## BIOENERGY DEVELOPMENT

Issues and Impacts for Poverty and Natural Resource Management

Elizabeth Cushion, Adrian Whiteman, and Gerhard Dieterle



## **CONTENTS**

Acknowledgments xiii About the Authors xv Abbreviations xvii	
Executive Summary I General Findings 2 Regional Findings 3 Policy Implications 5	
1. Overview 7 Main Types of Bioenergy 8 This Report I I Total Bioenergy Supply and Contribution toTPES 12 Outlook for Bioenergy Consumption 13 Forces Affecting Bioenergy Development 17 Concerns about Bioenergy Development 21 Policies, Targets, and Instruments 25 Notes . 3 9	
2. Solid Biomass 41  Long-Term Trend and Outlook for Primary Solid Biomass Bioenergy Production from Solid Biomass 46  Traditional Uses of Solid Biomass for Energy 65  Modern and Industrial Uses of Solid Biomass for Energy	44 70

Notes 86
3. Liquid Biofuels 89  Bioethanol for Fuel ,90  Biodiesel for Fuel 93  Economic Viability of Liquid Biofuel Production 96  Social and Environmental Impacts 99  Notes 120
4. Impacts and Issues at the Country and Regional Levels  Africa 122  East Asia and Pacific 127  Europe and Central Asia 133  Latin America and the Caribbean I 36  Middle East and North Africa 140  South Asia 142  Notes 146 • , •
5. Conclusions 147 General Conclusions 147 Regional Conclusions 151 Policy Implications 153 Note 155
Appendix A: Production of Alcohol Bioenergy from Sugars
and Starches 157  Sugarcane 157  Corn .163  Sweet Sorghum 167  Cassava 170  NypaPalm 173  Notes 175
Appendix B: Production of Bioenergy from Oilseed Crops 177
Oil Palm 177 Soybean 184 Rapeseed 189 Jatropha 193 Jojoba 197 Pongamia 199 Notes 202
Appendix C: Second-Generation Bioenergy Production  Economics of Second-Generation Bioenergy Production 209  Economic Impact of Second-Generation Bioenergy Production 209

Impact of Second-Generation Bioenergy Production on the Use of Land and Other Resources 210

Environmental Impact of Second-Generation Bioenergy Production 21

Notes 2 1 1 .

Appendix D: Third-Generation Bioenergy Production 213

Note 215

References 217 >

Index 233