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Book Review

SECOND GENERATION BIOFUELS AND BIOMASS

Essential Guide for Investors, Scientists and Decision Makers

Roland A. Jansen

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Roland Jansen, chief executive officer of Mother Earth Investments AG, is actively working on the development 2nd generation bioenergy feedstocks. In this book, Mr. Jansen generously shares his knowledge in the field, in particular, regarding the challenges and opportunities in development of biomass-derived fuels. This essential guide to investing in bioenergy commodities details second generation biofuels from a scientific, technical and economic perspective, and discusses their global environmental, political and financial impact.

The book is structured in 22 chapters and ends with the glossary and the index. The first chapter entitled *The Commodity Case – Introduction*, focuses on the most valuable commodity in the world: energy. The evolution of energy resources in the past decades and the structure of energy consumption are presented. The risks connected with the oil-based economy are discussed and the necessity to find feasible solutions to the energy crisis is underlined. Chapter 2, *First- and Second-Generation Biofuels* contains a comparative discussion on the two types of biofuels. The author affirms that global biofuel production has been increasing rapidly over the last decade, but the expanding biofuel industry has recently raised important concerns. In particular, the sustainability of many first-generation biofuels – which are produced mainly from food crops such as grains, sugarcane and vegetable oils – has been increasingly questioned over concerns such as reported displacement of food-crops, effects on the environment and climate change. The increasing criticism of the sustainability of many first-generation

biofuels has raised attention to the potential of so-called second-generation biofuels. It is underlined that, depending on the feedstock choice and the cultivation technique, second-generation biofuel production has the potential to provide benefits such as consuming wastes and making use of abandoned land. In this way, the new fuels could offer considerable potential to promote rural development and improve economic conditions in emerging and developing regions.

Chapter 3, “*Biofuels Feedstock: Jatropha curcas*”, is the largest chapter of the book. It represents a comprehensive coverage of *Jatropha* uses for various technological, social and economical issues. Plant description and properties, growing conditions, and *Jatropha* products are largely discussed. Seeds of this plant are used in the following products: crude oil, biodiesel/methyl ester, jet fuel/bio-derived kerosene. Sub-chapter 3.3 presents advantages, risks and challenges of *Jatropha*. The considered advantages are: high-quality oil which is obtained from seeds and *Jatropha* can grow on poor soils that are not suitable for other food crop systems production. The following risks and challenges are identified: *Jatropha* is a wild species, not a domesticated one; yield expectations are very uncertain; harvesting is very labor-intensive; the plant contains toxic substances such as toxalbumins and requires large volumes of water when irrigated. Opinions of the UN FAO and of the World Bank regarding the cultivation and processing of *Jatropha* are presented in the sub-chapters 3.7 and 3.8, respectively.

Chapter 4 “*Other Biofuel Feedstocks*” reviews the traditional plants and vegetable products used for biofuel such as: algae, palm oil, *Camelina*, *Crambe*, *Moringa*, castor, *Myscanthus* etc. Aspects regarding benefits and barriers of using these raw materials in production of biofuel grades are discussed.

Chapter 5 “*Cropping Methods*” reviews in only two pages intercropping and double cropping as methods of cultivation of two or more crops in close proximity. Some examples of the subject are presented.

Chapter 6 is entitled “*Socially Responsible Investing*” and deals with the benefits of the money invested in a community development. The discussion is centered on the effects of cultivation of *Jatropha* on the development of local communities. The discussion continues in the Chapter 7 “*Sustainability*”, the idea being that the plantation operators should accomplish the criteria for a sustainable biofuel production. One of the most significant is Chapter 8 entitled “*Biomass*”, dealing with its valorization. Biomass is a sustainable source of energy by reducing greenhouse gas emissions and stimulating the development of low carbon energy technologies. Some considerations regarding current situation and perspective of using biomass for renewable energy in Europe are presented.

Carbon credits, as a key component of national and international emissions trading schemes, are the subject of Chapter 9. The author anticipates that the price of carbon credits will increase in the next years and, as a consequence, importance of biofuels will increase as well. A number of chapters are allocated to the biofuel subject in different regions. An image of the biofuels policy in Europe and in United States is presented in Chapters 10 and 11, respectively. US have the most dynamic biofuel industry as the energy is an important theme and the US Army plays a big role. The US government is supporting projects that promote renewable jet fuels that will reduce US imports of crude oil. US are the biggest producer of second generation biofuels: ethanol, methanol, and butanol. United States Department of Energy selected universities and companies to conduct research and development of cost-effective, environmentally friendly biomass conversion technologies for turning non-food feedstocks into advanced biofuels.

Chapter 12 contains a large study referring to biofuel strategy of China. This country is a huge consumer of energy, being the second largest energy market in the world. China’s new 12th 5-Year government plan includes nuclear, wind, solar and biomass energy expansion. China will be in a short time the first car producer and the second aviation market in the world and for these reasons development of new energy sources for vehicles and aviation biofuel is an important target of the Chinese government. Development of renewable energy is a necessity for China to achieve its two basic policies in energy (to increase the use of non-fossil fuels) and the

environment (to reduce carbon intensity). The author underlines the huge potential of this country to develop biofuels industry. China owns of large surfaces of land unsuitable for agriculture that appropriate for cultivation for second generation biofuels, but supportive measures are necessary. In this field, Chinese government recently announced flexible subsidies and financial support for farmers who plant energy crops.

“*Biofuels in Brazil*” is the title of Chapter 13. Brazil is the world’s second largest producer of ethanol fuel, and together, Brazil and the United States lead the industrial production of ethanol fuel. Brazilian renewable fuel economy is considered to be the first in the world and the befool industry leader. Brazil is a policy model for other countries and its sugarcane ethanol is the most successful alternative fuel to date. However, the successful Brazilian ethanol model is sustainable only in Brazil due to its advanced agro-industrial technology and its enormous amount of arable land available. Ethanol produced from sugarcane is the cheapest befool ever produced. Sugarcane is the raw material for production of biodiesel and jet fuel. In this respect, Brazil and USA collaborate in doing research and investments in obtaining jet fuel on sugarcane basis.

African counties have a large opportunity to become a low-carbon region. With all its natural resources and wastes that are not converted into beinery, the potential for renewable energy across the continent is enormous and can release economic growth. Biofuels and biomass in Africa are issues treated in the Chapter 14. The energy consumption per capita in Africa is very low, this region being a global champion for energy poverty. Africa burns traditional biomass as wood, charcoal, and agricultural waste. However, modern biofuels are starting to replace traditional fossil fuels and offer broad potential for power generation and transport fuels. Three countries are analyzed in this respect: Ghana, Ethiopia and Nigeria.

Aviation befool is widely considered to be one of the primary means by which the aviation industry can reduce its carbon footprint. After a multi-year technical review from aircraft makers, engine manufacturers and oil companies, biofuels were approved for commercial use in July 2011. Since then, some airlines have experimented with using of biofuels on commercial flights. The focus of the industry is on second generation sustainable biofuels that do not compete with food. The author motivates in Chapter 15 the necessity of performing researches in obtaining of biokerosene in order to reduce the environmental impact of aircraft transport. The subject is developed in Chapters 16 and 17, entitled “*Aviation and Carbon Credits*” and “*Biokerosene*”, respectively. One of the problems for the aviation industry is the impending threat of emissions limits and trading. The EU ETS recently capped the amount of greenhouse gases that a country can release and the aviation industry is included as well. Use of biofuels, in particularly of biokerosene,

can partially solve this challenge. Mr. Jansen admits that *Jatropha* cultivation is a solution in obtaining second generation biokerosene and chapter 17 deals with the production and certification of biokerosene.

In the Chapter 18, the author extends the discussion about biofuels and includes products of yeast fermentation processes, mainly cellulose ethanol. Large quantities of bioethanol from sugarcane are already produced for fueling car engines. Obtaining ethanol from lignocelluloses materials (bagasse, *Myscanthus*, *Arundo donax*, wood chips, and recovered paper) is still difficult and costly, but the production costs are coming down.

Some aspects regarding testing of biofuels by the airlines are presented in Chapter 19. A number of important airlines such as Qatar Airways, Japan Airlines, KLM, Lufthansa, Continental Airlines, British Airways, Cathay Pacific already tested some biofuel grades during demonstration or commercial flight. Lufthansa wants to become the world's first airline using biokerosene on a regular basis. A few aviation companies invested in cultivation and production of biokerosene. The use of *Jatropha*-based fuel could have particular appeal in China which has plentiful stretches of dry and barren land to devote to growing the plant. Investment opportunities in biofuels and biomass are discussed in Chapter 20. The author shows that the opportunities refer to: invest and buy agricultural land; invest in forest; start of own plantation and in own production company; invest in renewable bioenergy stocks; invest in private equity funds that invest in biofuel industry. Each investment opportunity is discussed and their advantages and drawbacks are presented. A list of leading companies dealing with investment in biofuel is included.

Chapter 21 gives an insight how much several industrial companies are investing in *Atrophy*.

The perspectives of biofuel industry are discussed in Chapter 22. This industry is entering in new era of transition towards alternative feedstocks, emerging technologies, and revised government policies favoring sustainability. The author states that a shift from nuclear energy to renewable energy is already in progress, and, as a consequence, the second generation biofuel can be a feasible alternative. Finally, fascinating predictions on how our world will look like in the next future are presented.

Janson's guide to investing in the bioenergy market covers the topic from both a scientific, economic and political perspective. It describes the increasing number of second generation biodiesel projects which are now emerging in anticipation of growing sustainability concerns by governments, and in response to market demands for improved process efficiencies and greater feedstock production yields. The book also closely examines the science and technology involved in second generation biofuels and gives concrete examples, such as in the aviation industry.

The result is an essential guide for scientists, investors, politicians and decision-makers in the energy sector. The excellent index of the book puts it in light as a valuable and comprehensive resource of information, which might be an indispensable and powerful tool for both educational and practical reasons.

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