The problem of global sustainability is indisputably the most serious issue facing humanity today. One of the biggest factors in the deterioration of global sustainability is climate change, which has been exacerbated by the entire range of human activities and is inextricably related to modern civilization. Solving this difficult problem requires a drastic redesign of society from all aspects – technological, economic and social. This book looks at how to achieve a more secure level of global sustainability and gathers together a variety of recommendations.

Achieving Global Sustainability reviews the current status of global sustainability and analyses the relationship between globalization and sustainability, together with arguments on the necessity of a paradigm shift in economic growth. Paradigm shifts in socioeconomic development are discussed in terms of social common capital, contemporary social discipline and economic valuation of the environment. The contributors also examine various strategies for achieving a sustainable society, among them a basic strategy for mitigating climate change, a strategy of technology development toward global sustainability, and a post-2012 international policy framework. The book presents methods of adaptation for environmental change, including integrated assessment models of climate change and a risk-assessment approach to seismic hazard mitigation. Policy recommendations for global sustainability are also introduced, including those advocating a low-carbon society by 2050, a “Green New Deal” as a means of integrating policies, climate security, and a new international discipline.
Achieving global sustainability: Policy recommendations

Edited by Takamitsu Sawa, Susumu Iai and Seiji Ikkatai
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figures</td>
<td>viii</td>
</tr>
<tr>
<td>Tables</td>
<td>x</td>
</tr>
<tr>
<td>Plates</td>
<td>xii</td>
</tr>
<tr>
<td>Equations</td>
<td>xiii</td>
</tr>
<tr>
<td>Contributors</td>
<td>xiv</td>
</tr>
<tr>
<td>Abbreviations</td>
<td>xvii</td>
</tr>
<tr>
<td>Preface</td>
<td>xix</td>
</tr>
<tr>
<td><strong>1 Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td>Takamitsu Sawa</td>
<td></td>
</tr>
<tr>
<td><strong>2 Global sustainability</strong></td>
<td>7</td>
</tr>
<tr>
<td>2-1 Global sustainability: Current issues and challenges</td>
<td>8</td>
</tr>
<tr>
<td>Michinori Uwasu</td>
<td></td>
</tr>
<tr>
<td>2-2 Global sustainability: Globalization and sustainable development</td>
<td>25</td>
</tr>
<tr>
<td>Kazuhiro Ueta</td>
<td></td>
</tr>
</tbody>
</table>
2-3 A new paradigm for economic growth .......................... 40

Takamitsu Sawa

3 Paradigm shift of socio-economic development ................. 59

3-1 Sustainable development and social common capital ...... 60

Kazuhiro Ueta

3-2 Social norms and people’s values in light of sustainability .. 70

Takashi Ohshima

3-3 Measuring sustainability and economic valuation of the environment ......................................................... 87

Masayuki Sato

4 Strategies for sustainable society ................................. 103

4-1 Basic mitigation strategy for climate change ................. 104

Seiji Ikkatai

4-2 Technology development strategy towards global sustainability ................................................................. 119

Satoshi Konishi

4-3 Technological strategy for renewable bioenergy .......... 134

Shiro Saka

4-4 Clean development mechanism policy and sustainable rural development in China ................................ 148

Akihisa Mori

4-5 Conservation of peat bog and agro-forestry in Indonesia ... 162

Kosuke Mizuno and Haris Gunawan

4-6 Do markets matter? The role of markets in the post-2012 international climate regime .............................. 175

Yukari Takamura

5 Adaptation to environmental change ........................... 195

5-1 Adaptation in global integrated assessment models of climate change ....................................................... 196

Hans-Martin Füssel
5-2 Risk assessment approach for seismic hazard mitigation and its application to adaptation to global climate change
   Susumu Iai

5-3 Risk management of climate change and stochastic calculus
   Jiro Akahori

6 Policy recommendations towards global sustainability

6-1 Policy recommendations towards a low-carbon society in 2050
   Takamitsu Sawa

6-2 A Green New Deal as an integration of policies towards sustainable society
   Kazuo Matsushita

6-3 Climate security and its implications for integrating paradigms of development and security
   Seiichiro Hasui

Index
Introduction

Takamitsu Sawa

1-1 The end of the era of CO₂ emissions

The twentieth century was an era in which economic development and growth were achieved by burning fossil fuels, or in other words by continuously increasing carbon dioxide (CO₂) emissions. When delegations from 161 countries gathered in 1997 at the Kyoto International Conference Center and agreed to oblige industrialized nations to cut emissions of greenhouse gases (GHGs) – such as the CO₂ that was emblematic of the twentieth century – it was an epoch-making event that marked a historic turning point. At the same time, it signified a farewell to a twentieth-century model of industrial civilization that had been characterized by oil and automobiles. The Kyoto Protocol was viewed as standing in opposition to the morals and principles of market fundamentalism: its contents imposed “regulations” on industrialized nations in the sense that it set obligatory reduction amounts, and thus went against the basic principle of market fundamentalism, which believes that a free, competitive market economy is the optimal system.

At the same time, I do not think anybody believes that CO₂ emissions will be reduced through “market forces”. If global warming and the accompanying climate changes are not alleviated, an unimaginable global tragedy awaits us in the second half of the twenty-first century. By creating the necessary economic measures (an environmental tax, emissions quota trading, an automobile tax that is proportional to fuel efficiency, etc.), governments can encourage energy conservation on the part of
individuals and corporations and provide incentives for technological development that will contribute to a shift to low carbon usage. Supplementing these with regulatory measures to make up for the shortcomings is an appropriate strategy for mitigating global warming and climate change in a free market economy.

1-2 Green New Deal

As an economist who has worked on global environmental issues since 1990, I have continuously and vigorously disputed the view that “economic growth and environmental protection are incompatible”. Both then and now I take the position that they are compatible. It is said that the twenty-first century is the “century of the environment”, and I would summarize what is meant by this in two points. First, global environmental issues, and above all climate change, are becoming increasingly grave, and people are now showing an unprecedentedly high level of interest in them. Second, the objective of technological innovation will be to break through the limitations of the environment, and that kind of innovation will spur economic growth.

I have been espousing these points for a long time, and the fact that my explanation was not necessarily off the mark is demonstrated by President Obama’s Green New Deal policy. This groundbreaking policy, started in the United States, tries to tailor the promotion of policies to mitigate climate change into a driving force for economic growth. Let us look at a few examples. Taking a cue from the Germans, it will produce employment through the promotion of renewable energy (green-collar workers), and provide large-scale government investment for an IT-based “smart grid” to stabilize the power distribution network system in preparation for an increase in renewable energy, which lacks stability in terms of the amount of power generated, voltage and frequency. In addition, through the development and distribution of eco-friendly goods, it will boost personal consumption expenditures. By adopting an emissions quota trading system, it will encourage companies to make their production and business processes green. Companies will also endeavour to develop eco-friendly goods and lower the prices of those goods in response to the demands of consumers.

1-3 The end of the era of automobiles and oil

The twentieth century was an “era of automobiles and oil”. It was an era in which the diffusion of the automobile had an enormous inter-industry
ripple effect, and that in turn provided traction for economic growth. Petrochemical products derived from ethylene became substitutes for natural rubber, leather, textiles, lumber and so on, while gasoline, diesel oil and jet fuel were used to fuel the engines for transportation vehicles. Until the sudden advent of the oil shock of 1973, oil-fired thermal power was inexpensive and it was easy to adjust the load, and thus it became the mainstream of electricity supply.

However, by the end of the twentieth century passenger vehicles had reached saturation point in all industrialized nations, closing the book on the era when the diffusion of automobiles propelled economic growth. Only if some kinds of durable goods become available and widely used does personal consumption, which represents 60 per cent of GDP, increase. In Japan’s “take-off” period of rapid growth from July 1958 to October 1973, household electrical appliances such as black-and-white televisions and electric washing machines, refrigerators and vacuum cleaners flew off the shelves, allowing the Japanese economy to sustain a high real growth rate of nearly 10 per cent. Leaving aside the vacuum cleaner, the other three items just noted were referred to as the “three sacred treasures”, and in 1970 their diffusion rate was more than 90 per cent. Next it was the 3Cs that drove economic growth, namely colour TVs, cars and coolers (i.e. air conditioners).

Taking Japan’s household diffusion rate for automobiles as an example, in 1965 it was 10 per cent, in 1970 it was 22 per cent, in 1975 it was 40 per cent, in 1980 it was 57 per cent, in 1985 it was 67 per cent and in 1991 it was 80 per cent – nearly a straight-line ascent. In Japan, where the cost of car ownership is high, it appears unlikely that the household diffusion rate will exceed 90 per cent in the future. The average annual real economic growth rate from 1956 to 1973 was 9.1 per cent, and from 1974 to 1990 it averaged 3.8 per cent. The fact that Japan was able to maintain these high growth rates almost continuously, greatly exceeding those of the Western industrialized nations, was in large part due to the diffusion of passenger vehicles.

1-4 Automobiles and digital cameras

The electrical appliances that have become popular since the start of the Heisei recession in March 1991 are limited to digital products such as cell phones, personal computers, DVD recorders/players, digital cameras and so on. But no matter how widely diffused digital cameras, for instance, may become, they will produce no more than a tiny inter-industry ripple effect. Moreover, digital cameras took the place of film cameras, so for the camera industry there was a sense that it ended up as no difference.
Although it is plausible that the real economic growth rate remained at a low annual average of 1.1 per cent from 1991 to 2008 because of the lingering effects of the post-bubble recession, another cause was the low inter-industry ripple effect of digital products as compared to automobiles. The cellular telephone offers an example that is easier to understand. A single cell phone that has multiple functions is similar to the digital camera in that it has a weak inter-industry ripple effect. The cell phone possesses functions that more or less “substitute” for books, cartoons, dictionaries, newspapers, TVs, train schedules, personal computers, clocks, cameras, GPS, personal organizers and so on. It makes one suspect that the long-term recession that has been going on since 1991 is perhaps the result of the diffusion of these little 100 g or so devices. In any case, if asked what the three major discoveries of the twentieth century are as measured by their impact on changing lifestyles, without hesitation I would say the automobile, TV and cell phone.

1-5 Measures to combat climate change will spur global economic growth

What will move the global economy forward is the resolute implementation of both global Keynesian measures to encourage the steady diffusion of durable goods in emerging and developing nations and the Green New Deal measures in industrialized nations. The clean development mechanism (CDM) set out in the Kyoto Protocol works as an incentive for global Keynesian measures. To that end, it is necessary to impose strict GHG emissions reduction obligations on industrialized nations. Reduction targets that are so high they are impossible to meet through domestic policies alone are required. Industrialized nations would then have to invest in emerging and developing nations (i.e. the CDM; however, if the emerging nation bears some obligation to cut or restrain emissions, it becomes a joint implementation project), and through such efforts the potential demand that exists in those countries can be developed. Through investment, industrialized nations can receive certified emission reductions (CERs), or in other words a carbon credit, and can thereby reduce the costs of achieving their emissions targets. Not only that, but they can expect a boomerang effect in the positive sense (i.e. increased exports from the industrialized nations).

In short, in the post-Kyoto era, imposing strict GHG emission reduction requirements on industrialized nations to alleviate climate change provides an incentive for global Keynesianism and the Green New Deal measures, and by extension brings about sustainable development in the global economy.
INTRODUCTION

I have tried in the past to correct the fallacy that “climate change measures will slow economic growth”, but that fallacy has remained resolutely intact. Recently, however, the world economic situation has completely changed. As a result of the global recession that struck the world in 2008, the curtains were drawn on the twentieth-century model of industrial civilization that took automobiles and oil as the driving forces of economic growth, and a new era of green capitalism has arrived. In order to prevent a recurrence of the global recession, and to spur domestic demand in industrialized nations, the greening of the capitalist economy is essential. Be that as it may, there are still university professors who deny the causal relationship between the increasing density of GHGs in the atmosphere and global warming/climate change, just as there are also university professors who refer to Prime Minister Yukio Hatoyama’s call for 25 per cent emission cuts as utter nonsense. In mainstream economics, the claim that “GHG emission reductions will impede economic growth” is unyielding. The objective of this book is to correct the mistakes of those who profess that view, and to offer proactive proposals for restructuring the socio-economic system and implementing technological strategies to move us towards green capitalism.
Achieving Global Sustainability: Policy Recommendations

Edited by Takamitsu Sawa, Susumu Iai and Seiji Ikkatai

Sustainability Science

The problem of global sustainability is indisputably the most serious issue facing humanity today. One of the biggest factors in the deterioration of global sustainability is climate change, which has been exacerbated by the entire range of human activities and is inextricably related to modern civilization. Solving this difficult problem requires a drastic redesign of society from all aspects – technological, economic and social. This book looks at how to achieve a more secure level of global sustainability and gathers together a variety of recommendations.

Achieving Global Sustainability reviews the current status of global sustainability and analyses the relationship between globalization and sustainability, together with arguments on the necessity of a paradigm shift in economic growth. Paradigm shifts in socioeconomic development are discussed in terms of social common capital, contemporary social discipline and economic valuation of the environment. The contributors also examine various strategies for achieving a sustainable society, among them a basic strategy for mitigating climate change, a strategy of technology development toward global sustainability, and a post-2012 international policy framework. The book presents methods of adaptation for environmental change, including integrated assessment models of climate change and a risk-assessment approach to seismic hazard mitigation. Policy recommendations for global sustainability are also introduced, including those advocating a low-carbon society by 2050, a “Green New Deal” as a means of integrating policies, climate security and a new international discipline.

Takamitsu Sawa is Adviser to the Chief Director of the Kyoto Sustainability Initiative, Professor at the Graduate School of Policy Science at Ritsumeikan University, Kyoto, and Project Professor at the Institute of Economic Research, Kyoto University, Japan. Susumu Iai is Chief Director of the Kyoto Sustainability Initiative and Professor at the Disaster Prevention Research Institute, Kyoto University, Japan. Seiji Ikkatai is Professor of Economics at the Institute of Economic Research, Kyoto University, Japan.

Ordering information

UNITED NATIONS PUBLICATIONS
C/o National Book Network
15200 NBN Way
PO Box 190
Blue Ridge Summit, PA 17214
USA Toll free phone: 1-888-254-4286
Toll free fax: 1-800-338-4550
E-mail: unpublications@nbnbooks.com

UNU BOOKS
United Nations University
53-70 Jingumae 5-chome
Shibuya-ku
Tokyo 150-8925
Japan
Tel: +81-3-5467-1488
Fax: +81-3-3406-7345
E-mail: books@unu.edu

375p US$37.00

United Nations University Press
53-70, Jingumae 5-chome, Shibuya-ku, Tokyo 150-8925, Japan
Tel +81-3-5467-1212; Fax +81-3-3406-7345
E-mail: sales@unu.edu; http://www.unu.edu/unupress