the poor.

The following sections will deal with the profit, planet and people dimension of bio-fuels and the role of government policies, as well as private initiatives in encouraging sustainability in bio-fuels and taking care of non-trade concerns.

Profit and bio-fuels

If we agree to the notion that bio-fuels provide an opportunity for agriculture in theory, let's dwell upon some of the 'but's' that were raised by the World Development Report 2008. The first hesitation is that *few current bio-fuels programs are economically viable.*

An abundance of literature, reports, studies and articles is available addressing this issue. Their conclusions are equally varied. According to an impact assessment made by the European Commission Directorate General Agriculture in 2007, the 5.75 percent target for 2010 will only be reached in 2015, if left solely to the market without any supportive action by governments. The impact assessment is voicing serious doubts if the 10 percent target will ever be reached (European Commission Directorate-General for Agriculture and Rural Development; The impact of a minimum 10 percent obligation for bio-fuel use in the EU-27 in 2020 on agricultural markets.

According to the OECD the economic outlook for bio-fuels seems fragile. The share of bio-fuels could realistically amount to 13 percent in 2050, provided oil prices remain high. In that case, the reduction in emission of energy related CO_2 will be reduced by 3 percent. This will contribute to a reduction in the growth of the demand for fossil fuel. Another effect of the increased use of bio-fuels for transport is that food prices will be linked to oil prices. Higher oil prices will lead to an increase in the demand for bio-fuels, which in turn will lead to higher production cost for biomass and competition with other fossil fuels.

With respect to the area necessary for the production of the biomass for the production of bio-fuels, the findings differ radically. According to the OECD, the entire globe has to be covered with agriculture in order to be able to meet demand and the prices of food will increase sharply. The impact assessment by EC's DG Agriculture, on the other hand, claims that the European demand for bio-fuels can be met by rising productivity in agriculture, and in addition by the surplus supply created by a stagnating food demand in an already saturated market.

People and Planet & Bio-fuels

Even more than the economic benefits or viability of bio-fuels, the People and Planet aspect of bio-fuels has been debated. In the Netherlands, an advisory committee was requested by the government to advice on the sustainability of biomass for energy purposes. The Platform Groene Grondstoffen (Platform Green Resources) with its *Greenbook Energy Transition* drew attention to various social and environmental effects of the substitution of fossil fuels by renewable sources of energy. And the International Panel on Climatic Change agreed that changes in the climate could be attributed to the emission of green house gasses and (therefore) to human behaviour. In these discussions, various clusters of concerns with respect to the effects of the increased use of bio-fuels were voiced: deforestation and change in land use, the effective contribution to the reduction of CO_2 or GHG emissions, erosion of biodiversity, labour conditions and child labour, benefits to smallholders and the effects on food prices and food security, to name just a few examples.

As in the case of economic viability, the opinions vary widely across the many studies and reports, strongly depending on the political persuasion of the author or the organisation that commissioned it. The contribution to the reduction in CO_2 emissions strongly depends on the source material for biofuel-production. The reduction in case of bioethanol made from sugarcane might be as high as 90 percent, whereas ethanol from maize only scores 10-30 percent. For some, this reduction has to be weighed against effects of change in land use. The effects on People and Planet have to be mitigated by certification along the lines of Round Table on Sustainable Palm Oil (RSPO), Round Table on Responsible Soy (RTRS) or Forest Stewardship Council (FSC-wood). Others maintain that the contribution to the CO_2 reduction will remain marginal because of the small share of bio-fuels in total energy use, and because the CO_2 emissions/reduction have to be measured throughout the entire chain of production, trade and consumption. As the case of Brazil shows, the use of bio-fuels is predominantly an interesting option for raising energy security and access in developing countries.

Governmental policies

Amidst all these discussions, governments (national as well as regional) are addressed to play a meaningful role. After more than a decade of restructuring the EU Common Agricultural Policy, it is remarkable that at the first signs of a functioning world market in agriculture, governments and the European Commission are appealed upon to intervene for the sake of people or planet. Various non-trade concerns are raised with the intention to regulate or intervene with the functioning of global markets in bio-fuels, even if they are in violation of earlier agreements or commitments, e.g. with respect to WTO and Everything But Arms (EBA). Parliamentarians have come with motions and governments with policies, tariffs and levies to protect the interests of Dutch or European farmers against those of developing countries and with criteria and measures that are clearly discriminatory against foreign producers (Doornbosch & Steenblik, 2007).

A biobased economy?

In its response to the Platform Groene Grondstoffen Greenbook, the Dutch government indicates a fundamental problem in dealing with bio-fuels. In assessing sustainability criteria of production, trade and use of bio-fuels, it is impossible to make a distinction between biomass that is being produced or used for bio-fuels on the one hand and biomass that is used for e.g. food, feed or drinks on the other. After all, only with hindsight it can be ascertained which flow of biomass needs assessment or certification, and which not. The final use is determined at the end of the pipeline by the fuel distributor in Europe, not at the beginning by the producer of biomass, i.e. the farmer.
Any system of assessment or certification is therefore deemed to be fragile, or to even fail. Even if a farmer is able to determine beforehand for which purpose (s)he is going to produce; as long as (s)he is using existing cropland for the production of biomass for energy purposes, the farmer qualifies for the criterion of land use, even if (s)he is clearing tropical forest to grow biomass for food.

If we really want to engage in a discussion on the effects of using biomass for bioenergy on food security and food prices, we cannot limit ourselves to its use for bio-fuels. We should be prepared, almost as a moral obligation, to discuss any competitive claim on biomass, including the production of beer and meat. As long as there is hunger in the world, we should refrain from using valuable arable land to produce anything else than food. Not just in developing countries, but also in the Netherlands.

Led by the Ministry of Economic Affairs, the Dutch government is going to organize a series of public debates on non-trade concerns such as biodiversity, food security, labour conditions or climatic change in 2007 and the beginning of 2008. The findings of these debates will be translated into a revised Dutch policy and strategy on these non-trade concerns, and how to take care of them in various international for a like WTO, ILO and Multilateral Environmental Agreements (MEAs) such as the Convention on Biodiversity.

Promoting good practices

What can be expected from governments? Currently, governments are severely limited in their possibilities to formulate and implement measures, demands or requirements from a perspective of sustainability due to the nature and architecture of the international context, and as a result of their earlier commitment to development goals, e.g. as laid down in the MDGs. Of course, governments can include specific conditions and requirements for enhancing sustainability in subsidies, in stimulating innovation and research, as well as in its own purchases (as launching customer) provided that they are very careful in respecting the many agreements that were concluded internationally.
Equally challenging is the introgression of sustainability-criteria in the context of WTO, but also -and perhaps even more importantly- in the International Labour Organization (ILO) and the MEAs. Within WTO the challenge will be to address sustainability issues in international trade. Within the MEAs the challenge will be to effectively link the mandate of these MEAs (e.g. CBD with respect to biodiversity, ILO on labour conditions etc) to trade measures. As experience has already shown, this is going to take a lot of effort, energy and time. Although guarantees for success can not be given, the increasing awareness on sustainability is a contributing factor to the optimism that we will succeed.

What can be expected from private initiatives?

On the sort term, much more can be expected from private, voluntary initiatives among direct stakeholders, such as the various roundtables on soy or palm oil, efforts to formulate and translate social responsibility of consumers and corporations into the use of purchasing power to reward good behaviour. The purpose of these efforts is that the preferences of citizens coincide with their behaviour as consumers.

Essential is that also representatives of the various stakeholders in developing countries are included in the discussions and in the design of certification, as well as the reporting and monitoring schemes that belong to these certificates in order to make them trustworthy and persuasive to the consumer.
Recently the International Social and Environmental Accreditation and Labelling (ISEAL) Alliance, as an alliance of various private voluntary standards such as the Marine Stewardship Council (MSC), the Forest Stewardship Council (FSC), and Fairtrade, has adopted a Code of Good Practice requiring that private voluntary standards are set in open, transparent, participatory, multi-stakeholder processes. The Code demands that there must be a demonstrable need for the standard and includes measures to ensure that even the most marginalised stakeholders have a say in the standard's development. The ISEAL Code of Good Practice aims to become the international reference for setting credible voluntary social and environmental standards. It is referenced by a range of governmental and intergovernmental guidelines as the measure of credibility for voluntary social and environmental standards.

Based on decades of experience, the International Standardization Organization (ISO) has played an important role in assisting ISEAL in formulating their Code. ISO itself is actively engaged in setting up an International Standard providing guidelines for social responsibility (SR). The guidance standard is expected to be published in 2009 as ISO 26000 and be voluntary to use.
Governments have played and will continue to play an important role in supporting initiatives to come to such a private voluntary standards, as well as in supporting and strengthening capacities in developing countries to meet their demands without endangering the development objectives.

Concluding remarks

Summarizing, we can adhere to the preliminary conclusion of WDR 2008 that bio-fuels and the emerging biobased economy provide opportunities for agriculture in developing countries. Especially with respect to mandatory bio-fuel programmes, there are doubts however about their economic viability and the social and environmental costs. Governments can only play a limited role in influencing economic, social or environmental viability, bounded as they are by the architecture of international agreements. Private initiatives, such as various roundtables covering specific products en private certification schemes, are much less restricted and offer an interesting and potentially more effective instrument for taking care of non-trade concerns.

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9. Agro-energy - Global perspectives and the impacts on agriculture and food supply

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Claims on natural resources and development

Developments to reduce food insecurity, to suppress climate change, to reduce over-fishing, to bring a hold to degradation of land, to prevent pollution and overuse of water, and to improve poorly managed animal production have not dramatically improved over the past decades. At the same time the global demand for food and feed will increase drastically during the coming decades to meet the needs of the growing population. Billions of people will become wealthier and desire higher quality food, including more meat. In addition to these growing needs, the demand for agro-energy has abruptly increased during the past years because of policies for compulsory blending of transport fuel and subsidies for the production of biomass for energy. All these demands can be met only when the use of the world's natural, social and financial resources are utilized most optimally. The Millennium Development Goals address most of these issues aiming to increase benefits from the earth's resources for people living in developing countries, including the food insecure.

Demand for agro-energy

A number of concurrent global problems have fuelled the sense of urgency for agro-energy. CO_2 neutral energy from biomass would be a perfect answer to curb climate change. Use of agro-energy would allow countries to comply with the Kyoto agreements of reducing CO_2 emissions. The dispersed production of energy throughout the world suits the current geopolitical strategies to reduce the dependence on few and unreliable suppliers of energy. In Europe, agro-energy is seen as a way out of misery for the rural population due to the dwindling agricultural sector and has been strongly lobbied for by the agri-business (e.g. Aantjes, 2007).

CO_2 and GHG

Carbon dioxide (CO_2) is released when fossil fuels are burned for our energy needs and is seen as the prime cause of climate change. As plants fix CO_2 for their growth, the use of biomass for the production of agro-energy could potentially curtail CO_2 emissions and dampen climate change, as it would replace fossil fuels. The clearing of natural lands for the production of biomass feedstock for agro-energy may cause emissions of CO_2 because of the removal of vegetation and decomposition of soil organic matter ranging from 20 – 300 tons $C.ha^{-1}$. The prevented CO_2 emissions from agro-energy reach maximum values of up to 3 ton $C.ha^{-1}$ but could even be negative under poorly agronomic management. It may henceforth take 20 to more than 150 years to recover the initial losses of CO_2-emissions. Also, emissions of N_2O with a radiative forcing 300 time higher than of CO_2, may completely undo the potential CO_2 savings (Crutzen *et al.*, 2007). It is therefore questionable to what extent the use of agro-energy can contribute to curtail climate change and to meet Kyoto criteria.

Emissions of GHG of every hectare of land that is cleared for the direct production to energy crops should obviously be allocated to the balance of agro-energy. Also, every hectare of energy crops that takes over current agricultural land causing the clearing of land elsewhere for the production of food and should also be added to the balance of the agro-energy, as it makes no difference to the CO_2 in the air, for what reason a piece of land was cleared for.

Alternative energy source

Biomass is seen as one of the alternative sources for the provision of energy. Plants fix between 0.5 – 1.5 percent of the energy in the solar radiation that reaching them. Energy, as fuel for the tractors or for the production of nitrogen fertilizers in the factory, etc. is needed for the cultivation of the biomass, irrespective of the feedstock being first (vegetable oils, starch, sugars) or second (cellulose, wood, etc) generation. Transportation to the factories after harvest and the processes of the feedstock also incur energy losses. The amount of net energy that ultimately reaches a consumer might be as low as 0.2-0.3 percent of the initial solar energy reaching the plant. Due to these low efficiencies, large volumes of biomass will be needed for the production of energy what should be grown or collected from massive land areas. In addition to land and energy, water, nutrients and agro-chemical are needed for cultivation. Inputs can be kept minimal or can be completely omitted in production systems for agro-energy to prevent losses, but imply minimal production as well and consequently the need for even more extensive land masses. For the provision of the 5.75 percent obligatory blending with bio-diesel for the Netherlands only, an estimated land area of over 2 million hectares of soybean (grown in South America) would be needed (Bindraban – own calculations). Compared to efficiencies up to 15-25 percent for solar panels, agro-energy implies an inefficient use of natural resources.

Agro-energy to stimulate European agriculture

Europe has been seeking for ways to revive the dwindling developments of its rural areas. The dramatically increased demand for agro-energy has pushed commodity prices to unprecedented heights over the past year. Land that was set aside to control overproduction in Europe is again being taken into production for energy-crops and are therefore claimed not to compete with food. At the same time however, Europe is importing increasing amounts of feed, such as soybean, and therefore claims millions of hectares abroad, in turn leading to idle acreages in Europe. Competition for natural resources has therefore not changed from a global perspective.

Global potential of food, feed and fuel

Global potential for the production of energy crops have been reported to range from some 40 to over 1100 ExaJoules, as compared to the current global use of 440 ExaJoules (Hoogwijk *et al.*, 2005; OECD, 2007; Wolf *et al.*, 2003). The upper estimates are based on model analyses that did account for the availability of land, but did not explicitly take water and nutrient availability on board, resulting in severe overestimates. Energy crops tend to grow sky-high in the Sahara, which is theoretically possible, but only with sufficient water, nutrients and other agro-chemicals. It is not very likely that sufficient water nor nutrients can be made available for this purpose. On the other hand, other analyses take all suitable land into cultivation for food, feed and fuel and therefore clear current rainforest and other valuable ecosystems.

For more realistic estimates the ecological dimensions of the production of energy crops should be properly accounted for. We are currently developing such an approach with preliminary findings for the African continent (e.g. Bindraban *et al.*, 1999; 2000; 2007).

A production ecological analysis in the early 1990s on global food production and demand revealed the need for food supply from South America or Eastern Europe to Eastern and Southern Asian regions as these latter regions lack enough land and water to be self sufficient towards 2040 (WRR, 1995). The flow of food and feed from South America to China has indeed increased dramatically during the past decade. The demand for energy crops may therefore jeopardize the global food security, and more so worlds' biodiversity.

Opportunities for development

Agro-energy is perceived by many as an opportunity for development of current poor nations. On the other hand, an increasing number of reports call to be cautious as this new market also inherits threats. The large volumes of feedstock needed for the production of agro-energy calls for large scale and economically efficient operations to be competitive. Indeed large capital investments are made in countries like Brazil and the USA in processing plants and contracts with farmers are being negotiated to secure supply of feedstock. Developed countries and regions such

as the European Union aim to import feedstock for processing near the consumer. This may however imply an even greater outflow of nutrients from the exporting countries potentially leading to soil mining and degradation and accumulation in importing countries potentially leading to pollution, as with feed trade. Also, benefits from adding value to feedstock will not be made in the exporting countries.

Small scale energy production could be a means to catalyze development in poor rural areas. Agro-energy in itself may however not be the final commodity that will generate income. It could however be used to mechanize agricultural activities, such as running irrigation pumps, and for processing on-farm or within a community to add value to crops like sunflower. Sunflower seeds are for instance pressed by a hand-press for oil in Uganda with low efficiency and poor quality. Agro-fuels produced from hand pressing of energy crops, like Jatropha, Pongamia or others, could be used to small scale motorized pressing of sunflower (Bindraban *et al.*, 2006). The oil or even products baked from the oil would then generate the income. Similarly, agro-fuels could be used for public transport, such as a tricycle in Nepal.

The Brazilian government has developed a bio-diesel program that explicitly facilitates the participation of small farmers in poorer states through tax exemption. The ethanol program already showed that agro-energy follows a path of large scale production and processing. It remains to be seen whether the tax exemption will suffice to include poor farmers in a national and global energy market.

It may not be unwise therefore to temper expectations of the agro-energy sector as a great opportunity for development and for alleviating food insecurity.

Conclusions

Many of the arguments and claims in favour of agro-energy appear highly debatable. An increasing body of research evidence on the ecological aspects tend to reveal an adverse impact of agro-energy on ecological sustainability. This at least warrants caution in stimulating agro-energy and maybe even to refrain from obligatory targets until ambiguities in the insights and discussions on the ecological aspects have been cleared as much as possible.

While many stress the development opportunities that can be created by the development of an agro-energy sector, logical reasoning based on past experiences in development does not obviously support these claims. For instance, experience in the need for large scale operations in the ethanol sector has triggered the Brazilian government to take specific measures to stimulate the participation of small scale farmers in this new sector. (Brazilian Ministry of Agriculture, 2006) Opportunities for small scale agro-energy production might serve as a catalyser for rural development, but will need similar socio-economic, infrastructural, institutional and political support as any other rural activity to stimulate development.

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10. Bringing the benefits of bioenergy to farmers

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Bioenergy represents an outlet for farm products and a way to reduce economic risks through diversification in agriculture. Meanwhile it harbours opportunities for sustainable production and to protect the environment. The number of factors influencing these advantages is many. This article offers an overview of:

1. **Economic factors**: in particular the impact of this new product on producer's income, and related policies and incentive mechanisms to be implemented to ensure farmers to reap the benefits in producing bioenergy.
2. **Ecological factors**: in particular sustainable forest management, biodiversity conservation, and climate change.
3. **Political factors**: in particular rural development, food security, and land use.

Economic factors

The main economic argument of bio-fuels in favour of farmers' incomes is that bioenergy production might well allow farmers to sell their products to the most lucrative market: food or energy. Still, bioenergy is not an economic 'miracle solution'. The following complexities should be taken into consideration:

1. Bioenergy production allows for additional income generation through the export of value added energy crops. A steady and sustained increase in commodity prices should enable farmers to resume agricultural production and to improve their incomes and to better the living conditions of rural communities after 40 years of depressed agricultural prices. This would allow them to invest and to improve their productivity, especially in developing countries. Nevertheless, we are well aware that this trend could have adverse effects on the livestock market and meat producers due to higher prices for animal feeds. Alternatively, if bioenergy industries produced a significant amount of protein feed as a by-product, then this would reduce costs in the livestock industries and stimulate production.
2. The recent rise in food prices is often described by the media as a result of the increase in demand for bio-fuels. In reality, this trend is also mainly due to a combination of factors including bad harvests resulting from climatic variations like drought in Australia and floods in Western Europe and speculations in the food chain where increased profits benefit retailers and not farmers. In Europe, in 2006, less that 1.3 percent of the grains production was used for bioethanol, and is therefore not likely to be the prime cause of the price increase.
3. Ethanol and biodiesel prices are tied up with oil prices rather than with food market prices. According to the European Union, there is a depressing effect of 2 to 3 percent on the price of petroleum for a 14 percent incorporation of bio-fuels in the EU.[16]
4. Second generation bio-fuels based on cellulose, wastes and other by-products may have a large impact on the food and energy issue. Given the high costs of second generation bio-fuels, cost competitiveness of cellulosic energy crops is key. If cellulosic ethanol (2nd generation) becomes a cost-competitive technology, much of the pressure on food supplies would be alleviated as cellulosic energy crops could be grown on marginal soils inappropriate for food crops. These new developments will help overcome the issue of food versus energy production and balance food and non-food needs as well as supply and demands needs. However, in order to develop 2nd generation bioenergy, the first generation bioenergy needs to be ensured in order to provide the necessary R&D.

[16] European Commission.

5. Bioenergy increases energy efficiency. This is critical to farmers. A sustainable bio-fuels production can make available more energy than is required for its production. E.g. biodiesel is energy positive at a ratio of 3 to 1, the ratio for bioethanol is 2 to 1. The reduction of greenhouse emissions amounts to 70-75 percent.[17]
6. Production of biomass for bioenergy allows the re-cultivation of land, making use of set aside and marginal lands.
7. Trade prospects for bioenergies, and in particular bio-fuel exports from developing countries, are limited by the following issues: the clear classification of bio-fuel products (agricultural, industrial or environmental products), the effect of subsidies extended to feedstock or bio-fuel output and by- products, the existence of non-trade barriers and production standards, the existence of preferential tariff arrangements and differential export taxes. And yet, in order for bio-fuels to be an asset for developing countries, they must become internationally tradable commodities that conform to international standards. The current discussion in the WTO on "aid for trade" has significance in this context, since this initiative seeks to help developing countries upgrade their regulatory system so that they can meet international standards.

Ecological factors

There are many countervailing arguments on the ecological impact of large-scale bio-fuel production. We summarize the most relevant.

Potential advantages

1. Bio-energy stored in the form of biomass is available on demand at any time, regardless of weather conditions, time of day and season. For example, in many countries, unused residues from forests and forest industries represent a large untapped wood energy potential. This could be of utmost importance for the future development of forestry and associated sectors and could help reduce fuel imports, leading to a redistribution of economic benefits. Approximately 60 percent of the world's total wood removals from forests and trees outside forests are used for energy purposes. Wood fuel is one of the main products of forests and trees. While only 30 percent of wood produced in developed countries is used for energy (33 percent in Europe and 29 percent in North America), whereas in developing countries it reaches up to 80 percent.[18]
2. Bio-fuels and blended fuels burn cleaner than fossil fuels and as a result improve the air quality which in turn will reduce smog levels.

Potential disadvantages

1. An important potential disadvantage relates to increased prices for natural resources such as water and land due to a diversion of large tracts of land to feedstock production for energy. In particular, farmers are concerned about the price of water which should remain reasonable and affordable. Therefore appropriate pricing policies need to be implemented as well as an integrated approach in managing the water resources.
2. There is a danger that bioenergy ventures use more energy than they produce thus harming the environment and causing damage to natural resources (land, water, biodiversity, forests). There is also a risk that an uncontrolled development of bioenergy production backfires on farmers through deforestation and an uncontrolled development of bioenergy production e.g. deforestation in the Island of Borneo as a result of aggressive expansion of oil palm plantations[19]
3. For all these reasons, the development of bioenergy should be part of a global and integrated strategy which would take into account the sustainable management of natural resources. In particular, this integrated approach should make sure that water resources are managed in an integrated and rational way using the Integrated Water Resources Management (IWRM) approaches. .

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17 ADEM and Price Waterhouse Coopers

18 Background paper on forests and rural development by MTK (The Central Union of Agricultural Producers and Forest Owners of Finland).

19 Jason Clay, World Wildlife Foundation, personal communication.

Political factors

The production of bio-fuels may in due time become a large-scale business. As most production will take place in developing countries, social-political issues related to the allocation of the production, added value and profits are paramount. Our main argument at this point is that farmers need to become providers of value added products, instead of producers of raw materials and buyers of energy. To overcome this problem, farmers should, first of all, increase their influence on larger parts of the value chain, from production to distribution, avoiding that most benefits go to large players, notably multinational companies. To achieve this goal, farmers should ask governments to:

1. Create enabling environments with coherent political and legislative framework to facilitate the development of bioenergy where it does not exist. Besides, policy priorities and government regulations to stimulate the production of bioenergy need to be clear and simple and reflect the farmers' interests. In particular, the needs of small scale farmers must be addressed. Financial support to rural areas is needed. Management models aimed at reducing production costs, while at the same time stimulating environment friendly practices, need to be promoted.
2. Identify appropriate incentive mechanisms for both small and large farmers to make investments. Many support systems have been put in place across countries to encourage the production of bioenergy. Amongst the most appropriate mechanisms are:
    a. Improve market access for farmers though the creation of income tax credit for small bioenergy producers.
    b. Let the public sector finance bioenergy plants and increase farmers' participation by installing a system of matching grants. In Canada, for example, this kind of program would provide for a 100 percent matching non-repayable contribution. The government would provide $1,000 for every $1,000 up to $75,000 invested. The government matching per investing primary producer is maximally $20 million per ethanol project and $10 million per biodiesel project
    c. Establishing strong regulatory systems such as appropriate quality control systems.
    d. Reduce business risk for the commercialisation of new technologies such as high risk and high cost cellulose bioenergy. This could include direct capital investment in the project or provision of a commercial loan guarantee.
3. Develop a competitive domestic feedstock policy, as feedstock competitiveness will be a burning issue. In fact, a bioenergy strategy that builds an industry based on importing feedstock will not create gains for local farmers. Therefore, a competitive policy for energy feedstock is needed to avoid distortions in global markets.
4. Increased support for Research & Development
    a. The development of small scale technology is needed to benefit all farmers.
    b. Diversification of the possible sources of bioenergy is needed through strong primary research on new energy crops, new energy-specific varieties of existing crops, increased production efficiency, improved processing techniques and crops that yield both high energy content and high quality by-products.
5. Enhance data base and information sharing: There is a need to develop standardised databases and websites for investors and farmers to exchange information. In the gathering and retrieval of information, farmers' organisations have their role to play. They need to provide extension services and technology transfers for farmers, e.g. training support on bioenergy production, information sessions for farmers to enter the bio-fuels business, provision of local agricultural advisers, etc.

Conclusions

There are significant income opportunities for farmers in the high level of attention that is currently being given to the development of bioenergy worldwide. However, if farmers are to benefit from the developments in bioenergy, there is a need for careful analysis and planning to identify real opportunities aimed at improving producers' incomes, before pursuing bioenergy programs. The potential for bioenergy to provide a better alternative to fossil fuels with environmental benefits and economic and social opportunities for farmers is a good reason to try and work out sound strategies along with the different stakeholders. Farmers' organisations need to push for the creation of the right incentive mechanisms that will allow their members to benefit from this new opportunity and generate complementary incomes. Further research and development are needed in order to avoid competition between food and fuel uses of certain food crops.

11. Bio-fuels viewed from a perspective of the right to food

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Together with its partner organisations in Asia, Africa, Latin America, Eastern Europe and the Middle East, ICCO works towards a world without poverty and injustice. ICCO's partner organisations comprise local church-based and secular, non-governmental development organisations. Annually, ICCO spends over Euro 100 million per annum to support development programmes of these organisations. ICCO seeks on the one hand to make a relevant contribution to structural poverty alleviation in developing countries, and on the other hand to promote structures, systems and processes that contribute globally to a more equitable distribution of prosperity and power. In the Netherlands, ICCO has formed an alliance with Kerk in Actie, Edukans, Prisma, Share People en Oikocredit.

Experiences with bio-fuels

ICCO has asked some partner organizations in Brazil about their experiences with bio-fuels. The answers confirm the findings of some scientists who have calculated the limitations of bio-fuels. The risks mentioned by the ICCO partners are:

1. Environmental risks because of large scale monocultures;
2. Social risks because of the unsafe labour conditions in the fields and low salaries;
3. Social risks because land reform is being slowed down;
4. Last but not least: there is competition with food crops.

This last issue is highlighted especially from the point of view of the agricultural support system. Partners conclude there is less stimulus for (smaller) farmers to produce food since national agricultural extension and research is focussed primarily on agro-fuels. They relate the higher prices for some food products (e.g. milk) to the higher production of bio-fuels. It should be noted however that there are many factors affected these changes in price, such as diminishing supply on the world market due to crop failures, and higher demand from Asia.

Who benefits from bio-fuels?

Concluding from the above, one could say: Yes it is possible that using bio-fuels has a positive spin off for local development. But who is benefiting? Furthermore, they ask for agricultural research that is relevant for the small producers. Last but not least they state that it is an illusion to turn to bio-fuels as a solution for the rising energy demand.

Of course we have to realise that there are not just negative aspects to bio-fuels. We need to realise that around 33 percent of the energy needs in developing countries actually is supplied by biomass. In Africa this percentage is as high as 60 percent (M. Rosegrant, *et al.* , 2006). The traditional bio-fuels (e.g. fire wood) can cause health problems, especially for women and children when used in a badly ventilated kitchen.

Investments in (clean) bio-fuels could help solve these health risks, solve local energy needs and create a source of energy that can be used for local development. For example, many pumps that are used for irrigation, or mills that are used grinding grains use very expensive diesel. If a locally produced bio-fuel could be used as a source of energy, this could create opportunities for development. Instead of manual labour, people can use their spare time to earn extra income. This is even more favourable because it is mostly the women who are responsible for

collecting fire wood, for grinding, and sometimes for irrigation. Extra income for the woman is often positive for the wellbeing of the entire family.

Large scale farmers or small-holders? Male ore female? And what is the trade-off between agro-fuels production and food production? Has this any negative effect on price levels of food? And is there still enough and diverse food available on the local market?

IFPRI has calculated the impact of massive bio-fuels production on the world's main staple crops, concluding that the consequently rising food prices will in particular harm poorest consumer groups. It is interesting to note that the price increase will be somewhat mitigated when second generation bio-fuels are used, particular in combination with further technological improvements and relevant policy measures (M. Rosegrant, *et al.* 2006).

Another drawback of rising food prices due to bio-fuel production and consumption are diminishing food reserves. This could, in principle, protect local markets otherwise destroyed by massive food dumps from OECD countries. If, however, the trend to increasingly use agricultural resources for the production of bio-fuels we need to closely monitor the impact of bio-fuels for global agricultural food aid reserves.

The 'Right to Food'

What does all this mean in the light of World Food Day 2007? The international theme for this year is the 'Right to Food'. 'The Right to Food' implies that all people (man, women, children) have the right to safe and adequate food. Food security exists when all people have access to sufficient, safe and adequate food to lead an active and healthy life (WFS, 1996). The international community has committed itself to reduce hunger by 50 percent by the year 2015 (MDG1). The EU has also committed itself to mix fossil fuels for transportation with bio-fuels (up to 10 percent by 2020). I suggest we commit ourselves equally serious to the aim of reaching the targets set for MDG 1 in 2015.

There is a large social-economic dimension attached to global food problems. It is in this context that the notion of 'the right to food' can provide us with some concrete tools to assess the competitiveness between food and fuel. Right to food refers to human dignity and respect. From a 'right to food' perspective, the monitoring and evaluation of effects of an increase of bio-fuel use on food security would involve two research areas (Hospes, 2007):

1. Analysis of statements and steps of both states and enterprises regarding the increased use of crops for bio-fuel.
2. Analysis of changes of physical and economic access to food of different categories of people due to governmental and corporate policies and programs on bio-fuel.

Ad 1. Analyzing statements and steps

Three types of obligations that the right to food imposes on states can be used to analyze the impact of bio-fuel policies and legal acts on food security. The generic question is whether such policies and acts state that the right to food of every individual should be respected, protected and fulfilled. More specific questions in relation to the three obligations are:

- Does a bio-fuel policy or act state that existing physical and economic access to food of every individual should not be undermined? What steps have been proposed by government to prevent that the increased use of crops as bio-fuel reduces physical or economic access of individuals to food?
- Does a bio-fuel policy or act state that access and rights of small farmers and indigenous peoples to land and forest should be respected by enterprises? What steps have been proposed by enterprises to prevent that the increased use of crops as bio-fuel reduces physical or economic access of individuals to food?
- Is one of the central aims of a bio-fuel policy or act an improvement of physical and economic access to food for small farmers, forest people and/or landless labourers? Does a bio-fuel program prescribe that a certain percentage of the feedstock should be bought from small farmers? Does a bio-fuel policy or act state that compensation will be offered to those who will loose (access to) their land to give way to bio-fuel expansion?

The human rights principle of participation can be used to analyze processes of formulation of government and corporate policies. Some specific questions are:

- To what extent has the formulation of a government or corporate policy been based on consultations with indigenous people or small farmers whose land, trees or crops are or could be targeted for energy production?
- To what extent have Research and Development policies been based on consultation with indigenous people or small farmers whose land, trees or crops are or could be targeted for energy production?

Ad 2. Analyzing the relationship between government and corporate policies on the one hand and changes of access to food for different categories of people as a result of these policies on the other

Government and corporate policies and programs on bio-fuel are one of the many determinants of access to food. For instance, civil war, bad governance, climate change, environmental degradation and HIV/AIDS may affect access to food to a greater extent than bio-fuel policies and programs. Infrastructure, agricultural, trade and food policies may be more decisive for changes in food security than bio-fuel policies.

Conclusion

The issues relevant for analysing the various dimension of the right to food concept indicate that it is very difficult to determine to what extent changes of access to food can be attributed to government or corporate policies and programs on bio-fuel. A sophisticated theoretical framework would be needed to identify and assess various linkages between food security and use of crops as bio-fuel (Hospes, 2007). Despite these uncertainties, bio-fuels inherit potential threats to food security, but could as well be a catalyser for rural development to reduce food security. Our development organisation is trying to trace and support the potential benefits of these developments in bio-fuels.

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