



Q A

AS THE WORLD'S SUPPLY OF FOSSIL FUELS DIMINISHES, THERE IS A GROWING NEED TO FIND ALTERNATIVE SOURCES OF ENERGY. THIS SEARCH HAS NOW TAKEN THE INDUSTRY BEYOND SOLAR, WIND AND HYDRO SOURCES, INTO THE REALMS OF BIOMASS.

Dr. Ludwig Leible, senior scientist at the Karlsruhe Research Center in Germany, is a leading figure in this field. Here, he talks to *Generate* about the future potential of biomass. Photo: James Bell

Q. What is biomass and how does it relate to biofuel?

A. 'Biomass' encompasses a great number of different plant and animal organic materials. For instance, it stretches from cereals, forest timber, liquid manure from livestock farming up to kitchen and slaughterhouse waste. It can not only be used for fuel but also for generating electricity and heat.

Q. You draw a distinction between 'traditional' biomass and 'new' biomass. Can you explain the difference?

A. Traditional biomass involves residues from agriculture and forestry, for instance, harvest left-overs, firewood and dung from livestock farming. Particularly in the rural areas of developing and threshold countries, it is used directly for cooking and heating without further conditioning. What we have here is basically a non-commercial use of biomass. In contrast, new biomass needs further processing steps, such as drying or pelletizing before it can be used for generating electricity, heat and fuel heat and fuel via combustion, gasification and biogas production. Cultivated biomass, such as rape for the production of bio-diesel, also belongs to the "new" category.

Q. Do different types of plant matter produce different volumes of potential energy?

A. Yes, they do. The differing content of moisture and ash, in particular, results in different biomass calorific values. The efficiency with which useful energy can be recovered from biomass depends not only on this but also on the conversion technology for generating electricity, heat and fuel. This efficiency can be significantly raised by conditioning the biomass beforehand, for instance through drying. However, certain biomasses can only be effectively used by specific energy production processes. For instance, high-moisture content manure can only be effectively used from the energy point of view through biogas recovery: On the other hand, dry wood or straw can be used directly through combustion and gasification.

Q. What are the global factors that are now driving the development of biomass?

A. My estimation is that there are three factors at work here. A particularly strong one revolves around the dramatic increases in energy prices. This is due principally to the increase in demand for fuels on the international markets by China and India, and to speculation on the energy markets.

The second considerably weaker factor is the political aim of reducing greenhouse gases. And we have become increasingly aware that fossil fuels are finite. These factors are the driving forces behind dealing with energy more efficiently and raising the share of regenerative fuels in our energy supply. Here is where biomass can play a significant role.



BIOMASS CONTRIBUTES SOME TEN PER CENT TO COVERING GLOBAL PRIMARY ENERGY NEEDS.



Q. What are the key advantages of biomass-derived energy?

A. As already hinted at, biomass as a fuel has the advantage of being regenerative and storable. And its energy recovery is practically neutral from the greenhouse gas perspective. This means that the CO₂ released in energy recovery is re-absorbed by the plants and incorporated into the biomass. We thus have a practically enclosed CO₂ cycle. In addition, national biomass can raise security of supply and contribute to value creation in rural areas.

Q. And the disadvantages?

A. The low energy density and decentralized biomass distribution represent the prime drawbacks. Consequently, a raised logistics outlay (collecting, transport, storage and conditioning) is needed before electricity, heat and fuel can be provided from biomass.

Q. As an energy source, how does biomass rank against other renewables (e.g. solar, wind, thermal, hydro)?

A. Renewables – meaning, in fact, hydro, wind power, geothermals and solar energy in addition to biomass – currently contribute six per cent of primary energy consumption in Europe (the EU currently consists of 25 members). Biomass, with a 65 per cent share in renewables, plays the most significant part. It is followed way behind by hydro, wind power and geothermals. However, as against the other renewables, biomass is the only one as a renewable carrier of carbon which can be used for organic chemistry. It can also be deployed

in many diverse ways: heat, electricity and fuel can also be produced from it.

Q. What proportion of Europe's (or the world's) energy supply is likely to be sourced from biomass by 2050?

A. As already mentioned, Europe at the moment covers roughly four per cent of its energy needs from biomass. The European biomass action plan envisages a doubling of this share to eight per cent by 2010. The idea is for all renewables to meet 12 per cent of primary energy needs by this date.

It is not easy to make any prediction as to 2050. We estimate that in view of biomass potential it could achieve a 15 per cent share of what is today's energy consumption.

Q. Biofuels are already becoming available for vehicles, for use in combination with fossil fuels. Do you foresee this as a trend that will inevitably grow? If so, how quickly? Will there be bioethanol and biodiesel pumps on our forecourts within a decade?

A. As the principal economic and political conditions are not going to change that quickly, the use of biofuels in our cars will certainly grow. Crude oil prices will no longer drop sharply in view of their finiteness and increasing scarcity. Politically, the European objectives for biofuel point the way ahead. By 2010 biofuels should have a 5.75 per cent share of the entire fuel market.

The market will be dominated by mixing biofuels with fossil fuels; moreover, as regards premium brands, forecourts selling

fuels with an increased blended proportion of bioethanol, biodiesel and Biomass to Liquid (BtL) fuel can be imagined. The use solely of bioethanol, biodiesel or BtL fuel is more likely to be limited to niche markets such as agriculture, road haulage or public transport.

Q. At one time, natural gas (LNG/CNG) was hailed as a green transport fuel for the future because of its low emissions. But it has never really been a big success. Could the same thing happen to biofuels?

A. It is certainly true that natural gas enjoys emission advantages over petrol or diesel and for tax reasons it is cheaper in operation. However, on the debit side, we have the problem of infrastructure investments (natural gas filling stations) and vehicle conversions.

Current figures for new vehicle registration in Germany point to strong growth in natural gas vehicles – but regrettably still at a very low level. To get natural gas used much more, the automobile industry needs to considerably increase its advertising efforts in the natural gas vehicle field.

Given that the political framework is very much oriented to the admixture of biofuels, a similar trend to that of natural gas is not expected for them. Thus no additional capital expenditure in the infrastructure is needed.

Q. It's not just the depletion of finite resources that has signalled the wane of fossil fuels; it's also the matter of CO₂ emissions. What kind of emissions is produced from, say, a power station fuelled

with biomass? How do they compare with a conventional fossil-fuel powered plant?

A. Greenhouse-relevant emissions are certainly to the fore in a biomass power station fired on forest wood residues. They include not only CO₂ but also CH₄ (methane) and N₂O (nitrous oxide). In total, these gas emissions are considered as CO₂ equivalents in scientific papers. Particular attention is also directed to fine dust emissions, particularly from small decentralized firing plants.

Compared to the conventional use of coal in Germany for electricity generation, over 90 per cent of the CO₂ emissions can be eliminated. In absolute figures, this means that some 0.9 tons of CO₂ equivalents could be saved for each generated megawatt hour of electricity.

Q. If biomass-derived energy becomes a major energy source, will consumers actually notice any difference?

A. This depends on whether the fuel, electricity or heat market is considered. With electricity or admixed fuels, the consumer would not notice any differences at all. This would also apply to heat if distributed over a heating grid. But it is a different matter with decentralized heat provision e.g. using wood pellets as fuel. The consumer would certainly notice the changes here.

In general, the consumer would, of course, notice price effects but without being able to assign, for instance, price rises to biomass or the fossil fuel.

Q. A large proportion of biomass is derived from agricultural products. Does this mean that we will see the emergence of 'energy farms' – entire farms given over to producing biomass?

A. The development of pure energy farms is likely to remain the exception. What is more than likely is for agriculture and forestry in future to concentrate on providing food, feedstuffs and wood for material use. The option of using biomass as a fuel should stabilize prices on the raw material markets.

Q. It's been said that even if all Germany's farmland was devoted to growing crops for biomass, it would not produce enough energy to fulfil the country's energy requirements. And, of course, it would then have to buy in all its food. Is this true?

A. That is right. This simply shows the limits to the use of biomass as a fuel in Germany. With biogenic residues and waste alone some ten per cent of Germany's primary energy need could be covered – at the moment around 500 million tons of coal units. In Germany in 2005 biomass, inclusive of biodiesel, contributed 2.9 per cent to covering primary energy needs. The total contribution of renewables in the same year was 4.6 per cent. This demonstrates the dominance of biomass amongst the renewables. To put the matter into perspective: Biomass contributes some ten per cent to covering global primary energy needs.

Q. We know that possession of fossil fuel resources is a powerful benefit to a country's economy. Is the emergence

of biomass likely to change the balance of power, with major agricultural economies gaining the upper hand?

A. No. But, as I have said, it can be assumed the additional demand for biofuels globally will underscore the economic perspectives for agriculture and forestry. I would just like to add here that the prosperity of a country's economy basically depends on the gross national product and its distribution across the population. This can be promoted by owning and selling fossil fuels; however, examples from around the world show that this is often not sufficient. ■

Biographical details

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GENERATE

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COFFEE:
THE DRINK THAT
CHANGED THE
WORLD

LIVING IN THE SKY
DUBAI-STYLE
HOW TO MAKE BUTTER
IS BIOMASS THE FUEL
OF THE FUTURE?

GENERATE is published by the GEA Group Aktiengesellschaft, a global technology company with operating subsidiaries in over 50 countries.

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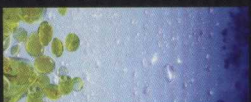
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Welcome to the first issue of GENERATE, the new magazine of the GEA Group Aktiengesellschaft.

Dear Readers,

Although technology can be extremely complex, most of us do not need to understand how it works. We do, however, need to understand the benefits that derive from technology.

As a company, we need to provide our customers with an advantage in their marketplaces. However, as a global technology group, we are ultimately pursuing a broader objective – to make the world a better place for people to live and work.

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This is why GEA Group is a front runner in technologies such as biofuels development, and why we currently design

and build the process plants that are producing the biofuels of the future.

And even more:
We are designing and building the technologies that enable Americans to drink coffee, Chinese to switch on their lights, South Africans to have milk on their cereal, and Australians to enjoy a beer.

Our own long-term goal is straightforward: to continuously improve process technology and equipment through innovation.

Without a doubt, for most of us, technology can truly appear complex. I hope this magazine will help to make the connection between our technology and its applications in the real, everyday world.

Jürg Oleas

Chairman of the Executive Board
GEA Group Aktiengesellschaft



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