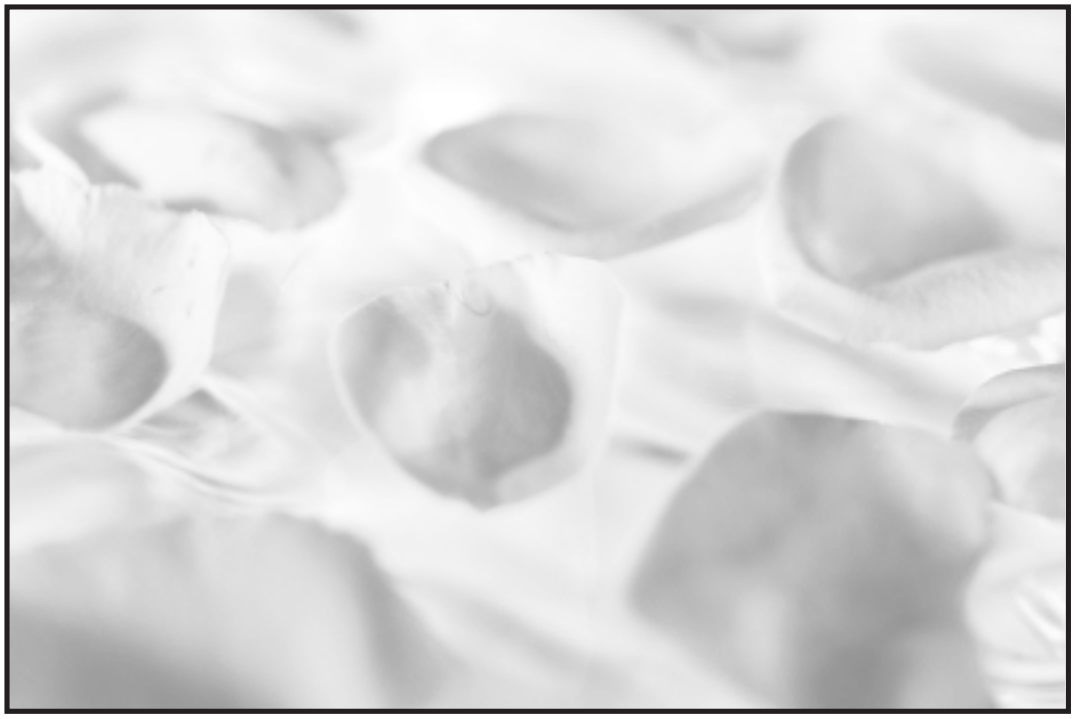
HEWIN INTERNATIONAL PROSPECTUS

BIOMASS MARKETS AND TECHNOLOGIES

AN OPPORTUNITY FOR THE 21ST CENTURY



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This prospectus includes the Executive Summary and Table of Contents from Hewin International's **Biomass Markets and Technologies**. After reviewing the prospectus, we are certain you will see how valuable the full Report will be for you and your business. For your convenience the final page of this prospectus is an order form.

Biomass Markets and Technologies, reveals what the future holds for this renewable energy source that has the potential to replace oil products to heat buildings, to fuel vehicles and to serve as a raw material in the chemical industry. An original work based on extensive research and interviews with industry experts and analysts; this Report provides executives, R&D managers, and investors with an in-depth analysis of government intervention, subsidies and investment incentives. Already the fourth largest energy source, the Report projects that biomass could provide 38% of the world's direct fuel by 2050 and nearly 10% of U.S. electric generating capacity by 2010. A thorough review of the markets and prospects for each diverse biomass energy source is provided. In addition, this Report addresses every aspect of the pipeline—agricultural production, industrial conversion and distribution in light of the political and economic climate of key countries.

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- Environmental protection, remediation and pollution control
- Applied genetics and biotechnology

BIOMASS ENERGY IN THE YEAR 2000—THE ISSUES

Background

Biomass energy, mostly in the form of wood, fueled the world's economy for many thousands of years before the advent of accessible coal, and subsequently oil, gas, and uranium. The Industrial Revolution over 200 years ago saw the West begin to embark upon the fossil fuel era—an era that is now recognized as short lived in the context of mankind's lifespan on this planet.

Yet biomass energy is making a serious comeback as a meaningful energy supply in both the world's developed and developing countries. Biomass already supplies around 15% of the world's energy, but because it is usually classified as a "noncommercial" fuel (as opposed to "commercial," e.g., coal, gas,

oil, and electricity), this is not well documented in official global energy statistics. Since most biomass energy is consumed within the rural regions of the Third World, it is often difficult to quantify with much accuracy. Nevertheless, in a world dominated by the decisions of the Organization of Petroleum Exporting Countries (OPEC), political instability in the Middle East, the nuclear debate, environmental worries about certain sites for coal and uranium mining, the danger of radioactive waste disposal, and the overriding depletion of our fossil fuel reserves, biomass energy lives on just as it has since man first began rubbing two sticks together several millennia ago. Its history is therefore a long one: predating coal, oil, and especially nuclear energy by thousands of years and also predating the more esoteric "alternative" options of wave power, tidal energy, and active solar energy capturing systems, as well as photovoltaics, ocean thermal energy conversion, and so on. Windpower and waterpower have a slightly longer history than the others. However, both in the past and at present, biomass has the obvious advantage of storing energy—probably the most important factor in comparison with the other renewable energy systems.

The Resurgence of Biomass Energy

Although biomass energy has always been with us in the West, it became, along with other ostensibly environmentally benign renewable energies, increasingly researched and developed as a feasible energy supply following the 1973-1974 and 1979 OPEC oil price hikes. These sent shock waves throughout Western economies, which were used to cheap energy and seemed unable to function properly without it. Many government energy departments were stirred into looking for alternatives to Middle East oil, and biomass plus energy conservation were near the front, if not at the head of, the line. The Organization for Economic Cooperation and Development (OECD) also viewed the possibility of finding and funding an alternative to overproduction of food in the agricultural sector, the conservation of the environment, and making rural areas more economic than hitherto. The fact that a barrel of crude oil in 1980-1982 cost roughly $35, over one and a half times as much as in September 1999 (despite massive rates of inflation), is testimony to the continuing power of OPEC, for in 1998 a barrel of crude oil cost just over $13. Then OPEC decided to restrict its quotas of oil exports, resulting in a near doubling of oil prices in about one year. So, the energy problem is still very much with us, and we adopt complacency at our peril. As is well known, the two oil crises had far-reaching effects on socioeconomic trends within the OECD countries. It is thought that the first oil shock reduced growth by 6-10 GNP points according to country between 1973 and 1975 and that the second reduced it by 4-6 GNP points according to country between 1979 and 1982. Thus, it was considered that biomass offered a way for the agricultural and forestry sectors to develop an energy production mechanism on a competitive basis that would simultaneously substitute for oil.

Biomass is an example of a national resource for which conversion equipment can to a large extent be manufactured in each individual country. Moreover, biomass can be substituted for oil products in many areas: as heating for buildings, as vehicle fuel, or as a raw material in the chemical industry. Any large-scale energy use of biomass, however, needs to be assessed realistically, and a clear distinction needs to be drawn between what is technically feasible and what is economically rational.

A great advantage of biomass over alternative "renewable" technologies lies in the sheer diversity of resources, conversion technologies, and end products adopted. These will be covered in Chapters 3, 4,

5, and 6 to a fuller extent, the point being that, provided the technology is available, the end product(s), whether solid, liquid, or gaseous fuels, or electricity or heat, can also be tailor-made to meet local requirements from largely local biomass inputs.

A Commercial Opportunity for the Agricultural Sector

The use of biomass for energy and to some extent in the chemical industry is a comparatively new outlet for agriculture. At present the market situation is characterized by an excess of supply over demand for almost all products intended as foodstuffs. Therefore, farmers can hardly hope to see their incomes increase through a change in the structure of their traditional production. The creation of an energy-producing activity such as biomass could help under certain circumstances and in certain countries to overcome this dilemma.

The interest expressed in this connection by farmers' associations is a clear indication that this is now an issue of agricultural policy. Furthermore, the major alcohol-for-energy-production programs conceived and implemented in Brazil and the United States from 1975 and 1978, respectively, could only materialize because of the agricultural surpluses there were then (in sugar and maize) in a situation of depressed world agricultural prices and strongly rising oil prices. Some governments felt the necessity of budgetary restraint and were looking for less costly ways of supporting their agricultural sectors; they are now beginning to wonder if it would be cheaper to assist alcohol production rather than give permanent support to surpluses of cereals, sugar, or milk products. Moreover, as energy crops are produced for domestic markets, there will not be any risk of tension in international markets (except, however, if production is accompanied by byproducts that are exported); at least some partial conversion of food crops to energy production might even help reduce such tension.

The author took part in an EU-funded study in the mid-1980s to investigate alternative land uses for European farmers who were overproducing hugely at that time. Yet 15 years later, the problem is still not solved. Biofuels and chemicals have partially replaced food crops, livestock, milk, and wine but at the cost of deteriorating farm incomes, grotesque subsidies, and international divisiveness. The European Common Agricultural Policy has had much to do with these problems, but the point is that self-interest (even among so-called partners) allied to the problems of politicians who wish to be re-elected can take precedence over technoeconomic advances that make sense on the farms but not on the forms of xenophobic bureaucrats and their masters.

Incentives for the Food-to-Biofuel Transition

Incentives to develop biofuels might be envisaged at different stages in the chain: agricultural production, industrial or small-scale conversion, and distribution. The relative weights of these three components would depend to a large extent on the administrative and political situation of the country concerned. Also to be taken into account should be the fact that reaction to incentives usually takes longer in the agricultural sector (especially when new plant varieties or species are to be introduced) than in the industrial sector, where new technologies are more easily adopted. It appears important to ensure coordination of development in the two sectors.

Farmers will only embrace biofuel production if they can make a profit from it. So far as the processing of residues is concerned, extension work and a means of subsidy for capital investment would be necessary to reach the mass production stage. In the case of energy crops, farmers will only agree to maintain or embark on them if they hope to earn at least as much as from traditional crops. This also implies allowing some degree of competition between energy crops so as to maintain some incentive for achieving economic viability as quickly as possible. In this respect it may seem preferable to operate through the price of alcohol, which has the added advantage of creating competition between the various conversion industries and of allowing an easier dialogue with oil product distributors. However, there is the question of whether orientation through alcohol prices may not benefit manufacturers far more than farmers; allocation of these subsidies will certainly have to be as transparent as possible.

Alcohol price policy may take one of two forms: fluctuations in line with the gasoline market, corrected by aid of some kind (compensatory payment or tax exemption), or guaranteed prices fixed by the state in agreement with the oil distributors. The first system was chosen by the United States and the Canadian province of Manitoba, where tax relief on gasohol containing 10% alcohol meant ten times as much support for the alcohol content (13–39 cents per liter of alcohol in the United States, depending on the state). For its part, Brazil chose a guaranteed price system. This is fixed each year on a par with sugar by the Sugar and Alcohol Institute on the basis of production costs. Subsidies are paid to compensate for the higher costs of production in the Northeast. The monopoly system is administratively more cumbersome and less flexible but enables the quantities marketed to be monitored. In each case, because of the substantial investments required, it is essential that the policy be continued over a certain period (ten years in the United States, no fixed limit in Brazil).

In order to get industrialists to commit themselves, investment incentives often seem necessary. In the United States, a program of loans and loan guarantees was set up in 1980. In Brazil, the loans were on extremely advantageous terms: 80% of the fixed investment (90% in the case of cooperative schemes) with three to four years of grace and eight to nine years for repayment at sharply negative real interest rates: 5% + 65% of the rate of inflation. The terms were even more advantageous in the Northeast. Other means may be envisaged, such as subsidies, participation bonuses, or guaranteed sales. In Denmark, for instance, the government brought in an investment program for installing wood chip boilers to heat government offices.

Government intervention in the market can provide another sort of incentive. The government can oblige oil distributors to incorporate a certain amount of alcohol in their products or indirectly persuade them to use alcohol as an octane additive by reducing the lead content allowed in gasoline for environmental protection purposes. In countries where the government does not have such power, it is still possible to oblige vehicles owned by the government or public services to use an alcohol blend. Such intervention needs to be finely tuned in order to maintain alcohol demand without expanding it to an extent that could have unfortunate consequences for the level of food production.

This kind of financial commitment by government, within limits fixed by economic and political considerations, is probably often inevitable in view of persisting technological and economic uncertainties. It could, however, provide an opportunity for selective orientation favoring projects best suited to the general interest, either because of their location, the chain selected, or their size. Thus,

particular aid could be given to projects that help create jobs or develop new technologies or that lead to a better distribution of agricultural incomes, the development of less-favored rural areas, and the preservation of the environment. Any financial commitment of this kind should also clearly be judged in the light of positive adjustment criteria, that is, duration, transparency, and effectiveness of the sums spent and the object of the support. If it looks as though the aid might become permanent, they should be examined with great care.

One of the practical problems encountered is the choice of converting old plants or setting up new distilleries using the latest technology but requiring much greater investment. Another problem, often linked to the first, is to decide what size distillery to encourage. If area-wide planning and management has already led to the creation of distilleries in certain regions, the economic conditions peculiar to those regions should determine the size of the plant, this being essentially a function of the density of cultivation in the surrounding area. Nevertheless, it should be noted that small or medium-sized installations have the advantage of fitting more easily into the agricultural economy: the transport of materials is kept down, the byproducts can be used on the local stock farm without drying or conditioning, the effluents can be used to fertilize the surrounding fields instead of causing disposal problems, and the operation can generally be more flexible.

TABLE OF CONTENTS

2. Photosynthesis and Biomass Yields
- Solar Energy—From Sun to Earth
- Mechanisms of Photosynthesis
- Photosynthetic Efficiencies
- Plant Biomass Productivities
- Energy Farming

3. Dedicated Biomass Feedstocks
- Energy Forestry and Nonwoody (Herbaceous) Crops—An Introduction
  - Overview
  - Biomass Feedstocks in the US
- Woody and Herbaceous Crops—Production Technology for Improved Results
  - Short Rotation Woody Crops (SRWCs)
    - Introduction
    - Site Requirements
    - Agronomic and Cropping Strategies
    - Harvesting Approaches
  - Herbaceous Energy Crops (HECs)
    - Introduction
    - Thin-Stemmed Perennials
    - Thick-Stemmed Perennials
    - Thick-Stemmed Annuals
    - Other Herbaceous Crop Candidates
  - Strategies for Woody and Herbaceous Energy Crops
  - Biotechnologically Improved Energy Crops
    - Introduction
    - The Genetic Improvement of Napiergrass and Hybrids
    - Genetic Improvement of *Pennisetum* for Biomass Production via DNA Markers
    - The Genetics and Management of Sorghum Systems for Biomass Production
- Oil Crops
  - Introduction
  - Crops and Yields
    - African Oil Palm
    - Coconut Palm
    - Babassu Palm
    - Chinese Tallow Tree
    - Physic Nut
    - *Salicornia Bigelovii*
    - Cuphea and Others
    - Sunflower
    - Groundnut
    - Soybean
    - Rapeseed
    - Microorganisms
    - Algae
  - Conclusions
- Economic Factors
  - Overview
  - Feedstock Production Costs in the US
    - Introduction
    - Projected Costs Based on Past Costs
    - Individual Energy Crop Comparisons
  - European and Other Countries' Feedstock Production Costs
  - Overview
    - Implementation Barriers

4. Biomass Residues and Wastes
- Introduction
- Agricultural and Forestry Residues and Wastes
  - The Overall UK Scene
  - The US Situation
  - Comparisons with Coal
- Municipal and Industrial Wastes
  - The UK Scene
  - The US Situation
- Economic, Commercial, Social, and Political Factors

5. Conversion Technologies and Energy Products
- Fermentation to Ethanol
  - Overview
  - The Fermentation and Distillation Processes
    - The Basic Technology
  - Energy Conservation
  - Ethanol-Gasoline Blends
    - Introduction
    - Octane Quality
    - Fuel Economy
  - Vehicle Performance
    - Gasoline-Engined Vehicles
    - Diesel-Engined Vehicles

FIGURES

TABLES

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