

### **Biotechnology: expensive or sustainable?**

*Since a few years large amounts of money are spent for the development of a ‘bio-based economy’. Time has come for the environmental movement to separate chaff from wheat, according to Huib de Vriend and Piet Schenkelaars.*

In December 2009, during the Climate Summit in Copenhagen, several technological gadgets were presented as contribution to address climate change. Ministers were transported ‘climate-friendly’ in Volvo’s that drove on E85 fuel. That is a mixture of fifteen percent petrol and eighty five percent cellulosic-bioethanol. Although the tyres of these cars were still made from fossil oil, Goodyear announced that they will soon be made from ‘renewable’ biomass, like agricultural waste, oils and sugars. These are examples of a so-called ‘bio-based economy’; an economy in which industrial, non-food applications are manufactured from biomass. The issue at stake is whether we should consider these initiatives a serious contribution to a structural mode of operation to address climatic and environmental problems, or a green marketing strategy.

### **Products and players**

What comes to mind when we think of a bio-based economy? It is an economy not based on fossil fuels. In a bio-based economy fibres, fuels and chemicals are produced from raw materials from algae, plants and animal products. We may distinguish three ‘generations’ of biofuels. The first generation is produced from food crops like maize, sugar cane (bioethanol), oilseed rape, soy or palm oil (biodiesel). The second generation is produced from cellulose-rich agricultural ‘waste’ like straw and the third generation is biofuel from algae. For this, knowledge from life sciences and ‘white’ and ‘green’ biotechnology is applied. White biotechnology concerns micro-organisms that are used for industrial applications such as alternatives for plastics or enzymes in detergents. Green biotechnology concerns altered crops for use in agriculture and food production. In both cases genetic modification may be applied. Important commercial players in the bio-based economy are life sciences companies, like DSM from the Netherlands, Novozymes from Denmark, and Genencor, originally from the US and now part of Danisco. In addition, traditional (petro)chemical companies like BP, Exxon Mobile and DuPont have also shown an increasing interest since a few years.

### **CO<sub>2</sub>-reduction**

In almost every part of the world governments, companies and researchers believe that this development will lead to a sustainable alternative for an economy based on fossil resources. At the Climate Summit in Copenhagen Europabio, the interest organisation of the European biotechnology industry, called upon the negotiators to consider biotechnology as *the* toolkit for addressing climate problems.

For companies, bio-based production processes are of interest, if they reduce the costs of energy, water and CO<sub>2</sub> emission and thus lead to an economically more efficient production. For governments, there are still other reasons to foster the development of bio-based approaches. Such as enhancement of industrial competitiveness, regional and rural

(re)development, and decrease of reliance on imports of fossil oil from 'politically unstable' regions.

In 2009 the Dutch Platform Green Raw Materials commissioned an explorative study that suggested that large-scale application of biomass could be one of the most promising strategies for the Netherlands to reduce its CO<sub>2</sub> emission. According to the most ambitious scenario, twenty five percent of fossil fuels is replaced by biomass in 2030, leading to a twenty five percent cut of greenhouse gases emission. The annual turnover amounts to seven billion euro extra and the growth rate of job opportunities in the chemical and energy sector is five percent.

### **Research funds**

Meanwhile governments have implemented several policy tools, such as fiscal measures, subsidies and governmental procurement arrangements. Governments also fund numerous research initiatives. For example, the Dutch government has recently provided 85 million euro to the research programme BE-BASIC (Bio-Based Ecological Sustainable Industrial Chemistry) that is coordinated by the Technical University Delft and at which, among others, DSM participates. And in its research budget for 2007 tot 2013 the European Commission has reserved 1.9 billion euro for research in the area of a so-called 'knowledge-based bio-economy'. A part of these research funds will be spent by technology platforms for forestry, agriculture, animal production, aquaculture, food processing, biofuels and sustainable chemistry. The objective of these technology platforms is to draft and implement a strategic research agenda and to coordinate research activities.

The concrete implementation of a bio-based economy is mainly a global process. At the same time we see that bio-based economy initiatives are shaped in regional development processes. An example of such a bio-based regional development is the crossing border initiative Bio Base Europe; a cooperation between Biopark Terneuzen in the Netherlands and Ghent Bio-energy Valley in Belgium. In December 2008 Bio Base Europe received 21 million euro from the European Regional Development Fund. 13 million euro thereof is spent for setting up a demonstration plant in Ghent for research and development of second generation technologies for biofuels, bioplastics and other bio-based products. In a biomass plant waste streams from agricultural industries and starch from Cargill's factory in Sas van Gent will be utilised for energy generation. The other 8 million euro is spent for setting up a training and education facility in Terneuzen for training of personnel for bio-based production processes and public education. This shows how much money is spent on the development of a bio-based economy.

### **Societal debate**

There might be much to say in favour of developing alternatives for the petrochemical production of energy and materials, provided usage is made of renewable raw materials and greenhouse gases emissions are cut. This however requires engagement of the environmental movement. While there is hardly any public support for (the cultivation of) GM crops in Europe (green biotechnology), the usage of genetically modified micro-organisms for industrial bioprocesses (white biotechnology) is rarely disputed. Just like many other publications the explorative study of the Dutch Platform Green Raw Materials suggests that white biotechnology could do fine without green biotechnology.

Yet, warned by controversies over biofuels and green biotechnology, policy makers, researchers and companies attach much interest to a societal dialogue over a bio-based economy. "Because if we don't, then the same will happen to us as with the European

Commission and its biofuels policy”, according to a civil servant from the Dutch Ministry of Agriculture.

We think there are profound reasons to view also critically at these developments. For example, at the way biomass is produced, the consequences of large-scale processing of that biomass, direct and indirect effects on land use and the dominant influence of industry on developments in this area. Moreover, the usage of controversial biotechnology applications cannot be excluded. For instance, in a crossing border initiative by the University of Gent and the Flemish Institute for Biotechnology gene technology is used to alter poplars for a more efficient production of paper and cellulosic-bioethanol.

It is now up to the environmental movement to decide whether or not to engage actively in such a societal dialogue. If yes, then this requires looking beyond environmental consequences of large-scale production of current generation of biofuels and to address these new developments in climate, energy and chemistry campaigns.

### **Technology Platforms**

However, the environmental movement has so far shown very limited engagement for several bio-based economy initiatives. In the Netherlands the development organisation Solidaridad is the only civil society organisation that participates at the Platform Green Raw Materials. The aforementioned European technology platforms are mainly populated by companies, universities and research institutions. In only a few cases a civil society organisation participates: World Wildlife Fund (biofuels), an animal welfare organisation (animal health) and a consumer organisation (food processing). Environmental organisations like Friends of the Earth, Greenpeace and European Environmental Bureau are not represented in these technology platforms. An exception at national level in the Netherlands is the Committee for Sustainability Issues that was installed by the environment minister Cramer. This “Committee Corbey” has in the mean time issued opinions on sustainability criteria for so-called ‘solid biomass’ and indirect land use change. In this committee several universities, major oil and energy companies, the vegetable oils and fats sector, Rabobank and two biofuels firms have a seat, as well as some civil society organisation: Solidaridad, Oxfam/Novib and the Society for the Nature and Environment (SNE).

According to Ron Wit from SNE, participation at such kind of initiatives depends on careful considerations. Because of limited staff, participation at technology platforms does not make much sense: “It is not there where it is determined what is sustainable. That happens where policy is made that ensures that the initiatives that comply with sustainability criteria are filtered out”. The Committee Corbey is such a spot, says Wit: “Thanks to our involvement in the Committee Corbey a reporting duty on the origin of biofuels has been included. This recommendation was adopted by Parliament”.

Willem Verhaak from Milieudefensie (FoE Netherlands) agrees: “We should focus mainly on the conditions laid down by the government that lead to sustainable technology. Such as for example levying CO2 emission, fiscal greening and further sharpening of norms. In addition, subsidies should only be given for non-controversial technologies of which we already know that they are really sustainable”.

Herman van Bekkem from Greenpeace acknowledges the importance to look critically at new technologies: “New technologies may lead to new issues. If we now bet on biomass, with corresponding finances and infrastructures, this could result in a lock-in effect, meaning that we are stuck with it for a long time. Therefore it is important first to think well, for example about effects on land use and the question which role ‘waste’ plays in the cycles of agricultural systems. Yet, Greenpeace makes the pragmatic choice to save trees that are threatened now.”

## **Pro-active**

It seems that many environmental organisations limit themselves to a rather reactive strategy concerning the bio-based economy, focussed at counteracting potential undesirable environmental consequences of first generation biofuels. A view on other matters, such as white biotechnology and newer generations biofuels, lacks so far. One of the few organisations with a more pro-active strategy in this area is the Danish branch of the World Wildlife Fund. Just before the Climate Summit in Copenhagen this organisation issued a report with hopeful expectations about white biotechnology. Fully applied in the production of food, textiles, leather, paper, detergents, biofuels, bioplastics and several fine-chemicals white biotechnology could result in drastic CO<sub>2</sub> emission cuts compared to a scenario without application of white biotechnology. On this basis the organisation pledges for intensive cooperation between public and private parties.

The question is whether the approach of WWF Denmark is the right one. Possibly, this strategy focuses too much on specific solutions. Yet, rapid technological developments ask for a more pro-active attitude from the environmental movement. If the environmental movement really wishes to separate the bio-based chaff from the wheat, it needs to have more eye for research and development of white biotechnology.

*Huib de Vriend en Piet Schenkelaars are both private consultants in biotechnology and life sciences.*