

Getting the Most from Bioenergy

An interview with
Dr. Kyriakos Maniatis, Executive Committee Chair, IEA Bioenergy¹



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IEA Bioenergy has had its finger on the bioenergy pulse for close to thirty years. The programme's participants, from more than 20 countries, work collectively to ensure that knowledge and expertise in a broad range of bioenergy domains circulates productively among researchers, industry players and policy makers. IEA Bioenergy's [website](#), publications and events keep track of the latest developments on topics ranging from socio-economic, environmental or trade issues to advances with the wide-ranging technologies that can help bioenergy make its full contribution to fuelling the world's economies.

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Could you give us your view on why bioenergy has such a high profile?

Dr. Maniatis

Bioenergy was the main energy source since mankind first walked on earth until the industrial revolution, when it was overtaken by coal and oil. Even since then it has been the main renewable energy source, contributing globally more than all other renewable energy sources together, including large-scale hydro. Bioenergy's high profile comes from the fact that it is the only renewable energy source that can directly replace coal, oil and natural gas physically. And at present it is the only renewable source that addresses all energy sectors in today's energy markets: electricity, heating & cooling, and transport.

It can also compete with facilities of widely varying size, ranging from the very small-scale applications - say from 50 kW in high-efficiency pellet boilers for household heating - up to the very large combined heat and power plants of 500,000 kW that can be found in the pulp and paper industries. Bioenergy therefore addresses all kinds of markets, from the very large to the very small, and for either centralised or decentralised applications, including distributed generation of heat and electricity. It has a unique advantage in that biomass and

¹ [IEA Bioenergy](#) is one of some forty international IEA Implementing Agreement energy technology R&D programmes operating within the IEA's collaborative framework.

most biomass fuels can be stored over long periods of time and used whenever needed or transported over long distances - especially when upgraded to fuel-grade energy carriers, either as solid biomass such as pellets or as liquid biofuels such as biodiesel and bioethanol, or gaseous biofuels such as biomethane (biogas and landfill gas). Furthermore, bioenergy's benefits cut across numerous sectors such as agriculture, forestry, waste, buildings and transportation, with major impacts on environment, health and employment.

There is no need for me to underline the uncertainties we face concerning the instability of the price of oil and natural gas or the related geopolitical issues. Because biomass is an indigenous source that can be found either as residues and process byproducts in numerous industries and in the biodegradable fraction of municipal waste streams, or as a purpose-cultivated energy crop, it is now considered a reliable and credible resource contributing to energy security. Due to recent international developments in the oil sector, biofuels for transport have received renewed attention and are now seen not as a "political nuisance" by the oil and car industries but as a needed alternative that can cover a significant fraction of global demand (up to 20% by 2050, according to some estimates).

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We often see conflicting figures for current shares of bioenergy in world primary energy supply. Can you set the record straight?

Dr. Maniatis

I do not think that anyone can set the record straight given that it is practically impossible to account for all uses of biomass, especially traditional uses for heating and cooking in the developing world. Nevertheless, the majority of recent studies and data from FAO and IEA indicate that bioenergy contributes about 50 EJ out of 440 EJ of global primary energy, or some 11% (some 80% of this being in the form of traditional biomass).

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Projections seem to fall short of the potential. What do you see as necessary government policies to fill the gap and to get the maximum from biomass?

Dr. Maniatis

This is an intricate issue since, in contrast with all other renewable energy sources (RES), biomass is not a free resource and there are competitive markets for forest products and, in the far future, there could possibly be competition with food and fibre production. Also, biomass entails a cost for its use so, if its full potential is to be achieved, it needs more focused policies than all other RES. Several policies have been implemented by numerous governments, such as price support mechanisms, de-taxation or technology subsidies. But there is general agreement that these are not always successful, since the initiative is left

to the market actors, who most of the time have different priorities on their agendas, mainly aimed at satisfying their shareholders. Important policies are those that actually mandate the market to supply a certain percentage of a market sector using biomass fuels. For example all transport fuels sold in the national market must have a minimum X% content of biofuel. Or all modern coal-fired power stations must have Y% of co-firing with biomass fuels. Such policies are direct and focused and leave no room for escape for the market actors. Since these percentages are generally relatively small (in the range of 5%-10%) the actual cost differential that will be passed on to the consumer is relatively very small.

Increased demand will drive production and better management of biomass resources and will also facilitate the international trade that turns biomass fuels into a commodity.

At the same time, due to the expansion of cultivated land, increased demand and use of biomass fuels raises serious concerns in relation to protection of sensitive areas and ecosystems such as tropical forests and peatlands. It is therefore very important that sustainability criteria and accompanying certification systems for biomass crops are developed and adopted internationally.

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As part of its recent package of proposals, the European Commission has just cited a minimum target of a 10% share in the fuel mix for biofuels by 2020. What sort of policy orientations do you see as necessary to achieve this? And would we be thinking about importing ethanol?

Dr. Maniatis

This is an ambitious but achievable target and it is a very important element in the forthcoming RES legislation targeting a RES contribution of 20% of primary energy by 2020. As mentioned previously, the most effective policy would be for Member States to mandate their market actors to achieve such a percentage in their national markets. It is now up to the Member States to assume their responsibilities and put into action what they proclaim at national level to be important policies.

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Created in 1978, IEA Bioenergy is an international Implementing Agreement energy technology R&D programme operating within the IEA's collaborative framework. Its aim is to improve co-operation and information exchange between countries that have national programmes in bioenergy research, development and deployment.

IEA Bioenergy participants are: Australia, Austria, Belgium, Brazil, Canada, Croatia, Denmark, European Commission, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States.

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The European Union already imports bioethanol and vegetable oils to be converted to biodiesel. However, while these are still at very low levels, they will certainly increase in the future. One tricky issue is the need to increase bioethanol imports in a managed way in order to allow the European bioethanol industry, which is still in its infancy, time to develop so it can compete on more equal terms with the highly competitive Brazilian ethanol industry, which has been subsidised for much longer than the European industry. The EU objective is for a balanced approach to trade, in which both domestic and imported biofuels can benefit from growing markets.

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Over coming decades we may see some competition for biomass resources between heat, power generation and transportation. In your view, what would be the most energy-efficient and strategically sensible way to exploit biomass?

Dr. Maniatis

This is a conflicts issue. From an efficiency point of view, the use of biomass for heating purposes gives the highest efficiency, followed by combined heat and power, then by power generation only and, finally, by biofuels for transport applications. However, transport is the only energy sector that continues to expand significantly, to the extent of being "out of control", one might say, on a global scale. Therefore, from a strategic point of view, if we wish to achieve carbon benefits and reduce greenhouse-gas emissions in this sector, the transport sector must be targeted.

Competition will come into play when the technologies to produce biofuels from solid biomass (such as straw and wood residues) reach industrial maturity. We must also keep in mind that there will come a point in the medium term when biomass for energy will compete with biomass for forest products and, in the long term, eventually when it will compete over land and water with food and fibre crops.

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Increasing the potential of biomass feedstock and its variety will call for development of cost-effective technologies to convert ligno-cellulosic resources into usable energy carriers. How do you see the future of such technologies?

A significant degree of the future strength of the bioenergy sector depends on the successful development of these technologies. Both the biological route (use of enzymes, hydrolysis and fermentation) and the gasification route (production of synthesis gas) aim to deliver bio building-blocks for the chemical, food and energy industries. The moment one can produce these building-blocks one has great flexibility in synthesising several products, depending on the final catalytic or synthesising process used. Just imagine that from clean synthesis gas (a mixture of carbon monoxide and hydrogen) produced by gasification

technologies one can produce ethanol, methanol, Fischer-Tropsch diesel, dimethyl ether (DME) and hydrogen, according to which synthesis process is used downstream. Of course, these processes are still very expensive and need significant R&D efforts before they can become technically reliable and cost effective. And on this particular question, international co-operation is of paramount importance to enable stakeholders to share the risks and the costs involved, as well as the benefits.

In general, from the technical point of view, we need to improve the efficiency at each stage in the conversion pathway from a biomass resource to an energy service, while at the same time reducing the carbon footprint along these pathways and reducing the cost of the energy service provided to consumers. Direct use of solid biomass for energy generation will always be an attractive and relatively simple technical solution. But we shall certainly come to a point in the future where competition exists for the various types of service. It will therefore be of great importance to examine the options for servicing several sectors - energy, products, chemicals and food - from a single installation. Such structures are commonly referred to as biorefineries. Simple biorefinery concepts already exist in the food, forest products and biofuels sectors, as in the case of co-production of paper, power and heat in the pulp and paper industry, or that of biodiesel, protein meals for animal feed and glycerin in the liquid biofuel industry. However we need to further develop these concepts for a wider variety of products, services and resources.

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What do you regard as other major R&D priorities?

Dr. Maniatis

Technologies such as flash pyrolysis that can be used to concentrate the energy content of biomass in the liquid phase that can easily face the logistic hurdles of transporting biomass over long distances will play an increasingly important role. Also the development of growing dedicated energy crops on a commercial scale is needed in order to maximise the yields per hectare while at the same time reducing their environmental footprint. Studies indicate that producing dedicated grass crops and then using the resource for biogas generation and subsequent biomethane production to be used in transport can deliver significantly higher benefits than using the same land for other crops for the production of bioethanol or biodiesel. And we should not forget that we have to improve the forest management systems to get out of the forest those enormous quantities of biomass that remain unused and will decompose and emit CO₂, and possibly some methane, which is the most potent GHG.

There is also a need to further improve the ash management in biomass cofiring applications with coal and the deployment of high efficiency (30%) municipal solid waste incinerators. Last but not least the emissions performance of small scale household boilers needs to be improved.

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In some countries, intensive cultivation of palm oil for biodiesel is already having negative environmental effects. What can be done from the regulatory point of view about the major issues relating to forestry and arable land management and ensuring that agriculture and environmental policies are aligned?

Dr. Maniatis

Here again, it is important to develop and implement sustainability criteria and certification systems ensuring the alignment of agriculture and environmental policies. The European Commission intends to propose such a system in the draft renewable energy legislation later this year. The Netherlands have already developed the basis for such a system and the United Kingdom and Germany are working on the same issue, too. However, it is important that such systems be adopted internationally and not only by the European Union, otherwise the effect will be minimal. And the experience of the Netherlands, United Kingdom and Germany reveals many practical problems that are tricky to solve. Most likely, the European Commission will go for a simpler approach, at least at the start.

Market actors need to realise that the European citizen is very concerned about such issues, as is the case in many other countries, and these have to be addressed sooner rather than later. We can only expect that the same will apply on an increasingly global scale in the coming years. We very much need to act now if our energy security and climate objectives are to be met in a sustainable way through the increasing use of bioenergy.

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Thank you, Dr. Maniatis, for sharing your thoughts with us.

Dr. Maniatis

It has been my pleasure.

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