

# Next Generation Biofuels

<https://marketpublishers.com/r/N886011455BEN.html>

Date: June 2011

Pages: 400

Price: US\$ 475.00 (Single User License)

ID: N886011455BEN

## Abstracts

With the demand for fuel increasing globally, researchers around the world are working on making fuel from waste products like plastic bags, wood, and other sources.

Next generation biofuels have been developed to address the growing concerns of the world on the usage of food crops for fuel. Next generation biofuels do not make use of food crops or compete for land with crops. Making low cost biofuels is the entire motive of these next generation biofuel companies. Yeast, algae, bacteria, cellulose, etc., are all being used to produce fuel.

Taiyou Research presents a comprehensive research report on the emergence of next generation biofuels.

Next generation biofuels analyzed in this report include the Second Generation Biofuels, Third Generation Biofuels, commonly known as Algal Fuels, and the fourth and yet under development generation of biofuels.

Here's what all the report Next Generation Biofuels contains:

Explaining what next generation biofuels are, this report undertakes an analysis of the technological developments for next generation biofuels, advantages of next generation biofuels, and the challenges facing the industry.

An analysis of the use of renewable feedstocks for biofuels and the new emerging market for lignocellulosic biofuels - perhaps the most common type of second generation biofuels being used commercially today.

The potential of biomass in the world along with the technical considerations for

next generation biofuels. This includes an analysis of productions procedures, economical considerations, and environmental considerations as well.

Moving on to the section on second generation biofuels, Taiyou Research's report on Next Generation Biofuels covers the following:

An introduction to what are second generation biofuels, along with the technologies involved, conversion routes and composition of biomass.

The impact of the worldwide economic recession on the second generation biofuels market is discussed.

Feedstocks used for producing second generation biofuels such as bioethanol, black liquor, energy crops, methane, and green waste are analyzed.

Technologies that are used for the production of second generation biofuels. Technologies analyzed in the report include biochemistry, co-current fixed bed, counter-current fixed bed, entrained flow gasifier, fluidized bed reactor, gasification, pyrolysis, and torrefaction.

The different types of second generation biofuels are analyzed including BioDME, bioethanol, biobutanol, biohydrogen, biomethanol, wood diesel, amongst others.

Growth drivers like regulatory support, blending mandates, etc., are analyzed as they support the growth of the market for second generation biofuels.

An in-depth analysis of lignocellulosic biofuels, lignocellulosic ethanol, synthetic biofuels, and biohydrogen.

The role of biorefineries in the production of next generation biofuels is also covered.

The environmental impact of second generation biofuels is analyzed, along with the role of biotechnology in the industry.

Commercial investment in second generation biofuels and the transition from first generation to second generation is looked at in the report.

Pilot projects for second generation biofuels such as biochemical ethanol and biorefinery projects and thermochemical BTL demonstration projects are analyzed.

A country-wise analysis of second generation markets is included. Countries analyzed include: Brazil, China, India, Mexico, South Africa, and Thailand.

The section on third generation biofuels or algal fuels includes the following:

An introduction to algal fuels including the kinds of fuels that are produced from algae such as biobutanol, biodiesel, ethanol, straight vegetable oil, and jet fuel.

How algae can be used as an energy source and the production of biological hydrogen from algae is analyzed.

Investment in the industry and a market analysis of algal fuel developments in the US and Europe.

Technical process for fuel production from algae.

Advantages of fuel production from algae as well as the challenges facing the development of third generation biofuels.

The production of microalgal biomass and the direct liquefaction of algae for biodiesel production is also analyzed.

Since fourth generation biofuels are presently under development, we focus on providing a snapshot overview of the market for fourth generation biofuels.

We provide in-depth analysis of 90 major players active in the market for next

generation biofuels including Abengoa, Verenium, BP Plc., BASF, Shell, Iogen, amongst others.

In conclusion, we analyze the wood ethanol market in Canada in a case study, along with various topics related to next generation biofuels such as the life cycle analysis of biofuels, production of green diesel and jet fuel range alkanes, production of distributed biofuels with fast pyrolysis, as well as an overview of first and second generation biofuels and feedstock and conversion processes.

Taiyou Research's report on Next Generation Biofuels is a complete guide for investors as well as first-timers to the industry for getting a strategic and realistic view of the market for Next Generation Biofuels.

## Contents

Executive Summary

### **SECTION 1: INTRODUCTION TO BIOFUELS**

#### **1. INTRODUCTION TO BIOFUELS**

- 1.1 What are Biofuels?
- 1.2 Uses of Biofuels
- 1.3 Ethanol & Biodiesel Markets
- 1.4 Pros & Cons of Biofuels
- 1.5 Direct Biofuels
- 1.6 Market Overview - Global Biofuels Industry
- 1.7 Biofuel Usage in Developed Economies and Developing Countries
- 1.8 Future Demand for Biofuels & Biomass

#### **2. IMPACT OF BIOFUELS**

- 2.1 Environmental & Economic Impact
- 2.2 Impact on Engines
- 2.3 Impact on Rural Development
  - 2.3.1 Policy Impact
  - 2.3.2 Environmental Impact
  - 2.3.3 Impact of Biofuel Programs
  - 2.3.4 Creation of Employment

#### **3. ENERGY DIVERSIFICATION - IS IT JUSTIFIED?**

#### **4. LIQUID BIOFUELS**

- 4.1 Introduction
- 4.2 Bioalcohols
- 4.3 Biodiesel
- 4.4 Bioethers
- 4.5 Green Diesel
- 4.6 Vegetable Oil

#### **5. SOLID BIOFUELS**

5.1 Features of Solid Biofuels

5.2 Types of Solid Biofuels

5.2.1 Biomass Pellets

5.2.2 Char

5.2.3 Wood Fuel

## **6. GAS BIOFUELS**

6.1 Introduction

6.2 Biogas

6.3 Biopropane

6.4 Synthetic Natural Gas

6.5 Syngas

## **SECTION 2: INTRODUCTION TO NEXT GENERATION BIOFUELS**

### **1. NEXT GENERATION BIOFUELS**

1.1 Introduction to Next Generation Biofuels

1.2 What are Next Generation Biofuels?

1.3 Next Generation Technology Development

1.4 Advantages of Next Generation Biofuels

1.5 Challenges facing the Development of Next Generation Biofuels

### **2. USING RENEWABLE FEEDSTOCKS FOR BIOFUELS**

### **3. LIGNOCELLULOSIC BIOFUELS – NEW EMERGING MARKET**

3.1 Overview

3.2 Biofuels from Lignocellulosic Biomass

3.3.1 Single Molecule Fuels

3.3.2 Mixture of Fuels

### **4. TECHNOLOGICAL CONSIDERATIONS FOR NEXT GENERATION BIOFUELS**

4.1 Introduction

4.2 Production Methods

4.3 Lignocellulosic Bioethanol

- 4.4 Synthetic Biofuels
- 4.5 Biohydrogen
- 4.6 Biogas
- 4.7 Economical Considerations
- 4.8 Environmental Considerations
- 4.9 Technological Considerations
- 4.10 Conclusion

## **5. BIOMASS POTENTIAL WORLDWIDE**

### **SECTION 3: SECOND GENERATION BIOFUELS**

#### **1. INTRODUCTION TO SECOND GENERATION BIOFUELS**

- 1.1 What are Second Generation Biofuels?
- 1.2 Technologies Used for Second Generation Biofuels
- 1.3 Conversion Routes for Second Generation Biofuels
- 1.4 Composition of Biomass
  - 1.4.1 Cellulose
  - 1.4.2 Hemicellulose
  - 1.4.3 Lignin
  - 1.4.4 Water
  - 1.4.5 Ash and Other Components
  - 1.4.6 Validation of Surrogate Molecules

#### **2. IMPACT OF THE ECONOMIC RECESSION ON SECOND GENERATION BIOFUELS**

#### **3. FEEDSTOCKS FOR SECOND GENERATION BIOFUEL**

- 3.1 Bioethanol
- 3.2 Black Liquor
- 3.3 Energy Crops
- 3.4 Gas Biomatter (Methane)
- 3.5 Green Waste

#### **4. TECHNOLOGIES INVOLVED IN PRODUCTION OF SECOND GENERATION BIOFUELS**

- 4.1 Biochemistry
- 4.2 Co-Current Fixed Bed
- 4.3 Counter-Current Fixed Bed
- 4.4 Entrained Flow Gasifier
- 4.5 Fluidized Bed Reactor
- 4.6 Gasification
- 4.7 Pyrolysis
- 4.8 Torrefaction

## **5. TYPES OF SECOND GENERATION BIOFUELS**

- 5.1 BioDME
- 5.2 Bioethanol & Biobutanol
- 5.3 Biohydrogen
- 5.4 Biomethanol
- 5.5 DMF
- 5.6 Fischer-Tropsch Fuels
- 5.7 Hydro Thermal Upgrading (HTU)
- 5.8 Mixed Alcohols
- 5.9 Wood Diesel

## **6. GROWTH DRIVERS FOR SECOND GENERATION BIOFUELS**

- 6.1 Overview
- 6.2 Regulatory Support
- 6.3 Blending Mandates
- 6.4 Trade Opportunities for Developing Countries
- 6.5 Government Funding
- 6.6 Foreign Investment
- 6.7 Trade in Feedstock
- 6.8 Scientific Cooperation and Research & Development

## **7. ANALYSIS OF LIGNOCELLULOSIC BIOFUELS**

- 7.1 What are Lignocellulosic Biofuels?
- 7.2 Potential of Lignocellulosic Biofuels
- 7.3 Is it Feasible to Produce Fuels from Lignocellulosic Biomass?
- 7.4 Types of Biofuels Produced from Lignocellulosic Biomass
- 7.5 Structure of Lignocellulosic Biomass

- 7.6 Conversion Process of Biomass to Fuel
- 7.7 Producing Biofuels from Catalytic Processing of Biomass
- 7.8 Requirement of Next Generation Biorefineries for Producing Liquid Fuels
- 7.9 Feedstocks for Lignocellulosic Biofuels

## **8. ANALYSIS OF LIGNOCELLULOSIC ETHANOL**

- 8.1 Overview
- 8.2 Importance of Size Reduction
- 8.3 Purpose of Pre-Treatment
- 8.4 Purpose of Hydrolysis
- 8.5 Fermentation
- 8.6 Distillation
- 8.7 Process Integration
- 8.8 Issues and Challenges

## **9. ANALYSIS OF SYNTHETIC BIOFUELS**

- 9.1 Overview
- 9.2 Importance of Size Reduction
- 9.3 Gasification
- 9.4 Components of Product Gas
- 9.5 Necessity of Gas Cleaning
- 9.6 Gas Upgrading
- 9.7 Pathways for Fuel Synthesis
  - 9.7.1 Fischer-Tropsch (FT) Synthesis
  - 9.7.2 Bio-SNG Production
  - 9.7.3 Production of Ethanol and Higher Alcohols via Gasification

## **10. ANALYSIS OF BIOHYDROGEN**

- 10.1 Overview
- 10.2 Production Technologies
- 10.3 Thermochemical Gasification with Water Gas Shift
- 10.4 Fast Pyrolysis with Reforming of Carbohydrate Fraction of Bio-Oil
- 10.5 Feasibility of Direct Solar Gasification
- 10.6 Other Gasification Process
- 10.7 Hydrogen Production from Biomass Derived Syngas Conversion
- 10.8 Supercritical Conversion of Biomass

10.9 Microbial Conversion of Biomass

10.10 Comparison of Different Process Routes for Hydrogen Production

## **11. ROLE OF BIOREFINERIES**

11.1 What is a Biorefinery?

11.2 Realizing the Potential of a Biorefinery

11.3 Emergence of Advanced Biorefineries

11.4 Types of Advanced Biorefineries

## **12. SUSTAINING SECOND GENERATION BIOFUELS IN DEVELOPING COUNTRIES**

12.1 Overview

12.2 Economic Impact of Second Generation Biofuels

12.2.1 Second Generation Biofuel Plants are Capital Intensive

12.2.2 Supply Costs of Biomass

12.2.3 Production Costs for Biofuels

12.3 Impact on the National Budget

12.3.1 Foreign Currency Savings

12.3.2 Requirement for Subsidies

12.4 Creating a Legal Political Framework

12.5 Securing Biomass Supplies

12.6 Access to Energy Services

12.7 Issue of Food Security

## **13. SECOND GENERATION BIOFUELS, GHG EMISSIONS & IMPACT ON THE ENVIRONMENT**

13.1 Overview

13.2 Impact of Second Generation Biofuels on Ecosystems, Carbon Cycle and Global Climate

13.3 GHG Balances

13.4 Impact on Soil

13.5 Impact on Water

13.6 Impact on Biodiversity

## **14. SECOND GENERATION BIOFUELS AND GENETIC ENGINEERING**

## **15. SYNTHETIC BIOLOGY FOR SECOND GENERATION BIOFUELS**

## **16. COMMERCIAL INVESTMENT IN SECOND GENERATION BIOFUELS**

- 16.1 Overview
- 16.2 Investment Costs
- 16.3 Operating Costs
- 16.4 Cost Assessments and Targets

## **17. TRANSITIONING FROM FIRST GENERATION TO SECOND GENERATION BIOFUELS**

## **18. CASE STUDY: PILOT PROJECTS FOR SECOND GENERATION BIOFUELS**

- 18.1 Biochemical Ethanol & Biorefinery Demonstration Projects
- 18.2 Thermochemical BTL Demonstration Projects

## **ANALYSIS OF SECOND GENERATION BIOFUELS BY COUNTRY**

### **1. BRAZIL**

- 1.1 Overview
- 1.2 First Generation Biofuels Production
- 1.3 National Policy Target for Biofuels
- 1.4 Types of Lignocellulosic Feedstock
- 1.5 Second Generation Biofuels in Brazil
- 1.6 Production Costs for Second Generation Biofuels in Brazil
- 1.7 Economic Impact
- 1.8 Ecological Impact
- 1.9 Second Generation Biofuels in Brazil: SWOT Analysis
- 1.10 Conclusion

### **2. CHINA**

- 2.1 Overview
- 2.2 First Generation Biofuels Production
- 2.3 National Policy Target for Biofuels
- 2.4 Types of Lignocellulosic Feedstock
- 2.5 Second Generation Biofuels in China
- 2.6 Production Costs for Second Generation Biofuels in China

- 2.7 Economic Impact
- 2.8 Ecological Impact
- 2.9 Second Generation Biofuels in China: SWOT Analysis
- 2.10 Conclusion

### **3. INDIA**

- 3.1 Overview
- 3.2 First Generation Biofuels Production
- 3.3 National Policy Target for Biofuels
- 3.4 Types of Lignocellulosic Feedstock
- 3.5 Second Generation Biofuels in India
- 3.6 Production Costs for Second Generation Biofuels in India
- 3.7 Economic Impact
- 3.8 Ecological Impact
- 3.9 Second Generation Biofuels in India: SWOT Analysis
- 3.10 Conclusion

### **4. MEXICO**

- 4.1 Overview
- 4.2 First Generation Biofuels Production
- 4.3 National Policy Target for Biofuels
- 4.4 Types of Lignocellulosic Feedstock
- 4.5 Second Generation Biofuels in Mexico
- 4.6 Production Costs for Second Generation Biofuels in Mexico
- 4.7 Economic Impact
- 4.8 Ecological Impact
- 4.9 Second Generation Biofuels in Mexico: SWOT Analysis
- 4.10 Conclusion

### **5. SOUTH AFRICA**

- 5.1 Overview
- 5.2 First Generation Biofuels Production
- 5.3 National Policy Target for Biofuels
- 5.4 Types of Lignocellulosic Feedstock
- 5.5 Second Generation Biofuels in South Africa
- 5.6 Production Costs for Second Generation Biofuels in South Africa

- 5.7 Economic Impact
- 5.8 Ecological Impact
- 5.9 Second Generation Biofuels in South Africa: SWOT Analysis
- 5.10 Conclusion

## **6. THAILAND**

- 6.1 Overview
- 6.2 First Generation Biofuels Production
- 6.3 National Policy Target for Biofuels
- 6.4 Types of Lignocellulosic Feedstock
- 6.5 Second Generation Biofuels in Thailand
- 6.6 Production Costs for Second Generation Biofuels in Thailand
- 6.7 Economic Impact
- 6.8 Ecological Impact
- 6.9 Second Generation Biofuels in Thailand: SWOT Analysis
- 6.10 Conclusion

## **SECTION 3: THIRD GENERATION BIOFUELS**

### **1. INTRODUCTION TO THIRD GENERATION BIOFUELS – ALGAL FUELS**

- 1.1 Overview
- 1.2 What is Algal Fuel?
- 1.3 Fuels Produced from Algae
  - 1.3.1 Biodiesel
  - 1.3.2 Biobutanol
  - 1.3.3 Biogasoline
  - 1.3.4 Methane
  - 1.3.5 Ethanol
  - 1.3.6 Straight Vegetable Oil (SVO)
  - 1.3.7 Ethanol
  - 1.3.8 Transport Fuels
  - 1.3.9 Jet Fuel

### **2. USING ALGAE AS AN ENERGY SOURCE**

### **3. PRODUCING BIOLOGICAL HYDROGEN FROM ALGAE**

- 3.1 Introduction
- 3.2 Technological Evolution
- 3.3 Bioreactor Design Issues
- 3.4 Biohydrogen Production from Algae
- 3.5 Applications
- 3.6 Ongoing Research & Development
- 3.7 Addition of Copper

## **4. INVESTMENT IN THE INDUSTRY**

## **5. MARKET ANALYSIS**

- 5.1 Algal Fuel in the US
- 5.2 Algal Fuel in Europe
- 5.3 Corporate Developments

## **6. USING ALGAE FOR TRANSPORT & POWER GENERATION**

## **7. FUEL PRODUCTION FROM ALGAE**

- 7.1 Overview
- 7.2 Basics of Fuel Production
- 7.3 Production Technologies & Strategies
  - 7.3.1 Overview
  - 7.3.2 Infrastructure for Production
    - 7.3.2.1 Three Dimensional Structures
    - 7.3.2.2 Open Ponds and Raceways
    - 7.3.2.3 Hybrid Systems
- 7.4 Products & Co-products
  - 7.4.1 Biodiesel
  - 7.4.2 Ethanol from Algal Biomass
  - 7.4.3 Hydrocarbons
  - 7.4.4 Mixed Alcohols
  - 7.4.5 Co-products
- 7.5 Improving the Yield

## **8. ADVANTAGES OF FUEL PRODUCTION FROM ALGAE**

## **9. CHALLENGES FACING THIRD GENERATION BIOFUELS**

## **10. TECHNOLOGY BEHIND THIRD GENERATION BIOFUELS**

- 10.1 Biological Concepts
- 10.2 Algae Production
- 10.3 Fuel Production Options
- 10.4 Biodiesel Production from Algae
- 10.5 Ethanol Production from Algae
- 10.6 Hydrocarbons Production from Algae
- 10.7 Extraction of Algal Oil
- 10.8 Types of Biofuel Produced

## **11. PRODUCING MICROALGAL BIOMASS**

## **12. DIRECT LIQUEFACTION OF ALGAE FOR BIODIESEL PRODUCTION**

### **SECTION 4: FOURTH GENERATION BIOFUELS**

#### **1. FOURTH GENERATION BIOFUELS**

### **SECTION 5: ANALYSIS OF MAJOR PLAYERS IN THE INDUSTRY**

#### **1. A2BE CARBON CAPTURE**

#### **2. ABENGOA BIOENERGY**

#### **3. AGRI.CAPITAL GMBHBD AGRORENEWABLES GMBH & CO. KG**

#### **4. AIR LIQUIDE**

#### **5. ALGAE FLOATING SYSTEMS INC**

#### **6. ALGAELINK, N.V.**

#### **7. ALGAEWHEEL**

#### **8. ALGENOL BIOFUELS**

#### **9. ALGODYNE ETHANOL ENERGY CORPORATION**

- 10. AMYRIS BIOTECHNOLOGIES**
- 11. ANDRITZ AG**
- 12. AQUAFLOW BIONOMIC CORPORATION**
- 13. AURORA BIOFUELS**
- 14. BASF**
- 15. BBI BIOVENTURES LLC**
- 16. BEST ENERGIES**
- 17. BIO FUEL SYSTEMS**
- 18. BIOCONSTRUCT GMBH**
- 19. BIOGASOL APS**
- 20. BLUE MARBLE ENERGY**
- 21. BLUEFIRE ETHANOL**
- 22. BP PLC**
- 23. BRI ENERGY**
- 24. BROIN COMPANIES**
- 25. BUTAMAX ADVANCED BIOFUELS LLC**
- 26. CELLANA**
- 27. CHEMREC**
- 28. CHOREN**

- 29. COBALT BIOFUELS**
- 30. COLUSA BIOMASS ENERGY CORPORATION**
- 31. COSKATA**
- 32. D1 OILS PLC**
- 33. DAO ENERGY, LLC**
- 34. DIVERSIFIED ENERGY CORPORATION**
- 35. DUPONT DANISCO**
- 36. ECOFIN LLC**
- 37. ENERKEM**
- 38. ENVITEC BIOGAS GMBH**
- 39. ETEK ETANOLTEKNIK AB**
- 40. FLAMBEAU RIVER BIOFUELS LLC**
- 41. FRONTIER RENEWABLE RESOURCES**
- 42. FUEL BIO HOLDINGS, LLC**
- 43. GEVO**
- 44. GLOBAL GREEN SOLUTIONS**
- 45. GREENERBIOENERGY CORPORATION**
- 46. GREENFUEL TECHNOLOGIES**
- 47. GREENLANE BIOGAS**
- 48. GS CLEANTECH**

**49. GUSHAN ENVIRONMENTAL ENERGY**

**50. HALDOR-TOPSØE AS**

**51. ICM INCORPORATED**

**52. IMPERIUM RENEWABLES**

**53. INFINIFUEL**

**54. INTERNATIONAL ENERGY, INC**

**55. INVENTURE CHEMICAL**

**56. IOGEN CORPORATION**

**57. LIGNOL INNOVATIONS, INC**

**58. LIVE FUELS INC**

**59. LS9, INC**

**60. LURGI AG**

**61. MASCOMA**

**62. NEDALCO**

**63. NESTE OIL OYJ**

**64. NOVOZYMES**

**65. PACIFIC ETHANOL**

**66. PAN GEN GLOBAL**

**67. PETROALGAE**

**68. PETROBRAS**

**69. PETROSUN**

**70. POET**

**71. QTEROS**

**72. RANGE FUELS**

**73. REPOTEC RENEWABLE POWER TECHNOLOGIES UMWELTTECHNIK GMBH**

**74. SAPPHIRE ENERGY**

**75. SEAMBIOTIC**

**76. SEKAB**

**77. SHELL**

**78. SOLAZYME**

**79. SOLENA GROUP**

**80. SOLIX BIOFUELS**

**81. SÜD-CHEMIE AG**

**82. TMO BIOTECH**

**83. VALCENT PRODUCTS INC**

**84. VERCIPIA BIOFUELS**

**85. VERENIUM**

**86. VIRENT**

**87. VIRGIN GREEN FUND**

**88. WEST BIOFUELS LLC****89. XL RENEWABLES****90. ZEACHEM**

Conclusion

**1. CASE STUDY: WOOD ETHANOL IN CANADA**

- 1.1 Introduction
- 1.2 Technical Developments
- 1.3 Why Produce Ethanol?
- 1.4 Wood Ethanol Production Technologies
  - 1.4.1 Fermentation
  - 1.4.2 Gasification
- 1.5 Demonstration Projects in Canada
- 1.6 Sources of Wood for Wood Ethanol Production
  - 1.6.1 Fast Growing Plantations
  - 1.6.2 Industrial Wood Waste
  - 1.6.3 Forest Residue
- 1.7 Regulatory Incentives
- 1.8 Research & Development
- 1.9 Conclusion

**2. PRODUCING BIOFUELS WITH HIGH-EFFICIENCY, SMALL-SCALE REACTORS****3. PRODUCING DISTRIBUTED BIOFUELS WITH FAST PYROLYSIS****4. DERIVING GREEN DIESEL & JET FUEL RANGE ALKANES****5. LIFE CYCLE ASSESSMENT OF BIOFUELS****6. OVERVIEW OF BIOFUELS OF THE FIRST AND SECOND GENERATION AND RELATED FEEDSTOCK AND CONVERSION PROCESSES****6. APPENDIX**

## 7. GLOSSARY

## I would like to order

Product name: Next Generation Biofuels

Product link: <https://marketpublishers.com/r/N886011455BEN.html>

Price: US\$ 475.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer Service:

[info@marketpublishers.com](mailto:info@marketpublishers.com)

## Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <https://marketpublishers.com/r/N886011455BEN.html>