International Trade and Climate Change

Economic, Legal, and Institutional Perspectives

THE WORLD BANK
Washington, DC
CONTENTS

ix Acknowledgments
xi Abbreviations

CHAPTER 1

1 Introduction and Overview
4 Technology Options to Stabilize Greenhouse Gas Emissions
7 The Debate on Trade and the Environment Revisited
8 Focus and Results of This Study
10 Findings and Recommendations
16 Notes

CHAPTER 2

18 Climate Change Policies and International Trade: Challenges and Opportunities
19 Do Climate Change Measures Affect Competitiveness?
29 In Search of Carbon Leakage: Examining the Relocation of Energy-Intensive Industries to Developing Countries
35 Trade Measures
39 WTO and Kyoto Protocol: Exploring Synergies for Advancing Both Trade and Climate Agendas
41 Key Findings from Chapter 2
41 Notes

CHAPTER 3

45 Beyond Kyoto: Striving for a Sustainable Energy Future in Developing Countries
46 Global Emissions Scenarios through 2030
47 Clean Energy for the Future
52 Liberalization of Trade in Clean Energy Technologies
54 Clean Coal Technology
59 Wind Power Technology
62 Solar Photovoltaics (PV) Technology
68 Energy-Efficient Lighting
70 Conclusions
72 Key Findings from Chapter 3
72 Notes
## CONTENTS

### CHAPTER 4

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>Opportunities for Win-Win-Win: Liberalizing Trade in Environmental Goods and Services</td>
</tr>
<tr>
<td>74</td>
<td>Complexity Surrounding Environmental Goods (EG) Discussions</td>
</tr>
<tr>
<td>78</td>
<td>Linking of Current EG Discussions to Climate Change Mitigation</td>
</tr>
<tr>
<td>80</td>
<td>Options for Negotiating a Climate-Friendly Package within the WTO Framework</td>
</tr>
<tr>
<td>82</td>
<td>Lessons from Current EG Discussions for Negotiating a Climate-Friendly Package</td>
</tr>
<tr>
<td>87</td>
<td>The Way Forward on a Possible Agreement on Climate Change Mitigation Products</td>
</tr>
<tr>
<td>95</td>
<td>Key Findings from Chapter 4</td>
</tr>
<tr>
<td>95</td>
<td>Notes</td>
</tr>
</tbody>
</table>

### CHAPTER 5

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>Conclusions and Recommendations</td>
</tr>
<tr>
<td>97</td>
<td>Findings</td>
</tr>
<tr>
<td>99</td>
<td>Recommendations</td>
</tr>
</tbody>
</table>

### Appendixes

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>APPENDIX 1. Kyoto Protocol: Countries Included in Annex B to the Kyoto Protocol and Their Emissions Targets</td>
</tr>
<tr>
<td>107</td>
<td>APPENDIX 2. Measures to Combat Climate Change</td>
</tr>
<tr>
<td>107</td>
<td>Regulatory Measures</td>
</tr>
<tr>
<td>109</td>
<td>Fiscal Measures</td>
</tr>
<tr>
<td>111</td>
<td>Market-Based Instruments</td>
</tr>
<tr>
<td>113</td>
<td>Voluntary Agreements (VAs)</td>
</tr>
<tr>
<td>114</td>
<td>Notes</td>
</tr>
<tr>
<td>117</td>
<td>APPENDIX 3. Model Specification and Results</td>
</tr>
<tr>
<td>123</td>
<td>APPENDIX 4. Industry-Specific Effects of Carbon Taxes and Energy Efficiency Standards</td>
</tr>
<tr>
<td>127</td>
<td>APPENDIX 5. Partial Equilibrium Trade Policy Simulation Model</td>
</tr>
<tr>
<td>129</td>
<td>APPENDIX 6. Maximum and Applied Tariff Rates on Select Climate-Friendly Technologies</td>
</tr>
<tr>
<td>133</td>
<td>Bibliography</td>
</tr>
<tr>
<td>139</td>
<td>Index</td>
</tr>
</tbody>
</table>

### Boxes

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.1 The Kyoto Protocol</td>
</tr>
<tr>
<td>6</td>
<td>1.2 Summary List of Technologies Considered as &quot;Wedges&quot; for Climate Change Mitigation</td>
</tr>
<tr>
<td>9</td>
<td>1.3 Environmental Aspects of Bilateral and Multilateral Trade Agreements</td>
</tr>
<tr>
<td>35</td>
<td>2.1 Globalization of the Chemical Industry</td>
</tr>
<tr>
<td>48</td>
<td>3.1 Approaches to Employing Technology Investments in Developing Countries</td>
</tr>
</tbody>
</table>
CONTENTS vii

51 3.2 Regional and Country-Specific HS Nomenclature
55 3.3 Clean Coal Technologies
60 3.4 A Case of Other Barriers to Technology Diffusion: The China Study
66 3.5 Cambodia: Additional Duties Leading to Lower Diffusion
67 3.6 Lessons Learned in Designing Financial Incentives for Renewable Energy
69 3.7 Bundling Policies to Promote Energy Savings: The Case of South Africa
75 4.1 Main Issues in Liberalization of Environmental Goods and Services
88 4.2 Trade, Environment, and Biofuels

Figures
4 1.1 CO₂ Emissions from Energy Use, 2002–30
31 2.1 World Crude Oil Price, 1990–2005
32 2.2 Import-Export Ratio of Energy-Intensive Products in High-Income OECD Countries and Low- and Middle-Income Economies
32 2.3 Import-Export Ratio of Energy-Intensive Products in the United States and EU
33 2.4 Import-Export Ratio of Energy-Intensive Products in Low- and Middle-Income East Asian and Pacific Economies and China
33 2.5 Import-Export Ratio of Energy-Intensive Products in Low- and Middle-Income Economies in Various Regions
46 3.1 CO₂ Emissions from Energy Use, 2002–30
54 3.2 Energy Production in China and India, 2004
57 3.3 Clean Coal Technology Import-Export Ratio in High-Income versus Low- and Middle-Income Countries
62 3.4 Wind Power Generation Import-Export Ratio in High-Income versus Low- and Middle-Income Countries
64 3.5 Solar Power Generation Import-Export Ratio in High-Income versus Low- and Middle-Income Countries
69 3.6 Import-Export Ratio of Fluorescent Lamps in High- and Low-Income Countries
88 4.1 Traditional Environmental Goods versus Environmentally Preferable Products
94 4.2 Considerations for a Win-Win-Win Package on Trade and Climate Change

Tables
21 2.1 Existing Measures to Combat Climate Change in Annex I Countries
23 2.2 Status of Carbon Tax Regimes in Selected OECD Countries
25 2.3 Existing Energy Efficiency Standards for Select Products in OECD Countries
26 2.4 Predicted Competitiveness Impacts of Carbon Taxes and Energy Efficiency Standards
28 2.5 Impact of Carbon Taxes and Energy Efficiency Standards on Export Competitiveness
2.6 Impact of an EU "Kyoto Tariff" on U.S. Exports

3.1 Potential Contribution to CO\textsubscript{2} Increase, 2002–30

3.2 Change in Trade Volumes in High-GHG-Emitting Developing Countries from Liberalizing Clean Energy Technologies

3.3 Top 10 Trading Countries for IGCC (Clean Coal) Technology Components

3.4 Applied Average Tariffs and NTBs for IGCC (Clean Coal) Technologies in the 18 High-GHG-Emitting Developing Countries

3.5 Top 10 Trading Countries in Wind Energy

3.6 Applied Average Tariffs and NTBs for Wind Technology in 18 High-GHG-Emitting Developing Countries

3.7 Top 10 Trading Countries in Solar Photovoltaics

3.8 Applied Tariffs and NTBs for Solar Photovoltaic Technology in 18 High-GHG-Emitting Developing Countries

3.9 Top 10 Trading Countries for Fluorescent Lamps

3.10 Average Applied Tariffs and NTBs on Fluorescent Lamps in 18 High-GHG-Emitting Developing Countries

4.1 Trade in Climate-Friendly Technologies of Both High-Income and Low- and Middle-Income WTO members

4.2 Fuel Subsidies in OECD and non-OECD Countries

3A Results from the Competitiveness Analysis: Effects of Climate Change Measures on all Relevant Industries

3B Results from the Competitiveness Analysis: Effects of Climate Change Measures on Energy-Intensive Industries

3C Results from the Competitiveness Analysis: Effects of Climate Change Measures on Industries Subject to Higher Efficiency Standards

4A Impact of Carbon Taxes and Energy Efficiency Standards on Export Competitiveness (Energy-Intensive Industries)

4B Impact of Carbon Taxes and Energy Efficiency Standards on Export Competitiveness (Industries Subject to Higher Energy Efficiency Standards)