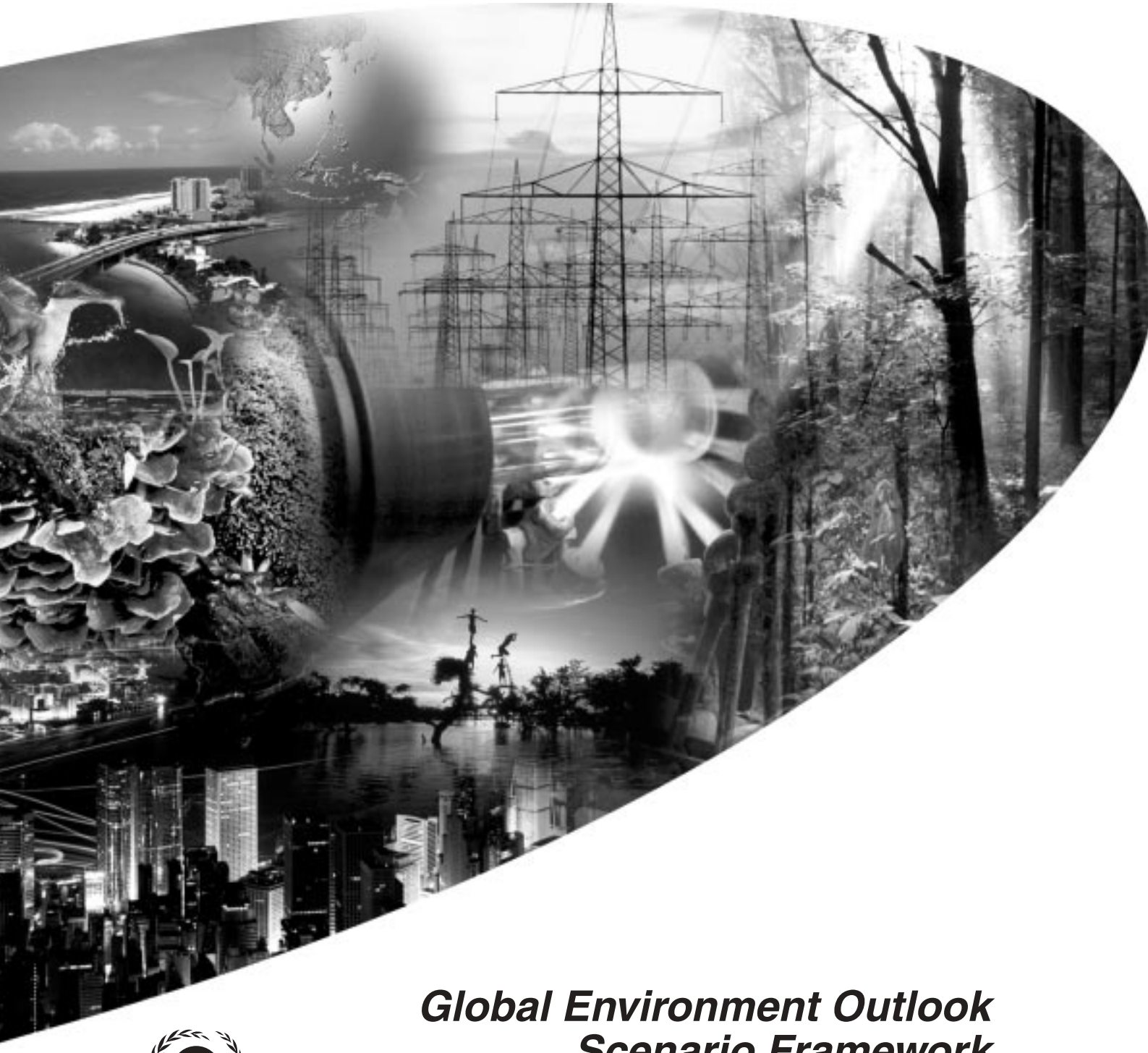


Global Environment Outlook Scenario Framework

Background Paper for UNEP's Third Global Environment Outlook Report (GEO-3)

UNEP

SEI STOCKHOLM ENVIRONMENT INSTITUTE

ISBN: **92-807-2461-4**

DEWA Job number: **DEW/0546/NA**

For bibliographic and reference purposes this publication should be referred to as:
UNEP (2004) Global Environment Outlook Scenario Framework: Background Paper for UNEP's Third Global Environment Outlook Report (GEO-3)

Disclaimers

The contents and views expressed in this publication do not necessarily reflect the views or policies of the contributory organizations or the United Nations Environment Programme (UNEP).

The opinions, figures and estimates set forth in this publication should not necessarily be considered as reflecting the view or carrying the endorsement of UNEP.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of UNEP concerning the legal status of any country, territory or city or its authorities, or concerning the delimitation of its frontiers and boundaries.

Mention of a commercial company or product in this publication does not imply the endorsement of UNEP.

Reproduction

Division of Early Warning and Assessment (DEWA)
United Nations Environment Programme
P.O. Box 30552
Nairobi 00100, Kenya
Tel: +254 20 623562
Fax: +254 20 623944
Email:
geo@unep.org
UNEP web site: http://www.unep.org

This report was prepared by:

Paul D. Raskin
Eric Kemp-Benedict

Stockholm Environment Institute – Boston Center
Tellus Institute
11 Arlington Street,
Boston, MA 02116, USA
Tel: (617) 266 8090
Fax: (617) 266 8303
Email:praskin@tellus.org

Table of Contents

1 GEO-3 and Scenarios

UNEP's Global Environment Outlook series provides a comprehensive assessment of the state of the global environment, a review of policy responses and an outlook on the future. The first Global Environment Outlook (GEO-1) was released in 1997, the second (GEO-2000) in 2000, and the third (GEO-3) in 2002. The *Looking to the Future* chapter of GEO-1 and the *Outlook* chapter of GEO-2000 used a scenario-based approach to illuminate the challenges and appropriate responses over the coming decades. Recognition of the important role of scenarios for scanning long-range prospects and synthesising global and regional perspectives goes back to the very beginning of the GEO series.[1]

The Outlook chapter of GEO-3 is ground-breaking in several ways. It goes beyond the earlier reports in assessing long-range global and regional environmental prospects in a coherent and comprehensive scenario framework. It is the result of an intensive two-year process, which included expert and collaborative meetings on global futures and regional scenarios, with the active participation of UNEP's collaborating centres throughout. It addresses environmental trends in an integrated framework that includes economic, social and cultural factors that ultimately shape the ways in which human activity impacts on nature. It places regional analyses in the context of global patterns, on the grounds that greater global interconnectedness links regional and global outlooks.

Earlier drafts of this paper served as discussion documents for the GEO-3 Outlook chapter meetings, and as a primary source for the chapter itself. Successive revisions captured the evolving consensus on the scenario descriptions and quantifications. In particular, the feedback from the various regional meetings provided the basis for further refinement of the global scenarios.

Section 2 of this paper introduces the scenario approach. Section 3 provides an overview of the major literature on scenario frameworks for structuring thinking about the future, and introduces a framework for GEO-3. Section 4 offers narratives for the GEO-3 scenarios and presents quantitative illustrations by region. Section 5 summarises some of the main lessons of the scenarios. Annex 1 presents statistical summaries of two of the scenarios for each region.

[1] At that time, the Stockholm Environment Conference Institute convened the Global Scenario Group (GSG), with participants from a wide spectrum of regions and disciplines. The GSG served as the Scenario Working Group for both GEO-1 and GEO-2000, and remained a key source for GEO-3. The presentation here draws heavily on previous GSG studies (Gallopin and others, 1997; Raskin and others, 1998; Raskin and others, 2002).

2 The Scenario Approach

GEO's mandate to assess long-term environmental issues poses significant methodological challenges. As the time horizon expands from years to decades, conventional techniques, such as trend analysis and mathematical modelling, become inadequate.

The long-term future cannot be extrapolated or predicted because of three types of indeterminacy – ignorance, surprise and volition:

- *Ignorance:* insufficient information on the current state of the system and the forces governing its dynamics lead to a classical statistical dispersion over possible future states.

- *Surprise:* even if precise information were available, complex systems are known to exhibit turbulent behaviour, extreme sensitivity to initial conditions and branching behaviours at various thresholds – the possibilities for novelty, surprise and emergent phenomena make accurate prediction impossible.

- *Volition:* the future is unknowable because it is subject to human choices that have not yet been made.

In the face of such indeterminacy, scenarios offer a means for examining the forces that shape our world, the uncertainties that lie before us and the implications for tomorrow of our actions today. A scenario is a story, told in words and numbers, concerning the manner in which future events could unfold; analysis of a range of scenarios offers lessons on how to direct the flow of events towards sustainable pathways and away from unsustainable ones. While we cannot know what will be, we can tell plausible and interesting stories about what could be.

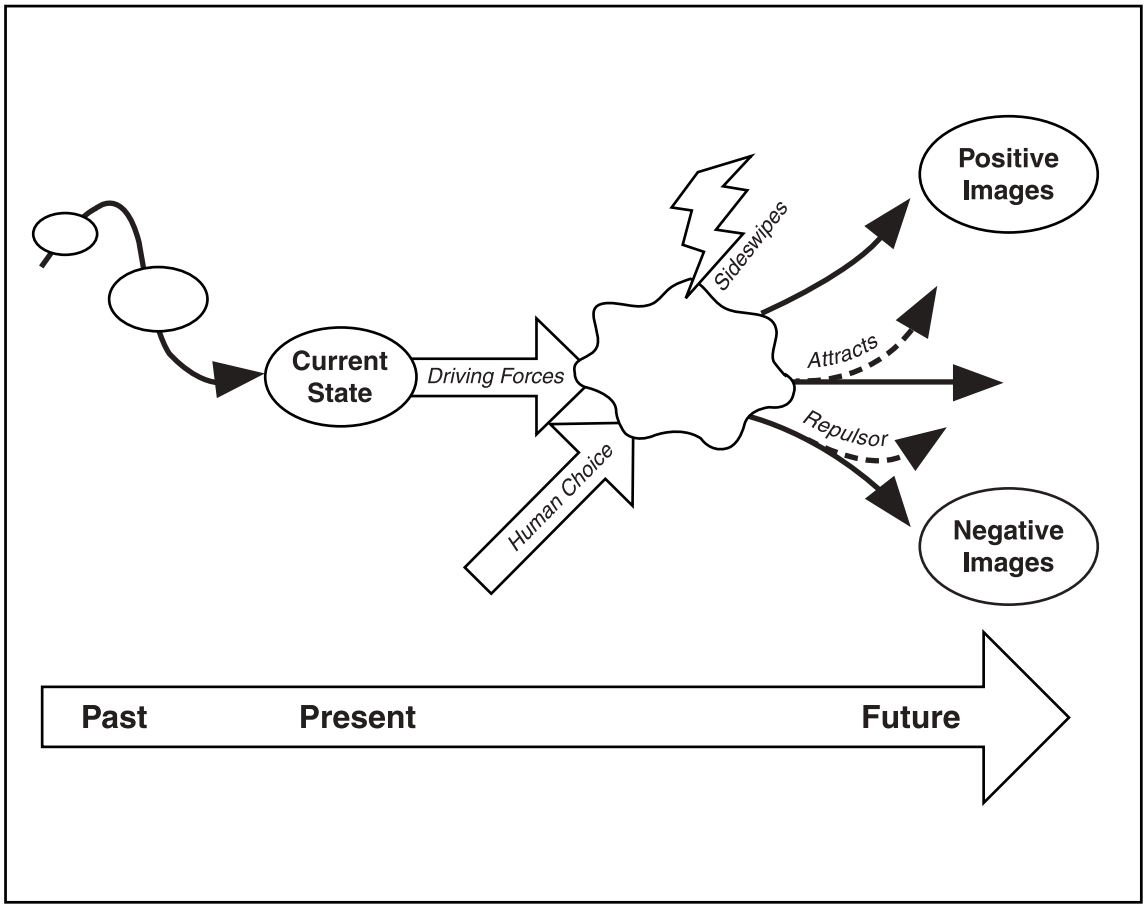
In the theatre, a scenario is a summary of a play. Analogously, development scenarios are stories about the future, each with a logical plot and narrative. Scenarios usually include images of the future – snapshots of the major features of interest at various points in time – and an account of the flow of events leading to such future conditions. Compelling scenarios need to be constructed with rigour, detail and creativity, and evaluated against the criteria of plausibility, self-consistency and sustainability, a process that requires thorough and intensive analysis.

Scenarios draw on science – our understanding of historical patterns, current conditions, and physical and social processes – and on the imagination to conceive, articulate and evaluate alternative pathways of development and the environment. In so doing, scenarios can illuminate the links between issues, the relationships between global and regional development, and the role of human actions in shaping the future. It is this added insight, leading to more informed and

rational action, that is the foremost goal of scenarios, rather than prediction of the future.

Figure 1 sketches the major features that govern the dynamics of change of combined human and environmental systems. The *current state* of the system is the outcome of an historical process. This state changes as a result of a set of *driving forces* which condition, but do not determine, the future trajectory of the system. The capacity of human beings to imagine alternative futures and act intentionally means that images of the future can act as *attractive* and *repulsive forces* in shaping a scenario. Positive images of future states might include their consistency with sustainability principles. Negative images can also play an important role, in raising awareness and guiding efforts to redirect the evolution of the system away from perilous conditions. In addition, surprising and extreme occurrences – called *sideswipes* in the figure – could affect development. Many unexpected events could have dramatic effects (e.g., a breakdown of the climate system, a world war, cheap fusion power, a major natural disaster, a rampant global epidemic), but probabilities cannot be assigned, nor can all the possibilities be imagined. From a sustainable development perspective, scenarios that minimise the vulnerability of societal and environmental systems to unfavourable events and enhance their resilience would be encouraged.

Figure 1. Scenario Dynamics



Scenario formulation generally involves the following steps:

- the *boundary* of the analysis is specified in several senses – spatially (e.g., global, regional, sub-regional), thematically (e.g., coverage of sectors, issues), and temporally (the time horizon of the analysis);
- the *current state* is described across a range of dimensions – economic, demographic, environmental, institutional and so on;
- the important *driving forces and trends* that are currently conditioning and changing the system are introduced;
- a *narrative*, or story line, provides the plot by which the scenario stories unfold (quantitative indicators are often used to illuminate aspects of the scenarios);
- an *image of the future* paints a picture of conditions at one or more points in time.

Some scenarios are 'forecasts', which describe how alternative futures might develop from current conditions and driving forces. Others are 'backcasts,' which begin with an image of the future and seek to identify plausible development pathways for getting there. The *Policy Reform* scenario, introduced in Section 3, is an example of a backcast.

The remainder of this section discusses the forces driving the GEO-3 scenarios at the global level. Regarding the other steps in formulating the scenarios, the temporal, spatial and thematic boundaries were set before the scenario development began. The GEO-3 Outlook chapter contains a thirty-year prospective, from 2002 to 2032, to balance the thirty-year retrospective in Chapter 2. Scenarios are developed for six global regions, with additional detail at the level of 21 sub-regions (see Annex). The environmental aspects of the scenarios focus on the eight GEO-3 themes: *Atmosphere, Land, Forests, Coastal and Marine, Biodiversity, Urban Areas, Natural Disasters, and Environment and Human Health.* The current state has been the focus of previous GEO reports and is taken up again in Chapter 2 of GEO-3. Finally, the global narratives and images of the future are the focus of Section 4.

Regarding driving forces, a number of significant trends and influences affect the initial direction of the global socio-ecological system and set the context for regional development. Major driving forces at the global level include:

Demographics

Populations are increasing and getting, more crowded and older. Global population growth is stabilising but total population will grow by about 30% in the next 30 years, according to mid-range United Nations projections. Nearly all of the additional population will be in developing countries. A massive transition from a predominately rural to a heavily urban society is underway. By 2032 over 2 000 million new city dwellers may be added, posing great challenges for infrastructure development, the environment and social cohesion. Meanwhile, low fertility rates in rich countries and decreasing fertility rates elsewhere will lead gradually to an increase in the average age of populations. Societies will need to adjust, as productive populations support a progressively greater population of the elderly. Although the linkages are not straightforward, in many instances population growth and urbanisation can aggravate environmental and resource pressures.

Economics
Product, financial and labour markets are becoming increasingly integrated and interconnected in a global economy. Advances in information technology and international agreements to liberalise trade have catalysed the process of globalisation. Huge transnational enterprises operate increasingly in a planetary marketplace, posing challenges to the traditional prerogatives of the nation-state. A related factor is the resistance to these trends by nationally- based economic interests, geopolitical isolationists, and environmental and social advocates concerned about the impacts on environmental protection, labour conditions and community cohesion.

Social
Increasing inequality and persistent poverty characterise the contemporary global scene. As the world grows more affluent for some, life becomes more desperate for others left behind by global economic growth. Economic inequality between nations and within many nations is growing. This phenomenon, combined with population growth, leads to the persistence of poverty and human suffering for billions of people throughout the world. At the same time, the transition to market-driven development erodes traditional support systems and norms, leading to considerable social dislocation and scope for criminal activity. In some regions, rampant infectious diseases such as AIDS are an important social driving force affecting development.

Culture
Consumer culture is rapidly permeating many societies in the wake of globalisation and the penetration of information technology and electronic media. This process is both a result and a driver of economic globalisation. At the same time, the advance toward a unified global marketplace triggers nationalist and religious reaction. In their own ways, both globalisation, which leaves important decisions affecting the environment and social issues to transnational market actors, and the traditionalist reaction to globalisation pose important challenges to democratic institutions. The rejection of Western-dominated globalisation has its most virulent expression in global terrorism.

Technology
Technology continues to transform the structure of production, the nature of work and the use of leisure time. The continued advance of computer and information technology is at the forefront of the current wave of technological innovation. Also, biotechnology could significantly affect agricultural practices, pharmaceuticals and disease prevention, while raising a host of ethical and environmental issues. Advances in miniaturised technologies could revolutionise medical practices, materials science, computer performance and many other applications.

Environment
Global environmental degradation is another significant transnational driving force. International concern has grown about human impacts on the atmosphere, land, and water resources, the bioaccumulation of toxic substances, species loss, and the degradation of ecosystems. The realisation that individual countries cannot insulate themselves from global environmental impacts is changing the basis of geo-politics and global governance.

Governance
There is a significant trend toward decentralisation of authority and greater individual autonomy. On an individual level, there is increased emphasis on ‘rights’ – human rights, women’s rights, and so on. In the private sector, the trend is reflected in ‘flatter’ corporate structures and decentralised decision-making. Some entities have no formal authority structure, such as the Internet or NGO networks. In the public sector, the trend is noticeable in the spread of democratic governments, the devolution of governmental authority to smaller and more local units, separatist movements, and the emergence of civil society as an important voice in decision-making.

While these driving forces and persistent trends set the initial course for development, the complex global system, as we have argued, can rapidly change direction at critical thresholds of extreme turbulence and instability.

Scenarios can be constructed across multiple spatial levels – global, regional, national and local. While many issues cut across levels, specific aspects come into focus as one *zooms* in or out. For example, a planetary panorama is needed to reveal global economic, cultural, demographic and environmental phenomena. A regional perspective is required to analyse the problems of acid rain, water allocation, institutional patterns and certain migration patterns. A national focus sheds light on many policies, trade patterns and security issues. A local view often is often appropriate for evaluating land-change patterns, biodiversity and ground- level pollution. These alternative spatial scales provide complementary and mutually enriching windows for perception and understanding.

In an increasingly connected world, all levels of spatial resolution are needed to tell the scenario story fully and to illuminate the critical questions that scenarios address – where we might we be going, where do we want to go and how do we get there. Global scenarios must reflect regional insights and patterns, while scenarios in various regions should be informed by common global assumptions. In this spirit, scenarios at regional and global levels need to evolve in an iterative process of mutual clarification, a process that has been adhered to in the development of the GEO-3 scenarios.

Finally, it should be stressed that while scenarios can certainly can offer quantitative insight, they are not primarily modelling exercises. The qualitative scenario narrative plays a critical role in giving voice to key aspects that are not quantifiable, such as cultural influences, values, behaviours and institutions. Thus, scenarios can provide a broader perspective than model-based analyses, while at the same time making use of various quantitative tools such as accounting frameworks and mathematical simulation models. Quantitative analysis offers a degree of structure, discipline and rigour. Narrative can offer texture, richness and insight. The art is in the balance.

3 Scenario Framework

All scenario studies must reduce the immense range of possibilities to a few stylised story lines. Two competing considerations must be weighed. On the one hand, the goal of analytic rigour invites a comprehensive consideration of many scenario alternatives. On the other, the need to communicate to a wide audience of non-specialists dictates brevity and clarity. Generally, scenario exercises organise the possibilities into a very few scenario alternatives.

Much of the scenario literature falls into two distinct streams of inquiry – one qualitative and narrative and the other quantitative and model-based. Each approach has its strengths and limitations. Narrative scenarios can challenge the imagination, underscore critical uncertainties and motivate actions for desirable futures. They are able to address qualitative factors (values, culture, behaviours, institutions), system shifts and surprise. But as largely literary exercises, they lack scientific rigour, and tend to reflect the biases and whims of the individual author.

Model-based scenarios can offer data-rich and systematic analysis. But quantitative models, since they assume structural continuity of the socio-ecological systems, are not easily adapted to address discontinuity and surprise. This sharply constrains the range of plausible futures that are considered. Moreover, important qualitative aspects of the problem are not addressed. Such studies are generally confined to a 'business-as-usual' scenario and variations. For many non-specialists unfamiliar with such limitations, models have an aura of scientific precision that can lead to an unwarranted level of confidence in their predictive power and accuracy.

The cutting edge of scenario research today combines the strengths of the narrative and modelling traditions. The challenge is to retain scientific rigour while including a range of contrasting narratives on future possibilities. We introduce three recent efforts that take up this challenge: the work of the Global Scenario Group, Special Report on Emissions Scenarios (SRES) of the Intergovernmental Panel on Climate Change (IPCC) and the World Business Council on Sustainable Development (WBCSD).

3.1 Global Scenario Group

The Global Scenario Group uses a two-tier hierarchy to classify scenarios: *classes* and *variants.* Classes are distinguished by fundamentally different social visions. Variants reflect a range of possible outcomes within each class. Three broad classes are *Conventional Worlds, Barbarisation* and *Great Transitions*. These are characterised, respectively, by essential continuity with today's evolving development patterns, fundamental but undesirable social change, and fundamental and favourable social transformation.

Conventional Worlds envisages the global system of the 21st century evolving without major surprises, sharp discontinuities or fundamental transformations in the basis for human civilization. The future is shaped by the continued evolution, expansion and globalisation of the dominant values and socio-economic relationships of industrial society. By contrast, the *Barbarisation* and *Great Transitions* scenario classes relax the notion of the long-term continuity of dominant values and institutional arrangements. Indeed, these scenarios envisage profound historical transformations over the next century in the fundamental organising principles of society, perhaps as significant as the transition to settled agriculture and the industrial revolution.

Within *Conventional Worlds*, the *Market Forces* variant incorporates mid-range population and development projections, and typical technological change assumptions. The *Policy Reform* scenario adds strong, comprehensive and coordinated government action, as called for in many policy-oriented discussions on sustainability, to achieve greater social equity and environmental protection. In this variant, the political will evolves for strengthening management systems and rapidly diffusing environmentally- friendly technology. Whatever their differences, *Conventional Worlds* variants share the premises of the continuity of institutions and values, the rapid growth of the world economy and the convergence of global regions toward the norms set by highly industrial countries. In the business-as-usual *Market Forces* variant, the problem of resolving the social and environmental stresses arising from global population and economic growth is left to the self-correcting logic of competitive markets. In the *Policy Reform* variant, sustainability is pursued as a pro-active strategic priority.

Barbarisation scenarios envisage the grim possibility that the social, economic and moral underpinnings of civilization deteriorate, as emerging problems overwhelm the coping capacity of both markets and policy reforms. The *Breakdown* variant leads to unbridled conflict, institutional disintegration and economic collapse. The *Fortress World* variant features an authoritarian response to the threat of breakdown. Ensconced in protected enclaves, elites safeguard their privileges by controlling an impoverished majority and managing critical natural resources, while outside the fortresses there is repression, environmental destruction, and misery.

Great Transitions explore visionary solutions to the sustainability challenge, including new socio-economic arrangements and fundamental changes in values. These scenarios depict a transition to a society that preserves natural systems, provides high levels of welfare through material sufficiency and equitable distribution, and enjoys a strong sense of social solidarity. Population levels are stabilised at moderate levels and material flows through the economy are radically reduced through lower consumerism and massive use of green technologies. The *Eco-communalism* variant incorporates the green vision of localism, face-to-face democracy, small technology and economic autarky. The *New Sustainability Paradigm* variant shares some of these goals, but would seek to change the character of urban, industrial civilization rather than replace it, to build a more humane and equitable global civilization rather than retreat into localism.

Conventional Worlds is where standard policy discussion occurs. But if environmental and social stresses are not resolved through incremental market and policy

adaptations, development could veer toward some form of *Barbarisation, Great Transitions* represents alternative forms of development in which the response to the sustainability challenge includes new values, consumption patterns and institutions.

3.2 Special Report on Emission Scenarios

The mandate for the IPCC Special Report on Emission Scenarios (SRES) was to develop greenhouse gas emissions scenarios to the year 2100 assuming that policies to mitigate emissions are not implemented. The SRES team, unlike earlier IPCC scenario efforts, recognised the need for 'multiple baselines' to reflect the fundamental uncertainty in basic long-range global development narratives. Modelling teams computed greenhouse gas emissions for each of these scenarios. Thumbnail sketches of the four SRES scenario types follow (SRES, 2000).

The four scenarios are constructed as different combinations of the following criteria: whether the world is integrated or fragmented, and whether sustainability is a priority or not. In the SRES notation "A" and "B" signify unsustainable or sustainable, and "1" and "2" signify global integration or fragmentation. Thus, A1 is an integrated unsustainable world, A2 is a fragmented unsustainable world, B1 is an integrated sustainable world and B2 is a fragmented sustainable world.

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are; convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil- intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B).

The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally- oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

The B1 storyline and scenario family describes a convergent world with the same global population, peaking in mid-century and declining thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with continuously increasing global population at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels.

3.3 World Business Council on Sustainable Development

Consistent with its mission, the World Business Council on Sustainable Development's (WBCSD) scenario project is aimed at engaging its corporate members to reflect on the risks and opportunities posed for business by the sustainable development challenge. The WBCSD's three scenarios are summarised below (WBCSD 1997).

The world of "First Raise Our Growth!" *(FROG!)* is a familiar world – at least at first. Many nations experience a fair degree of economic success, and, for almost all, economic growth is the major concern, with sustainable development acknowledged to be important, but not pressing. As environmental NGOs continue to demand enforcement of standards that have been set in global summits, those nations who are striving to develop argue that if the developed nations insist on raising environmental standards, they should FROG! Indeed, in this scenario, some nations leapfrog from underdeveloped status to bench marker in particular areas of technology. People in western nations respond in uneven ways – sometimes by offering help in improving the environment, and sometimes in raising various cries of "FROG!" themselves, especially in response to perceived threats from underdeveloped nations in the areas of employment and copyright and patent infringement.

People value sustainable development in the *FROG!* scenario – but it is not top priority. In addition, in the early years, environmental health in many areas improves significantly. The improvements in local air quality, solid waste management, and environmental education lead to a perception that the environment is in much better shape than it was in the late 1990s. But at the global level, the picture is less clear. With economic growth and the increase in population, greenhouse gases are rising, unnoticed by most. The signals are difficult to read, and people disagree about what they mean – both the difficulty and the disagreement are good reasons, it is felt, to continue to FROG!" But by 2050 there is evidence that the darkest predictions about global warming are actually nearer to the truth than the more optimistic ones.

In *FROG!*, the habitual reliance on technology has not been sufficient to solve longer-term problems of either environmental or social health. Globalisation and liberalisation of markets along with the pressures of rapid urbanisation have raised the degree of social inequity and unrest to a level that threatens basic survival of both human and environmental ecosystems. In this scenario, people react like the proverbial frog: when placed in boiling water, the frog leaped out of danger; but placed in cold water that was gradually heated to the boiling point, the complacent frog was boiled to death.

Geopolity begins with a succession of signals in the first two decades – some real, some imagined – that an environmental and social crisis looms. The prevailing economic myth' is increasingly viewed as dangerously narrow. This is particularly true in Asia, where rapid economic growth has meant that corners have been cut and traditions lost. Because many institutions, especially governments, have lost credibility as problem-solvers, people expect something from the new centres of power – multinationals. But the business sector seems unable or unwilling to respond adequately. Business is distrusted, and in some cases, because of its prevailing focus on narrow self-interest, is even perceived to be hindering solutions to problems. Its actions are not coordinated on a global level, and it seems to lack the will even to address the problems.

Because neither governments nor businesses are effective in providing leadership, people begin to look for new leaders and to demand new social institutions. Some of these involve the strengthening of government – for example, 'sustainable cities,' 'sustainable national accounting,' and comprehensive implementation of industrial ecology. Others are politically innovative. The perceived need for strong and certain responses leads to a new global consensus that welcomes technocratic solutions, sanctions, and more direct control of the market to ensure that environmental values and social cohesion are preserved. The impetus behind all these movements is the growing consensus that the market has no inherent incentives to protect the commons, social welfare, or any other non-economic values. In the absence of leadership from business and government to solve problems, people form new global institutions – such as the Global Ecosystem Organisation (GEO), which has broad powers to design and enforce global standards and measures to protect the environment and preserve society – even if doing so requires economic sacrifice.

In *Geopolity*, governments are rejuvenated as focal points of civil society. Governments seek to work with markets rather than to displace them. But they take the lead in shifting the structure of the economy towards sustainable development in conjunction with institutions such as GEO.

In the world of *Jazz*, diverse players join in ad hoc alliances to solve social and environmental problems in the most pragmatic possible way possible. The key note of this scenario is dynamic reciprocity. This is a world of social and technological innovation, experimentation, rapid adaptation, much voluntary interconnectedness, and a powerful and ever-changing global market.

What enables the quick learning and subsequent innovation in *Jazz* is high transparency – the widespread availability of information about ingredients of products, sources of inputs, company financial, environmental, and social data, government decision-making processes, and almost anything else that concerned consumers want to know. Many players are involved, in part because the way information technology lowers barriers to entry allows new actors to step onto the economic stage. And that stage itself is characterised by a global free market, sound legal systems, and a respect for property rights.

To the extent that government is involved, it is most active at the local level, with ad hoc global institutions arising to solve particular problems. Agreements are reached through mediation in a world in which transparency is required, but particular 'green' behaviours are not, even though such behaviours are rewarded. Achievement of the new environmental and social standards occurs largely out of self-interest. The public is made aware of transgressions and quickly acts against companies or countries that violate standards. Companies have an interest in seeing that disputes do not escalate and indirectly harm them. They monitor relationships with customers and suppliers closely and drop risky partners quickly. In this highly competitive and interconnected world, businesses see strategic economic advantages in being perceived as environmentally and socially responsible, and many become pro-active leaders in responding to social and environmental challenges.

Jazz is a world in which NGOs, governments, concerned consumers, and businesses act as partners – or fail. Together, along with other players, they learn effective ways of incorporating environmental and social values into market mechanisms.

3.4 GEO-3 Framework

The point of departure for the GEO-3 scenarios is the Global Scenario Group (GSG) framework described in Section 3.1 and listed in the first column in Table 1. For direct use in GEO, both the SRES and WBCSD efforts have significant limits. The SRES scenarios focus on the climate change issue. An integrated consideration of other major environmental and research issues was beyond its mandate, as were the social dimensions of the scenarios, such as the implications of international equity and poverty. The WBCSD work is focused heavily on the business perspective. Also, the full description of the scenarios is only available to non-members at considerable cost. Nevertheless, we can learn from these efforts and, since they are variations on similar themes, they can be synthesised into a common framework (see table below).

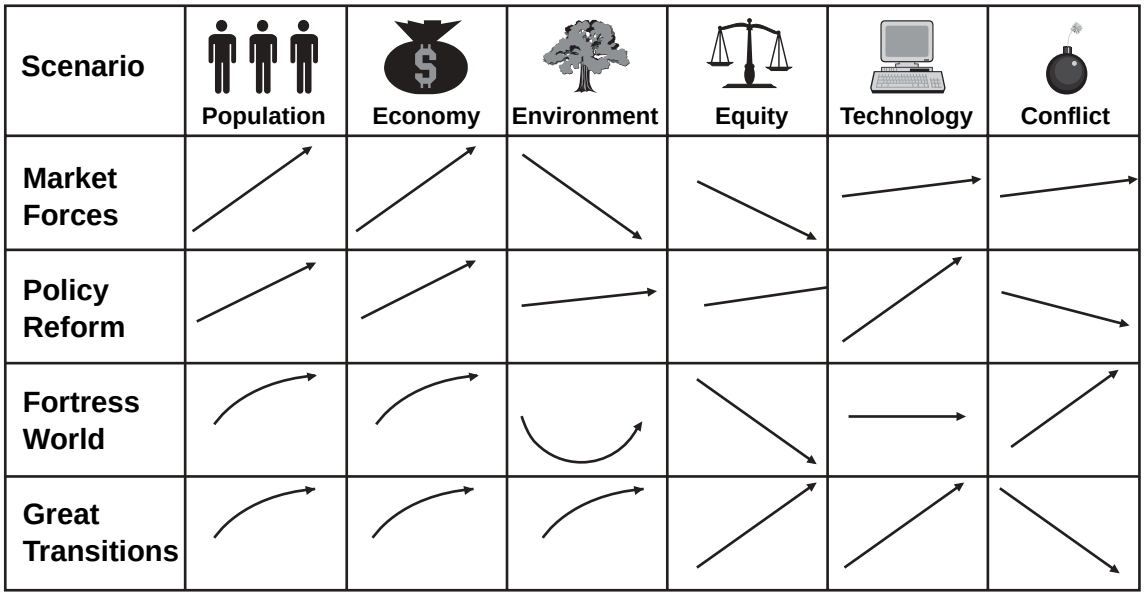
The final column of Table 1 introduces the proposed GEO-3 scenarios. Rather than the full GSG structure, the GEO-3 scenarios will focus on the GSG's *Conventional Worlds-Market Forces, Conventional Worlds-Policy Reform, Barbarisation-Fortress World and Great Transitions-New Sustainability* paradigms.

Table 1. Scenarios Compared

	Framework			
	GSG	**SRES**	**WBCSD**	**GEO-3**
Scenarios	Conventional Worlds			
	Market Forces	*A1*	*FROG!*	*Market Forces*
	Policy Reform	*B1*	*Geopolity*	*Policy Reform*
	Barbarisation			
	Breakdown			
	Fortress world	*A2*		*Fortress World*
	Great Transitions			
	Eco-communalism	*B2*		
	New sustainability paradigm		*Jazz*	*Great Transitions*

The scenarios are shown in **Figure 2** with indicative sketches of their behaviour over time for six descriptive variables: population growth, economic scale, environmental quality, social and economic equity, technological change and degree of social and geopolitical conflict. The curves are intended as rough illustrations only of the possible patterns of change.

Figure 2. Scenario Structure with Illustrative Patterns of Change



3.5 Note on Scenario Names

The names for the four GEO-3 scenarios are drawn from the scenario taxonomy of the Global Scenario Group (Gallopin and others, 1997; Raskin and others, 1998; Raskin and others, 2002). Participants at global and regional meetings considered various alternatives before settling on those shown in **Figure 2**. The debate was particularly

intense regarding the *Market Forces* scenario. Alternative suggestions, such as *Market Forces*, *Business-as-usual* and, perhaps facetiously, *IMF's Dream*, were rejected on the grounds that they did not suggest the fundamental changes and challenges entailed in the scenario. It was felt that *Market Forces* better conveys the normative character of a future dominated by liberalised markets and progressive integration of all countries into the dominant development paradigm. It would require substantial policy initiatives at global, regional and national levels to overcome the barriers to such a market-driven future, to foster the necessary institutional conditions and to bring the developing world into the global market system.

The *Policy Reform* scenario accepts the basic development and modernisation model of *Market Forces*, but envisages the successful imposition of policies to meet strong environmental sustainability and social goals. Such an incremental approach to sustainable development tacitly underlies much of the international discussion and negotiation on these issues, which seeks to reduce ecological impacts and levels of poverty through better technology and management practices, but does not take up more fundamental questions of the conventional model of development. In light of this, alternative names offered for the *Policy Reform* scenario were *Balanced Growth* (since the objective of economic growth is moderated by environmental and poverty-reduction targets) or *Brundtland's Dream*, since this worldview seems to underlying the seminal Brundtland Report (WCED, 1987).

The metaphor *Fortress World* is meant to connote a future of global polarisation, extreme inequity and rampant conflict. An alternative name suggested was *Fragmented World* but this failed to communicate the sense of a dualistic form of global development – a kind of global apartheid – in which the elite may still operate in a connected world economy and culture. An interesting but disquieting note is that many scenario discussants seem to think of this dark future as the 'business as usual' scenario, that is, the most likely outcome of current trends.

The essence of the *Great Transitions* scenario is a values-driven and fundamental modification of the *Market Forces* paradigm and the long-range development model. *Sustainable World* was suggested but thought to be inadequate – with a likelihood depending on one's values, each of the scenarios may be thought to have the potential to meet sustainability criteria. Even in the authoritarian *Fortress World* some form of environmental sustainability may be imposed. Also, while the values driving a *Great Transitions* would certainly include a sustainable development ethic, they would in addition embrace a strong sense of human solidarity and would reconceptualise development as a search for qualitative meaning in addition to quantitative prosperity.

The names used here for the four scenarios –
Market Forces, Policy Reform, Fortress World and *Great Transitions* – were used throughout the consultation process and initial drafting stages of the GEO-3 report. In the final draft, they were changed, respectively, to *Market First, Policy First, Security First* and *Sustainability First*, the names that appear in the published report.

4 Scenario Narratives

Global and regional environmental outlooks are explored through four contrasting visions of possible future global and regional developments. The scenarios are based on the work of the Global Scenario Group (Gallopin and others, 1997; Raskin and others, 1998 and Raskin and others, 2002), an organisation that was originally established, in part, to provide a scenario framework for the GEO series. The scenarios have been elaborated and given regional specificity through an extended series of global and regional consultations.

The scenarios offer archetypal images of the future. All are plausible, none are certain. In reality, as future events unfold, elements of all of the scenarios are likely to be visible. Indeed, aspects of each of the scenarios can be seen in the world today. The actual global development path over the next several decades could well include features of each, along with unforeseen new elements. In the context of sustainable development, a feature that distinguishes the scenarios is the different ways in which the tension between economic growth and environmental limits is reconciled.

To review from the previous section, *Market Forces* envisages the global system evolving without major surprises or sharp discontinuities as dominant values and relationships shape a globally- integrated world. Economic development and environmental preservation are addressed largely through market adaptations. In a variation on this conventional story, *Policy Reform* pictures a world in which social and environmental goals are actively pursued through comprehensive policies for sustainable development, while still relying on the market to generate prosperity and allocate resources. But there are other ways in which environmental limits on the scale of economic activity might play out. Some visions are bleak, including the possibility of authoritarian control over resources in order to avoid catastrophic environmental and social breakdown – a *Fortress World*. Some are idealistic, picturing a fundamental transition to a world dominated by post-consumerist values and lifestyles and high levels of social equity – *Great Transitions*.

While the implications are complex, the essential stories that underlie each of the scenarios may be captured in a sentence:

- *Market Forces:* market-driven global development leads to convergence towards dominant values and development patterns.
- *Policy Reform:* incremental policy adjustments steer conventional development towards environmental and poverty-reduction goals.
- *Fortress World:* as socio-economic and environmental stresses mount, the world descends toward fragmentation, extreme inequality and widespread conflict.
- *Great Transitions:* a new development paradigm emerges in response to the challenge of sustainability, distinguished by pluralism, planetary solidarity, and new values and institutions.

The scenarios are summarised in **Figure 2** with indicative sketches of their behaviour over time for five six descriptive variables: population growth, economic scale, environmental health, social and economic equity, technological change and degree of social and geopolitical conflict. The environmental implications will be elaborated in later sections. The curves are intended only as rough illustrations of the possible patterns of change.

The *Market Forces* scenario refers to a future governed by a conventional development paradigm of market-driven development, as represented by the 'Washington Consensus.' It features accelerated globalisation, trade liberalisation and convergence of developing countries toward the development and institutional models of industrialised countries. The dominant 'western' model of development prevails, as consumerism and individualism spread as core values. It is believed that the most effective poverty-reduction strategy is growth promotion, and that growth will tend to be 'broad-based' and will trickle down. Furthermore, economic growth is expected to automatically repair the environmental damage caused by development. This scenario is neither policy-free nor is it 'business-as-usual.' Rather, *Market Forces* is a normative future that would require substantial policy initiatives at global, regional and national levels to overcome the barriers to such a market-driven future, foster the necessary institutional conditions and bring the developing world into the global market system.

Like *Market Forces,* the *Policy Reform* scenario envisages the evolution of institutions and values, the rapid growth of the world economy, and the convergence of global regions toward the norms set by highly industrial countries. As in *Market Forces*, western values still prevail. However, there is less faith that social and environmental stresses can be mitigated adequately through the automatic responses of competitive markets. The distinguishing feature of the *Policy Reform* scenario is the emergence of the political will to constrain and guide market-driven growth with a comprehensive set of sustainability policies. In *Policy Reform*, sustainability goals are pursued as a proactive strategic priority. The goals are based on social and environmental targets adopted by the international community and set at global, regional and national levels. Comprehensive government action seeks to diffuse environmentally- friendly technology, strengthen management systems and reduce poverty as encouraged by the Earth Summit. Policy initiatives for achieving the goals are regionally differentiated but include a mix of economic reform, regulatory instruments, voluntary actions, social programmes and technology development. The *Policy Reform* vision is reflected in much of the recent international discussion and negotiation on sustainable development.

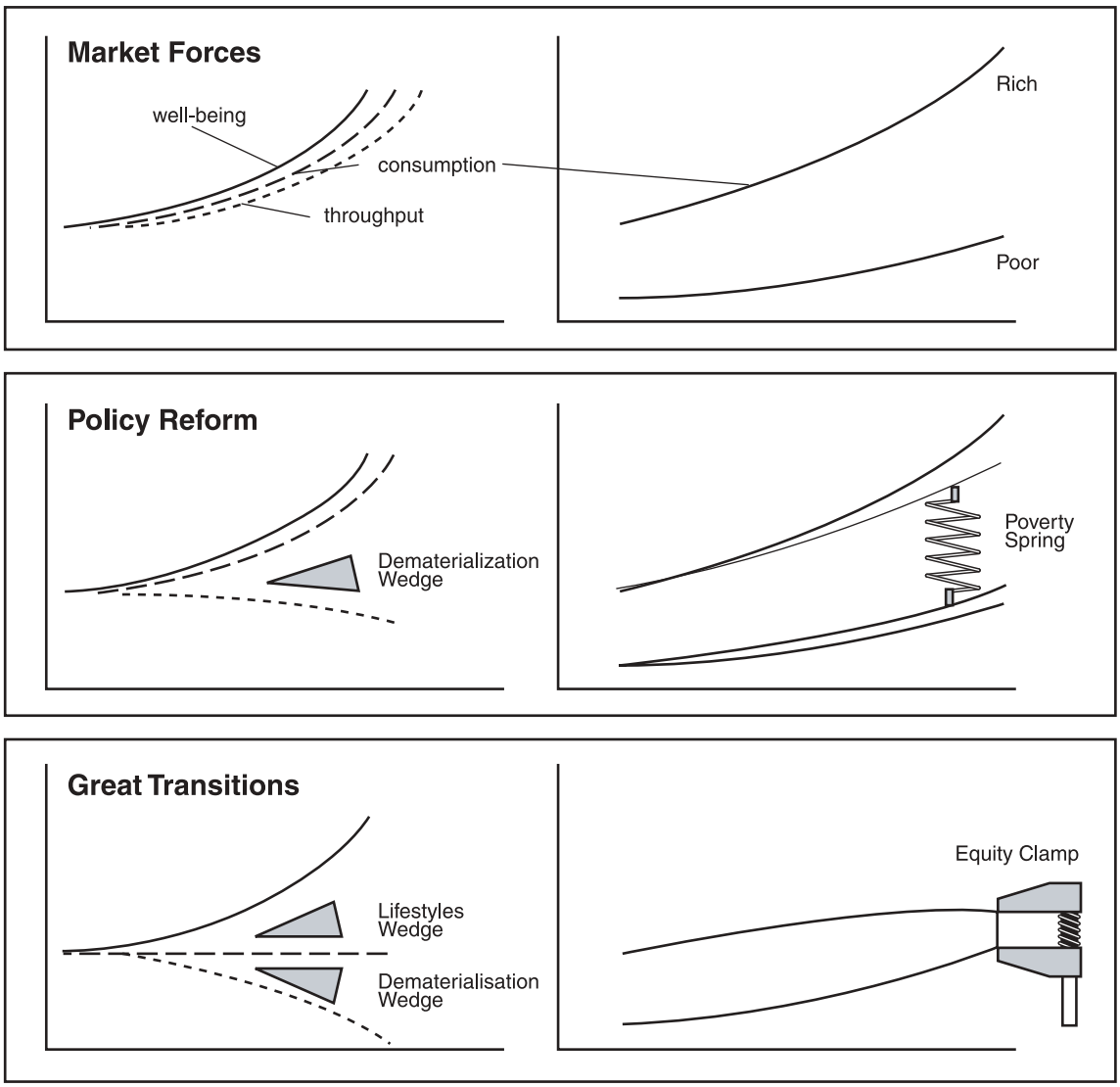
The *Fortress World* scenario envisages the grim possibility that the social, economic and moral underpinnings of civilization deteriorate, as emerging problems overwhelm the coping capacity of both markets and policy reforms. The metaphor of the 'fortress' connotes a future of global polarisation, extreme inequity and rampant conflict, in which increasing social and environmental stresses lead in time to increasingly authoritarian 'solutions.' The scenario has two faces: an elite minority in protected enclaves and an impoverished majority eking out a precarious existence on the margin. Fortresses, precursors of which can be seen in the world today, come in many varieties. They may or may not involve a physical wall, and may be protected regions within a country or

may be a country to themselves. The fortresses are bubbles of privilege within oceans of misery. Note that components of the environment may actually improve under this scenario, as those in the fortresses reserve natural areas for their own purposes. Furthermore, this scenario envisages a form of globalisation as the network of fortresses coordinates economic exchange, security arrangements and global policy. Meanwhile, the excluded majority has few options and few resources. This future need not be unsustainable. It is plausible that such an unequal and authoritarian world might be maintained for an indefinite time – but at what cost?

The *Great Transitions* scenario offers a vision of a values-driven response to the sustainability challenge. This global development alternative would be a fundamental modification of the conventional development paradigm. The transitions emerge from the growing consensus that the conventional 'wisdom' is both insufficient and undesirable. As social and environmental sustainability becomes broadly accepted as a basis for values, the conviction spreads that top-down policies alone are inadequate to combat social inequities and ensure environmental resilience. Markets are not abandoned as a policy tool but social, cultural and environmental goals take priority. Material flows through the economy are moderated as population growth in developing regions and consumerism in richer regions abate. Eco-efficient production processes and green technologies are deployed everywhere. Among the affluent, disillusionment with consumerism prompts a search for more fulfilling ways of living, while in the less-affluent regions a new generation of thinkers, leaders and activists shape a 'new development paradigm'. The period is characterised by a cultural renaissance, based on respect for life, the social community, equity within and between generations, and social solidarity. Wealth and access to resources are much more equitably distributed than today or in the other scenarios.

In some ways, *Policy Reform* and *Great Transitions* scenarios are similar. Each seeks to meet sustainable development goals. The difference between them is in the underlying values that determine human action. The effect of this difference on economic and material development is illustrated in **Figure 3** (Robinson and Tinker, 1996; Raskinand others, 2002). The assumptions that underlie the two scenarios are compared to those that underlie the *Market Force* scenario, in which well-being is identified with consumption. Material throughput, in turn, is tightly tied to the economy. Policy attention is not focused on questions of distribution, and the incomes of rich and poor diverge in absolute terms, although there is some convergence in relative terms. The *Policy Reform* story breaks with this pattern by separating consumption and material throughput through technological means, illustrated in the figure by the 'dematerialisation wedge.' Policy attention focuses on poverty reduction, which tends to reduce inequities. The decline in inequality between countries is dramatic when compared to past patterns but, despite the changes, strong inequalities still characterise the world in 2032. The *Great Transitions* scenario introduces further changes. In this story, concepts of well-being are separated from consumption, illustrated in **Figure 3** by the 'lifestyles wedge.' The dematerialisation wedge is still active, leading to the possibility of considerable reductions in material throughput. In this scenario, attention goes beyond poverty reduction to emphasise greater equity. This is represented in the figure by the 'equity clamp,' which rapidly narrows the gap between rich and poor.

Figure 3. Tools for Transitions



The *Market Forces* and *Policy Reform* perspectives define the space where the conventional policy discussion on sustainable development occurs. But if environmental and social stresses are not resolved through incremental market and policy adaptations, development could veer toward some form of *Fortress World*. *Great Transitions* offers an alternative development vision in which global development responds to the sustainability challenge with new values, consumption patterns and institutions.

How might the alternative scenario stories come to pass? The narratives can be sketched as ‘histories of the future’ which look back from the vantage point of the year 2032.

4.1 Market Forces

At the beginning of the 21st Century, the world is marked by tumultuous change. A global system seems to be taking shape as economic interdependence increases, information technology accelerates cultural influence and the human transformation of nature reaches planetary scales. In the new wave of prosperity, the rich get richer and many of the poor join the middle class. But disparities persist as vast wealth coexists with deep poverty, and each extreme generates its own characteristic environmental pressures.

For many in the development community, it seems inevitable that market forces will drive the global economy toward increasing interconnectedness in which western lifestyles become the norm. The primary challenge becomes creating the appropriate forms of global governance and modernising national institutions, particularly in poor countries, so that all can join the new wave of global prosperity. However, many others are apprehensive about the future. Will the momentum toward a global economy endure? Will institutional development evolve toward a common and integrated multilateral system? Will environmental distress eventually destabilise economic growth? Will social tensions induced by inequality, poverty and friction between regions and ethnic groups be contained?

Indeed, the *Market Forces* world faces numerous challenges and setbacks along the way. But the deepest scepticism proves unfounded. The challenges, rather than derailing economic growth, stimulate corporations to seek new markets. Environmental problems are dealt with through incremental technological responses spurred by market signals. The global poor become targets for innovative forms of digital technology, accelerating economic and cultural convergence.

In this scenario, world development evolves without major discontinuities, change in dominant global values or other structural ruptures. The major trends and driving forces shaping world development at the end of the 20th Century dominate through the next decades. Population grows at mid-range projections, urbanisation proceeds apace, economies grow steadily, and consumption and production practices in developing and transitional regions converge toward those of industrialised countries.

The world becomes increasingly more integrated both economically and culturally, as development everywhere converges gradually toward western lifestyles and values. Even economically stagnating regions begin to expand. Competitive markets and private investment are the engines for economic growth and wealth allocation. Globalisation of product and labour markets continues apace, catalysed by free trade agreements, increasingly unregulated capital and financial flows, and advances in information technology. The Americas coalesce into a giant economic bloc, the European Community (EC) expands eastward, and regional blocs form in Asia.

Transnational corporations dominate an increasingly borderless economy. Consumerism and possessive individualism endure and spread as primary human motives. The nation-state remains the dominant unit of governance although its capacity to control developments within its borders diminishes, as global society

becomes more interconnected. Also, the political momentum for reduced government, privatisation and de-regulation of the late 20th Century continues.

A number of important initiatives pave the way. The World Trade Organisation (WTO) provides the legal basis for the global trading system. A multilateral agreement on investment liberalises investment regimes, first in OECD countries and soon throughout the world. Barriers to trade and capital movements gradually vanish, as protectionism becomes a thing of the past. New institutional instruments promote market openness and global competition. Virtually all national governments advance a package of policy adjustments that include modernisation of financial systems, investment in education to create a work-force that is competitive in the emerging global market, privatisation, reduced social safety nets, and, in general, reliance on market-based approaches.

While many are euphoric about fashioning a liberalised global market, a troubling counterpoint can be heard from those excluded from the new prosperity and those concerned about the environment, labour practices and the erosion of community. For at the heart of the *Market Forces* scenario is an unfulfilled promise – the international commitment at the 1992 Rio Earth Summit to the principles of sustainable development. The ambitious intentions codified in *Agenda 21* remain largely rhetorical as the global commitment gradually dissipates and the difficult political journey from good intentions to effective action is abandoned. Of course, initiatives continue – national sustainability studies, incremental progress on international climate and biodiversity agreements, countless local efforts and so on. But these are fragmented and insufficient.

The collapse of the climate negotiations leaves industrialised countries free to increase their greenhouse gas emissions. The earliest effects of climate change are felt mainly in developing countries. Low-lying coastal areas are repeatedly inundated, disease vectors migrate to new areas, and more frequent and intense El Niño events alter rainfall. Small island states are affected particularly strongly by rising sea levels and increasingly variable weather. Developing countries face other challenges, as well. The ravages of AIDS continue to spread in Africa; in Asia, population densities, already high at the turn of the century, increase further; in most developing regions large urban areas expand to form giant ‘megacities’ at a pace that outstrips the rate of expansion of services and infrastructure.

It was widely hoped that ‘Rio+10’, the World Summit on Sustainable Development (WSSD) of 2002, would be a planetary opportunity to renew the spirit, energy and vision for a sustainable future. Indeed, a brief upsurge of activity and optimism does occur at that time. But gradually the political momentum for sustainable development ebbs amidst global fatigue with the sustainability issue. Social and environmental policy remains partial, inadequate and episodic, rather than the coordinated, comprehensive and continuous response required. By 2032, the era of sustainable development is over, remembered only by historians of the late twentieth-century and by nostalgic grandparents recalling their idealistic youth.

In this context, the rich get richer and, even though new social strata achieve affluence, poverty persists. Developing countries, despite substantial economic growth, nevertheless remain dependent on technology developed by the industrialised countries and vulnerable to economic shifts outside their control. Aid dependency, debt, volatile capital flows and continued reliance on primary commodities compromise the stability and predictability necessary for effective long-range planning. Global institutional arrangements help to mitigate some of these effects, but they are put in place primarily in response to the concerns of industrialised countries, rather than of the countries most affected.

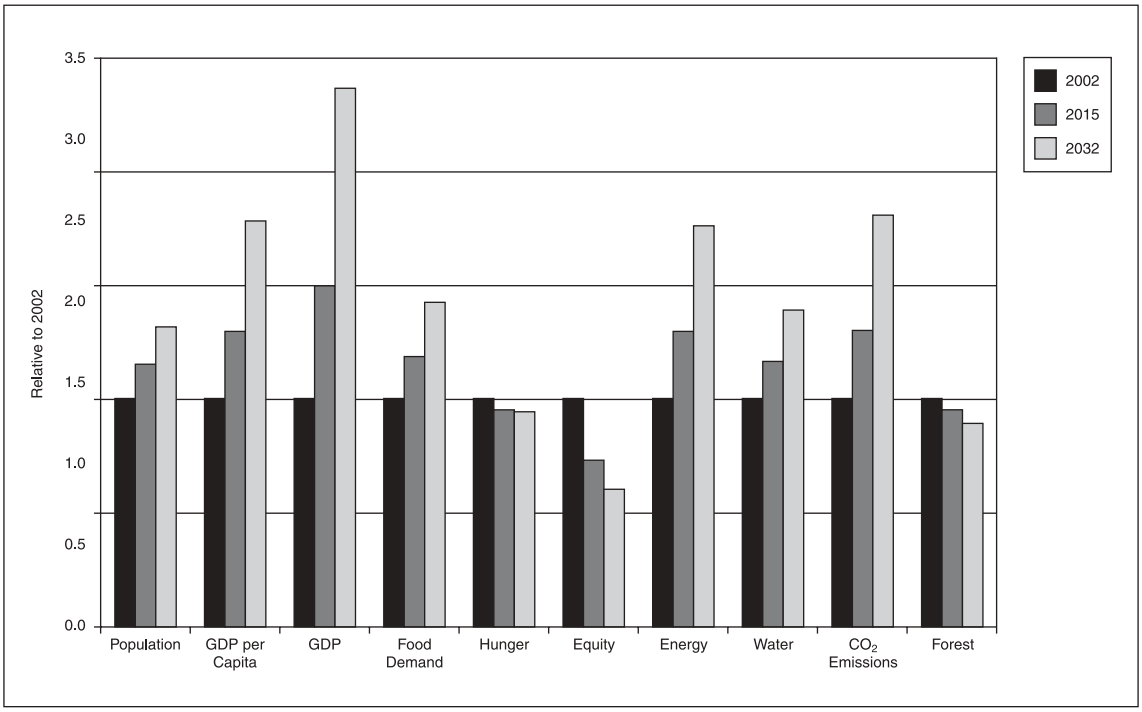
Income distribution becomes more skewed both within most nations and between rich and poor countries. Environmental quality improves in some of the rich areas, but deteriorates in the poor areas while the cumulative effects on global scales are exacerbated. In developing countries, the growth of cities, the effects of climate change and the expansion of tourism all contribute to pressures on coastal areas. In all regions, the degradation of ecosystems and the spread of modern agricultural practices threaten genetic diversity. Social friction is aggravated by migration pressure, competition for natural resources and environmental deterioration. National development projects in thinly settled areas, such as in the Amazon, cause environmental disruption and the displacement of indigenous communities.

The gradual shift in the composition of economic activity from industry to services that has been occurring in OECD countries continues, and is seen eventually in other regions. In particular, the shares of material- intensive industries decrease gradually, consistent with recent trends in industrialised countries. The penetration of new technology leads to more efficient use of energy and water, growing utilisation of renewable energy resources, and cleaner industrial processes. In general, developing country patterns of consumption and production converge toward OECD patterns, thus leapfrogging toward modern technologies.

The aggregate global patterns of the scenario are illustrated in **Figure 4**.[3] Note that total energy and water use grows far less rapidly than GDP due to the structural and technological changes described above. Despite reductions in the throughput per unit of GDP (throughput refers to the materials input to the economy and waste output), pressure on resources and the environment increases as the growth in the scale of human activity overwhelms the greater levels of efficiency. As a measure of environmental pressure, we see that carbon dioxide emissions (CO_2), the major contributor to the risk of global climate change, increase substantially. The scenario is also problematic with respect to meeting social goals as indicated by the persistence of the number of hungry people (**Figure 4**).

[3] Note that the *Market Forces* and *Policy Reform* quantitative illustrations are updated versions of the scenarios in Raskin et al. (1998). See Kemp-Benedict et al. (2002) for details.

Figure 4. Global Overview of the Market Forces Scenario



Please see the Annex for summaries of the scenario for each of the 22 GEO-3 sub-regions and six regional groupings.

The *Market Forces* scenario achieves much in terms of modernisation, economic growth and opportunity for millions of people. But in fundamental ways, it is neither sustainable nor desirable. First, environmental degradation continues, including climate change, habitat destruction, biodiversity loss and the accumulation of toxic chemicals in the environment. Second, pressure on resources grows severe, including fresh water scarcity, conversion of forests and wetlands for agriculture and human settlements, continued loss of degraded arable land due to unsustainable farming practices and growing scarcity of oil with the risk of economic uncertainty and conflict. Third, social stress threatens socio-economic sustainability as persistent poverty and growing inequality, exacerbated by environmental degradation, undermines social cohesion, stimulates migration and weakens international security.

4.2 Policy Reform

In retrospect, the year 2002 stands out as a milestone in global development. The momentum for change has been brewing since the 1972 Stockholm Conference on the Human Environment. The 1987 Brundtland report crystallised the emerging concept of sustainable development, bringing it to the attention of the policy community and general public. The 1992 Rio Earth Summit converted the broad idea of sustainable development to an agenda for change that was endorsed by the nations of the world.

While this agenda languished for a time, the WSSD galvanises a renewed commitment to action. A reinvigorated NGO community becomes the channel through which citizens everywhere express their demands, a rising voice that political leaders cannot ignore. A consensus emerges on the urgent need to temper what had come to be called the *Market Force* scenario, with policies to secure environmental resilience and to sharply reduce poverty. The scientific consensus that human action is compromising the integrity of the climate system is underscored by the release of a new IPCC report. The UNDP and other international organisations forcefully advocate action for poverty reduction and sustainable livelihoods. UNEP's GEO-3 report portrays long-range environmental perils, but more importantly offers a vision of an equitable and sustainable future.

In the years following WSSD, a steady flow of news of new environmental disasters, long-term ecological degradation and unforeseen threats intensifies concerns. At the same time, geo-political and cultural polarisation is fed by the growing resentment of those people excluded from or resistant to helter-skelter economic globalisation. The public grows increasingly apprehensive about the troubling proposition that their children will inherit an impoverished and fragile world. The Internet amplifies the global dialogue on the need for action. The political basis for implementing a comprehensive set of environmental and social policies takes shape. A new generation of political leadership responds at all levels to make sustainable development a cornerstone of policy agendas. In developing countries, activist policies and strengthened economies drive a reversal of the 'brain drain' that had characterised the 20th Century.

In many ways, the *Policy Reform* scenario that emerges from this process is not a radical deviation from *Market Forces*. The emphasis on economic growth, trade liberalisation, privatisation and modernisation remains. The integration of the global economy proceeds apace, as poorer regions converge very gradually toward the model of development of the rich countries. The values of individualism and consumerism persist, transnational corporations continue to dominate the global economy and governments modernise their economies and social welfare structures. However, the character of development changes in fundamental ways. In all regions there is greater recognition, respect and protection for indigenous cultures. Gender discrimination in education and the workplace is eased, and in many countries essentially erased. Developing countries see greatly increased investment in domestic technology development. The lack of a communications infrastructure in many countries prompts investment and development in wireless communications, which accelerates other social and economic changes.

The defining feature of the scenario is the emergence of the political will to constrain and guide market-driven growth with a comprehensive set of sustainability policies. The*Policy Reform* scenario is based on a set of social and environmental goals adopted by the international community and articulated at global, regional and national levels. These guidelines are adjusted periodically in light of new information. Planners call this a 'backcast', which begins with an image of desirable future conditions and seeks development trajectories to reach these future states. The policy initiatives for achieving the goals are regionally differentiated but include a mix of economic reform, regulatory instruments, voluntary actions, social programmes and technology development.

Global social targets are expressed in terms of measures of poverty reduction. They are based initially on the goals set at a series of international conferences in the 1990s. For example, the 1996 World Food Summit resolved that undernutrition was to be halved by the year 2015. To achieve this goal, the number of undernourished people must decline from more than 800 million to roughly 400 million over 20 years. This was an ambitious goal – the number undernourished fell only about 70 million between 1970 and 1990. Nevertheless, in this spirit a *Policy Reform* goal is set at cutting hunger in half by 2025 and half again by 2050. Similar reduction targets are set for other social indicators such as the number of people who are illiterate and who do not have access to safe water services.

The social goals are complemented by international agreements on targets for various environmental indicators. The indicators fall into two broad categories. Climate destabilisation, eco-efficiency and toxic wastes relate primarily to industrial activities and the demands of modern lifestyles. Deforestation, degradation of land, over-exploitation of fisheries, and potential scarcity of freshwater relate, in addition, to poverty and growing populations. The targets call for substantial decreases in the environmental pressures from OECD economies. At the same time, the targets for developing countries acknowledge that the process of development and industrialisation must continue in these regions, and generally propose that developing regions converge gradually toward the decreasing OECD targets.

The response to the climate change challenge illustrates the approach. Targets are negotiated for keeping human alterations of the climate system within safe limits. One criterion is that the pace of global warming should be slow enough to allow most ecosystems to adapt. A provisional guideline, subject to further research and revision, is that average global temperature should increase no faster than 0.1°C/decade on average between 1990 and 2100. This implies that the concentration of carbon dioxide in the atmosphere should stabilise at less than 450 parts per million by volume (ppmv) by 2100, far less than current projections but more than the pre-industrial level of 280 ppmv and the current level of about 370 ppmv. Achieving such a concentration limit constrains the total budget for cumulative carbon dioxide emissions from human activities.

Aggregate global emissions must be allocated to regions and countries taking into account economic impacts, emission rights and equity considerations. Eventually a comprehensive burden-sharing compromise is negotiated in which OECD regions commit to decreasing emissions and developing countries agree to moderate emissions growth, with a gradual approach to common emissions per capita rights in the last second half of the century. Regional responses provide flexibility in meeting greenhouse gas reduction targets, including strengthened ties between Eastern and Western Europe. The approach is illustrated in **Figure 5**, which shows emissions per capita. The total emissions pattern is shown in **Figure 6**.

Figure 5. Energy-Related CO_2 Emissions per Capita in *Policy Reform*

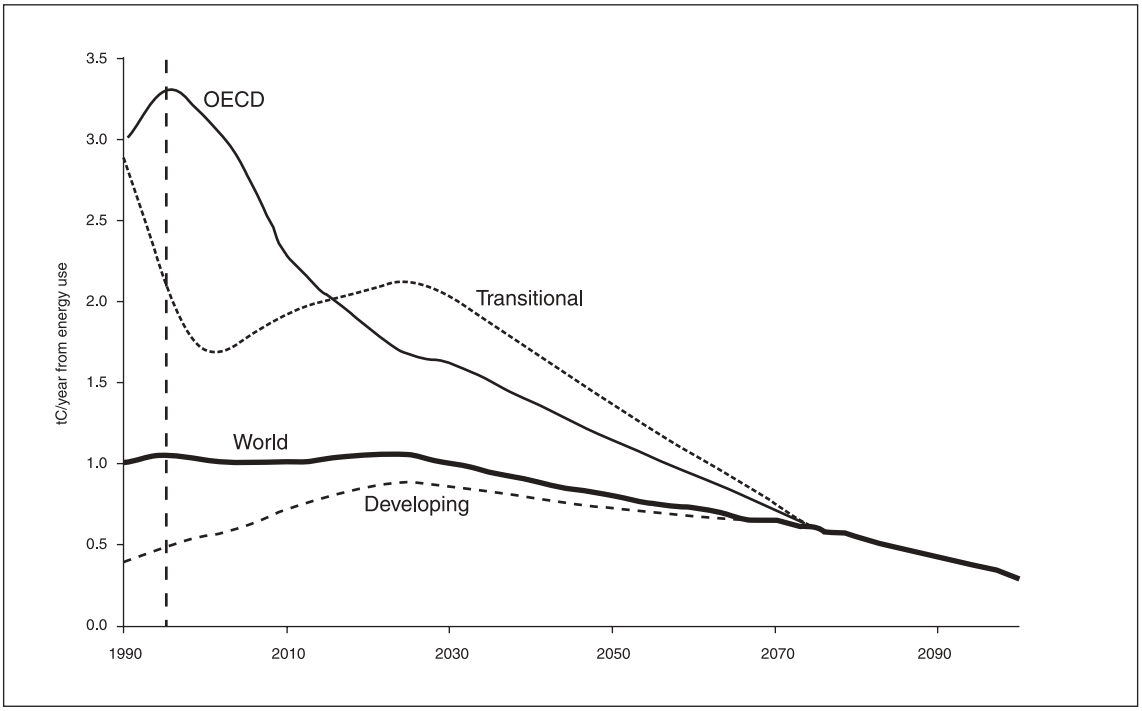
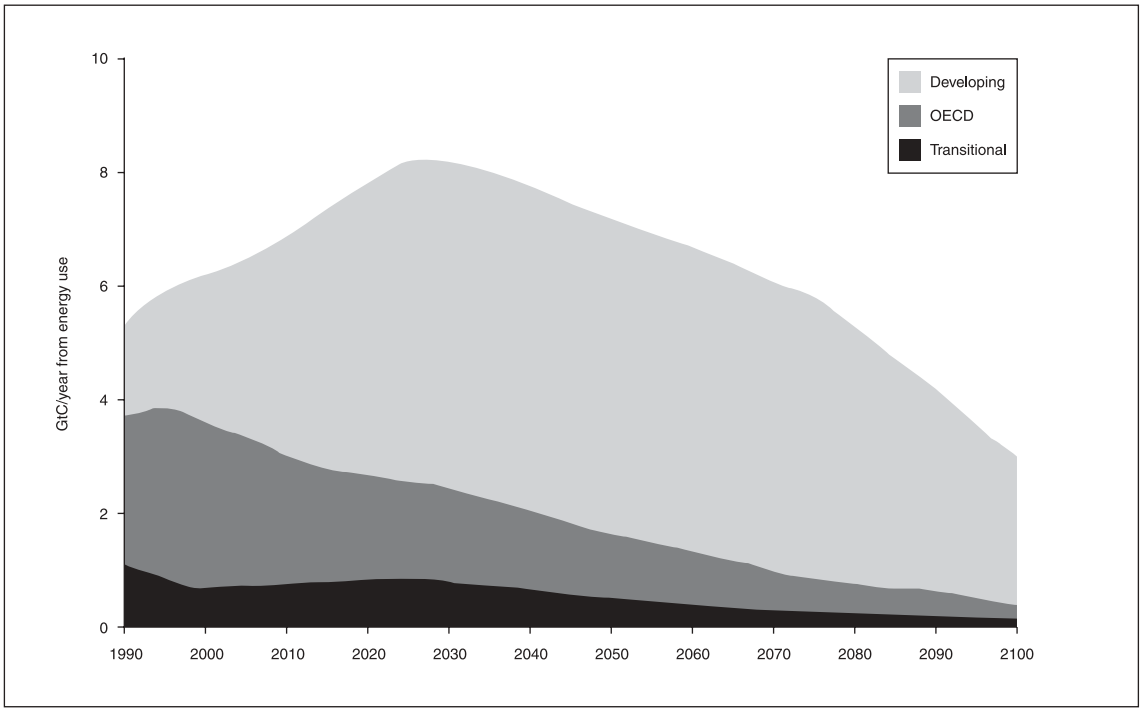


Figure 6. Annual CO_2 Emissions in *Policy Reform*



Complementary environmental initiatives are adopted for decreasing the material flows through economies. As a broad target for dematerialisation, OECD countries set the ambitious but achievable policy goal of increasing aggregate eco-efficiency (economic output per unit of material input) by a factor of five by 2032 relative to 1995 practices. Allowing for economic growth, these targets correspond roughly to a 25 per cent reduction in materials use per capita by 2025. The sustainability target for developing countries is to converge toward OECD practices in the course of economic growth.

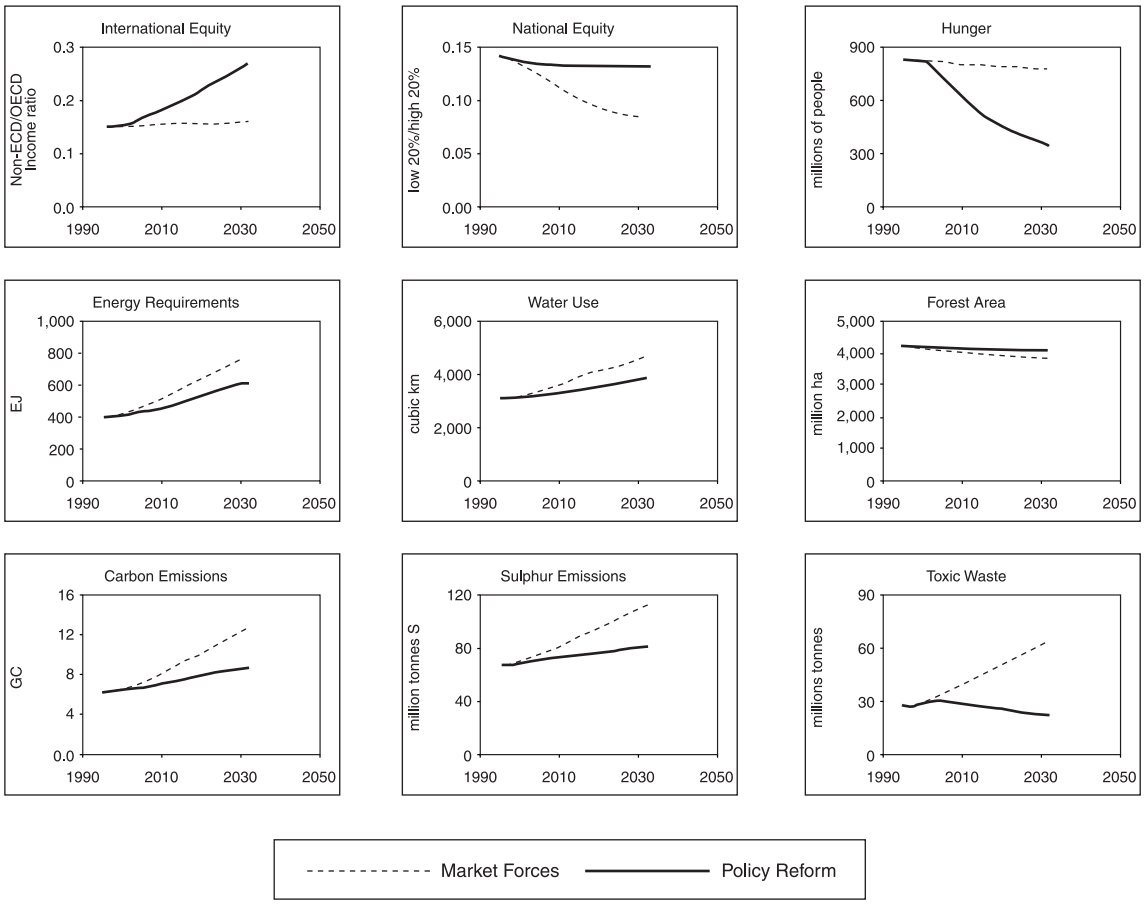
Similar provisional sustainability targets are set for toxic substances - a reduction of emissions by about 50 per cent by 2032. Use and emissions of toxic substances in developing countries are far below OECD levels on a per capita basis but are rising rapidly and are likely to increase further as industrial activity intensifies. These increases begin to slow and converge toward OECD per capita levels.

Tackling the problem of sustainable freshwater use proves to be one of the more daunting challenges to the *Policy Reform* movement. A series of global water assessments show that there is no easy or quick fix in many parts of the world to the problem of providing water of sufficient quantity and adequate quality to support both human economic development and ecosystem preservation. But they do indicate that well-designed policies can gradually moderate this deepening problem. Programmes to increase water-use efficiency, reduce losses and enhance dependable resources are set in motion, along with massive efforts at institutional reform, capacity building and river basin planning, guided by the principles of transparency and participation by local stakeholders.

A centrepiece of the *Policy Reform* process is the global mobilisation to assess and preserve the planet's precious ecosystems. A constellation of policies that protect threatened areas and foster sustainable livelihoods and sustainable land-use practices effectively reduces the rates of deforestation and ecosystem loss. By 2032, there is clear evidence of stabilisation and ecosystem recovery. Coastal regions in developing countries, which were facing increasing pressure from urban expansion, climate change and tourist activities, are protected through well-designed management programmes. Similarly, land degradation, such as the chemical and physical erosion of agriculture land, is largely eliminated. In another area, over-fishing is curtailed, allowing the world's wild fish stocks to recover to levels that support sustainable harvests.

These social and environmental goals are achieved through a comprehensive set of initiatives to address poverty and income distribution, increase the eco-efficiency of agriculture and production systems, facilitate the deployment of renewable resources and improved end-use technologies, and improve management systems. The *Policy Reform* scenario is highlighted in **Figure 7** where global patterns are compared to the *Market Forces* scenario.

Figure 7. *Market Forces* and *Policy Reform* Compared



Detailed results for the *Market Forces* and *Policy Reform* scenarios are presented in the Annex for each GEO-3 region and six major regional groupings.

4.3 Fortress World

The turn of the new millennium was an opportunity for scholars, journalists and average citizens to reflect on the past and speculate about the future. Some found grounds for euphoria about the human prospect. Others were apprehensive. As the optimists scanned the scene, they observed a new wave of technology with the promise of vastly increasing human communications and the potential to manipulate nature at genetic and molecular levels. They foresaw the formation of a true global market and exulted in the potential for efficiency and global connectedness. Adam Smith's hidden hand, helped by the pursuit of individual wealth on a global economic playing field and supported by global governance mechanisms to reduce market barriers, could guide the transition to a new age of global affluence. And if developing country institutions could be modernised to conform to the imperatives of the new technologies and the emerging borderless economy, all would be lifted by the rising tide of global prosperity.

The sceptics looking at the same phenomena discerned more perilous possibilities. They wondered how the feckless pursuit of economic growth would be harmonised with environmental limits. They feared that market-driven global development would not engender a sense of participation in a common global society, but rather would tend to split humanity into antagonistic parts, privileged and excluded, North and South, modernist and traditionalist. They were concerned that the accelerated transition to a global economy would not give institutions time to adapt and that community cohesion and democratic participation could be the victims. Some had fundamental objections to the very values - consumerism, individualism and greed - and lifestyles that they saw as the foundation for the emergent global market culture.

In the early years of the century, it becomes clear that the worldview of the market optimists would dominate global development. The triumph is underscored by the failure of WSSD, the collapse of the climate negotiations and the general withdrawal from meaningful global engagement in environmental and social issues. The momentum for sustainable development, so promising in the 1990s, entirely fizzles. The voices for a strong *Policy Reform* response are not silent, but they are not heeded. The world grows complacent about the issues of the global environment and equity. As a matter of philosophy or convenience, the belief spreads that free markets alone are sufficient to stimulate appropriate adaptations.

Unfortunately, the optimists' dream gradually turns to nightmare. With time, the vision of market-driven global economic prosperity, modernisation, poverty reduction and environmental adaptation is revealed as a Utopian fantasy. The hope for a new age of a global society bound by a common market place and shared values is shattered. Instead, the world descends into a general crisis with economic, social and environmental aspects. In a deeper sense, it is a crisis of civilization itself. It is a terrible irony of twenty-first century history that an era, founded on the push for market liberalisation and modernisation, sets in motion forces that lead ultimately to an authoritarian and intolerant *Fortress World*.

The process of degeneration has a number of interacting elements. One critical dimension is the gradual retreat by governments from social concerns. Partly this is fostered by the spreading ideology of privatisation and individualism, which supplants the last vestiges of civic commitment. In addition, the scope for governmental action contracts with the ascendancy of global market forces. In Europe, a history of repression and liberation leads to strong resistance against the growth of authoritarian regimes. However, the pace of change and the degree of uncertainty in the global economy overwhelms even the best- intentioned of political leaders. In the borderless economy, foot-loose transitional investors make investment decisions increasingly without a commitment to a particular polity. Institutional adaptation cannot keep pace with accelerating economic and technological change. Long- cherished ideals such as democracy, transparency and participation in governance are undermined. In poorer countries, especially, the economies come increasingly under the control of transnational corporations.

Gradually, conventional forms of development aid decline and poverty rises. The aid that is offered is increasingly targeted and conditional, inclined more toward the needs

of the donors than of the recipients. As the sceptics feared, the global economy remains stratified and fails to include the billions who are economically and politically marginal. Technology dependence in poorer countries increases as the flow of new technology from the industrialised countries dries up. Not only are the poor excluded from the new economy, but also traditional livelihoods and communities erode as global markets penetrate peripheral regions, seek cheap labour and control resources. In some areas, the strength of traditional culture is able initially to mute the impact of general decay, but this gradually weakens. Absolute poverty begins to increase and the gulf between rich and poor does not close – it widens.

While the poor do not have access to resources, they do have increasing access to global media. Tantalised by images of opulence and dreams of affluence, the excluded billions grow restive. Many seek opportunity in exploding megacities, as the pace of urbanisation puts further pressure on already overextended infrastructures. Limited opportunities in cities foster the growth of organised crime. In an atmosphere of despair, illegal drugs find ready markets. Many of the poor try to immigrate to rich countries, and illegal entry rises. The stream of people on the move grows into a river of the desperate toward the wealthy areas. The affluent respond with growing xenophobia and policing of borders. The poison of social polarisation deepens. Extremists and terrorist groups find ready recruits in the ranks of the desperate, the angry and the hopeless.

Another key factor in the incipient crisis is the gradual deterioration of environmental conditions. While the environmental situation declines far more rapidly in the poorer countries than in the rich, everywhere there is increased pollution, the bite of climate change, and ecosystem degradation. Poorer countries find themselves caught in a web of demands from rich countries. Burdened by debt, countries mine their resources and serve as dumping-grounds for the toxic wastes of industrialised countries – consuming their natural capital to keep ahead of financial interest. The wealthy\ elite co-opts the environmental agreements that are still in force, and uses them as a lever for taking control of resources owned by poorer countries. Environmental stresses interact and amplify one another. In the context of increasing geo-political distrust, transboundary environmental problems lead to growing pressures. Disputes over scarce water resources feed conflict in regions with shared river basins, and the influx of transboundary pollutants limits the capacity for countries to maintain their environments. Both rain-fed and irrigated agriculture become riskier as the climate changes. Agricultural land gradually consolidates in the hands of a wealthy few. In regions where subsistence agriculture is the source of food for most of the population this is a devastating development. Environmental degradation, growing concentrations of toxic pollutants, food insecurity and emergent diseases foster a vast health crisis.

Rampant social conflict and environmental degradation are two prongs of the growing crisis. The third is economic stagnation. The enabling features needed to underpin a vibrant global economy – effective governance systems, international trust and political stability – erode. The dream of an open global economy fades, replaced by a resurgence of economic protectionism and geo-political hostility. The global economy first sputters and then contracts, a process accelerated by the bite of climate change and environmental devastation. The global crisis spins out of control.

In this atmosphere of deepening social, environmental and economic tension, violence is endemic, feeding off old ethnic, religious and nationalist fissures. Poor countries begin to fragment as civil order collapses and various forms of criminal anarchy fill the vacuum. War and environmental degradation lead to massive movements of refugees in some regions. Even some of the more prosperous nations feel the sting as infrastructure decays, technology fails and institutions weaken. As OECD economies falter and their populations age, the social programmes that were introduced in the 20th Century begin to unravel.

Alarmed by rampant migration, terrorism and disease, the affluent minority fears that they too will be engulfed. To stem the tide of collapse, the forces of order react with sufficient cohesion and strength to impose an authoritarian *Fortress World*. The wealthy flourish in protected enclaves in rich nations, and in strongholds in poor nations, as well. The fortresses form a global network with shared economic, environmental and security interests. Globalisation continues, albeit in a distorted form. However, in some regions, particularly in parts of Africa, the composition of the 'fortresses' is not stable. Rather, the power base shifts as one faction or ethnic group overpowers another.

The fortresses are bubbles of privilege amidst oceans of misery, descendants of the 'gated cities' of our own time. The majority is mired in poverty outside the fortresses, denied basic freedoms. Draconian police measures control social unrest, prevent migration and protect the environment. The elite halts barbarism at their gates and begins to enforce a kind of environmental sustainability.

4.4 Great Transitions

The first years of the new millennium witness a remarkable shift in human history. The most visible manifestation is the initiation of a process of *Policy Reform* to redirect development toward sustainability. The conviction spreads that the weakening of governance systems, begun in the late twentieth century, must be reversed. But an even more profound set of changes quietly unfolds. Gradually, people everywhere begin to embrace the idea of a 'new sustainability paradigm' that would fundamentally transcend the values and lifestyles embodied in the conventional development paradigm.

Partly this emergent worldview is stimulated by a deep concern about the future. Increasingly the global free market is seen as an environmentally and socially costly engine for economic growth. But would the *Policy Reform* approach be able to guide globalisation toward sustainability? A major uncertainty is the feasibility of deploying eco-efficient technology on the scale and at the level of complexity required to keep an expanding global economy within safe environmental limits. With the size of the global economy projected to more than double during the early decades of the century, a rapid technological transition would be required. A related concern is whether the political will for such an effort can be established and maintained without a reconsideration of the development model and a change of human values.

But the growing global movement is animated, as well, by a positive vision of a better basis for planetary culture. The new sustainable paradigm has a powerful personal and philosophical dimension that complements concern about economic growth, technological potential and political possibility. Among the affluent, disillusionment with consumerism spawns a search for more fulfilling and ethical ways of living that can provide a renewed sense of meaning and purpose to life. The values of simplicity, cooperation and community begin to displace those of consumerism, competition and individualism. Voluntary reduction in work hours frees time for study, art, hobbies, engaging in the wider community, and an incipient secondary economy.

In developing regions, and in indigenous communities in industrialised regions, a new generation of thinkers, leaders and activists join and shape the global dialogue. Many regions inherit a dual legacy of ecologically-oriented traditional societies and, of more recent origin, the ideas of visionary thinkers seeking better paths for development. What is new in the current discussion is the breadth of response to the reintroduction of these ideas. A fresh debate on the future is launched within the developing world that engages an expanding circle of stakeholders. Gradually a consensus emerges that the conventional development wisdom is both insufficient and undesirable. With the support of the rich countries, a process of social and economic renewal unleashes a spiral of positive change.

Global development is pluralistic rather than relying on a single cultural and institutional model. In some areas, traditional and local values and techniques that respect the community and the environment are revived and woven with modern technologies, services and international exchange. In what comes to be called the *Great Transitions*, the quality of life begins to improve. The re-invention of development rests on effective governance, vastly improved educational opportunity and socially- inclusive participation.

But no less important is a cultural renaissance, rooted in a pride in and respect for tradition and an appreciation of local human and natural resources. The sense of possibility and optimism spreads. Youth from all regions and cultures rediscover idealism as they join together in the project of forging a global community. The Internet is the natural medium for the new consciousness, providing a sense of immediacy and unity to a diverse and pluralistic movement.

The momentum for change grows. A global federation of diverse constituencies forms to advance the alternative agenda. Policy networks address pressing issues of public health, environment, social equity and corporate responsibility. Measures of development success increasingly focus on equity, sustainability and the quality of life, rather than the discredited metric of economic growth. Natural resources are increasingly regarded as a kind of capital from which societies can draw but must maintain in perpetuity. International standards for national accounts are changed to include natural resource accounts in a more inclusive ‘green’ measure of GNP. Gradually, the new sustainability paradigm finds expression in a growing number of communities that opt for alternative economic practices and lifestyles that become simpler materially and richer qualitatively. The old obsession with things gives way to intellectual and artistic pursuits. Forward-looking corporations advocate a new business

ethic based on meeting human needs instead of multiplying human wants. Meanwhile, an explosion of technological innovation responds to the new demand for sustainability and efficiency. Eventually, politicians that are responsive to the ferment for a new sustainability paradigm enter government, and the process of change accelerates.

A new metropolitan vision begins to reorganise urban life built around integrated settlement patterns that place home, work, commerce and leisure activity in closer proximity. The inertia of existing urban infrastructure hinders the rapid fulfilment of the vision, but by 2032 the outlines of new metropolitan forms are taking shape. Some of the earliest examples are in the more affluent developing countries, where increasingly unmanageable 'megacities' spurs the search for alternative modes of urban development. For many, the town-within-the-city provides the ideal balance of a human scale with cosmopolitan cultural intensity. Others find dispersed small towns attractive as communication and information technology increasingly allow for the decentralisation of activities, an approach strongly promoted in Asia. With attractive urban and rural alternatives, the lure of the 'mall culture' begins to fade in more affluent and suburbanised regions. The new metropolitan vision provides an alternative to sprawling megacities and begins to wed the virtues of urbanisation and community. In the new sustainability paradigm, markets remain critical for achieving efficiency in the production and allocation of goods. But well-designed policies constrain the level and structure of economic activity to be compatible with social, cultural and environmental goals. A variety of mechanisms enforce these principles, including regulation, international negotiation and market signals such as revised tax systems that discourage the production of environmental 'bads' and reward restorative practices. Environmental, economic and social indicators track real progress at all scales – business, regional, national and global – giving the public an informed basis for seeking change.

Environmental protection is accelerated by dramatically reducing material flows through the economy. Three primary factors drive dematerialisation: rapid stabilisation of population levels, universal adoption of an ethos of material sufficiency to displace consumerism, and a swift transition to renewable resources and clean technology. With the active engagement of an immense network of digitally linked NGOs and local groups, information technology is used for real-time monitoring of sensitive environments and to alert the world community of environmental transgressions and threats. Information-intensive and ecologically-oriented monitoring methods are referenced to carrying capacities limits and critical thresholds of ecosystems. The 'precautionary approach' is the guiding test for human activity, and proactive measures, rather than end-of-pipe technologies, becomes the norm.

While the material economy stabilises, development flourishes in the non-material realms of services, culture, art, sports and research. At the same time, a labour-intensive craft economy rises spontaneously on the platform of the high technology base, providing a rewarding outlet for creative expression and a dizzying diversity of highly aesthetic goods and services. The demand for environmentally- friendly and regionally- grown food products begins to transform the agro-industry model of high chemical inputs, vertical integration and monoculture. Experimentation with high-yield forms of eco-farming that are knowledge-intensive and ecologically complex stimulates

diverse bio-regional solutions, attracts a new generation of sophisticated farmers and helps transform local economies.

Governance evolves toward a nested system in which regions and communities have considerable control over socio-economic decisions and approaches to environmental preservation. Indeed, there is tremendous variation in development patterns and choices. But each level must conform to standards imposed by governance of larger-scale environmental and political systems. For example, local energy systems vary greatly, but must meet guidelines for greenhouse gas emissions that are negotiated through global-level agreements. Similarly, local water strategies must be compatible with allocation rules and ecosystem goals set at the river basin level.

Global governance relies on a rejuvenated and re-organised United Nations to express the politics of diversity-through-global-unity of the new sustainability paradigm. A New International Deal redistributes wealth and assures strong environmental protection. A mobilisation for education, economic opportunity and poverty reduction leads to a rapid demographic transition and stabilisation of populations everywhere. Borders become more porous as international disparities are reduced. In Europe the arrival of new immigrants softens the economic impact of an ageing population. In some regions, such as in Africa, the opening of borders permits some pastoral and nomadic groups to return to traditional methods of production. Spending on armaments is decreased drastically and a massive peace dividend is used to help restore ecosystems and further reduce poverty.

In 2032, pockets of poverty remain, geopolitical conflicts occasionally flare up and residual environmental and resource stresses require concerted attention. But the world community looks back over the previous decades with justifiable pride on the immense achievements in human development, global solidarity and ecological resilience. An engaged citizenry looks forward to the future and the challenge of forging a sustainable civilization of unprecedented creativity, freedom and sense of shared destiny.

5 Discussion

The *Market Forces* scenario would be a risky and imprudent path to an environmentally sustainable future. The increasing pressure on environmental systems – the combined effects of growth in the number of people, the scale of the economy and the throughput of natural resources – would be partially offset by price-induced improvements in technological efficiency and greater penetration of renewable resources. But to believe that such automatic responses would be of sufficient scale and rapidity is more a matter of faith than demonstrable analysis. There is no insurance certainty that this path for global development would not compromise the environmental endowment of future generations. Rather, the scenario would flirt with major ecosystem changes and unwelcome surprises. Indeed, environmental feedbacks could undermine the globally- integrated economic growth that is a fundamental postulate of the scenario.

The scenario also fails to ensure the social goals for sustainability. The number of people in absolute poverty is likely to persist in the scenario. This is because population expansion and skewed income distributions combine to negate the poverty-reducing effect of growth in average income that is assumed for all countries. Enduring social and economic inequities, environment stress and cultural change induced by global communications media would be a volatile mix. The desire of the desperate to migrate to rich areas would grow stronger, as would the resistance to such migration. The scenario offers no compelling basis for concluding that it would meet the ethical imperative to sharply reduce human deprivation. More likely, the link between human desperation and environmental stress would continue.

Economic and social polarization could compromise social cohesion and make liberal democratic institutions more fragile. Resource and environmental pressures would magnify domestic and international tensions: conflict over water, regional concentration of petroleum supplies, scarcity of land, climate change impacts, biodiversity loss. Inter-regional inequity also could aggravate geopolitical tensions.

The *Policy Reform* scenario shows that these perils are not inevitable. Technologies and policy instruments are available for redirecting development towards sustainability goals. But meeting these goals in the context of market-driven and growth-oriented development poses daunting challenges. Nevertheless, sustained policy-driven adjustments in social, technological and resource-use patterns can become cumulatively significant over the coming decades. But a critical uncertainty in the *Policy Reform* path to sustainability remains: can sufficient political will be mobilized for such a sustained effort?

Market Forces relies on market adaptations to resolve problems. *Policy Reform* adds an array of policy adjustments. But what if an expanding web of ecological and social stresses overwhelms the capacity of both markets and policy to cope? Then the

institutional and moral bases of modern civilization could erode and the global development trajectory could veer toward conflict and chaos. The *Fortress World* scenario tells of these cascading and de-stabilizing possibilities. If environmental degradation and social frictions are allowed to fester, the path of history could tilt toward xenophobia, conflict and authoritarianism.

Such dark futures are possible, but certainly not inevitable. But fundamental changes in values and lifestyles – in the very model of development – may need to complement policy responses in the transition to sustainability. The *Great Transitions* scenario envisages the gradual emergence of a caring civilization based on the values of respect for the community of life, equity within and between generations and social solidarity.

Elements of all these scenarios are observable in today's world while various trends and drivers could prove to be precursors to the alternative development visions. Which of them – or which mixture - becomes dominant is a matter of contingency and choice. It is the implication for human choice that most concerns us here. A scan of the possible can guide the practical business of formulating appropriate responses for seizing opportunities and avoiding perils. The global perspective has given us a big-picture view of alternative futures and environmental conditions. It provides a backdrop for more detailed examination of the environmental outlook at regional scales.

Abbreviations

CO_2	carbon dioxide
EC	European Community
FROG	First Raise Our Growth
GDP	Gross Domestic Product
GEO	Global Ecosystem Organization
GEO	Global Environment Outlook
GNP	Gross National Product
GSG	Global Scenario Group
ILO	International Labour Organization
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
NGO	Non governmental
OECD	Organization for Economic Cooperation and Development
ppmv	parts per million volume
SRES	Special Report on Emissions Scenarios
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WBCSD	World Business Council on Sustainable Development
WCED	World Commission on Environment and Development
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization

References

Gallopin, G. A. Hammond, P. Raskin and R. Swart. (1997). *Branch Points: Global Scenarios and Human Choice*. Stockholm: Stockholm Environment Institute. SEI PoleStar Series Report No. 7. (Available from the Internet at http://www.gsg.org)

Kemp-Benedict, E., C. Heaps and P. Raskin. (2002). *Global Scenario Group Futures: Technical Notes*. Boston: Stockholm Environment Institute-Boston. SEI PoleStar Series Report No. 9 (revised). (Available from the Internet at http://www.gsg.org)

Raskin, P., T. Banuri, G. Gallopin, P. Gutman, A. Hammond, R. Kates and R. Swart. (2002). Great Transition: *The Promise and Lure of the Times Ahead*. Stockholm Environment Institute. SEI PoleStar Series Report No. 10. (Available from the Internet at http://www.gsg.org)

Raskin, P., G. Gallopin, P. Gutman, A. Hammond and R. Swart. (1998). *Bending the Curve: Toward Global Sustainability*. Stockholm, Sweden: Stockholm Environment Institute (PoleStar Series Report No. 7) and Nairobi, Kenya: UNEP. (Available from the Internet at http://www.gsg.org)

Robinson, J. and J. Tinker. (1996). *Reconciling Ecological, Economic and Social Imperatives: Towards an Analytic Framework*. Vancouver: Sustainable Development Research Institute, University of British Columbia.

SRES (Special Report on Emission Scenarios). (2000). *Summary For Policymakers. Working Group III of the Intergovernmental Panel on Climate Change*. (Available from the Internet at http://www.ipcc.ch/pub/SPM_SRES.pdf)

WBCSD (World Business Council for Sustainable Development). (1997). *Exploring Sustainable Development*. Summary Brochure. Geneva.

WCED (World Commission on Environment and Development). (1987). *Our Common Future*. Oxford: Oxford University Press.

Annex 1: Illustrative Scenarios:

Global and Regional Patterns

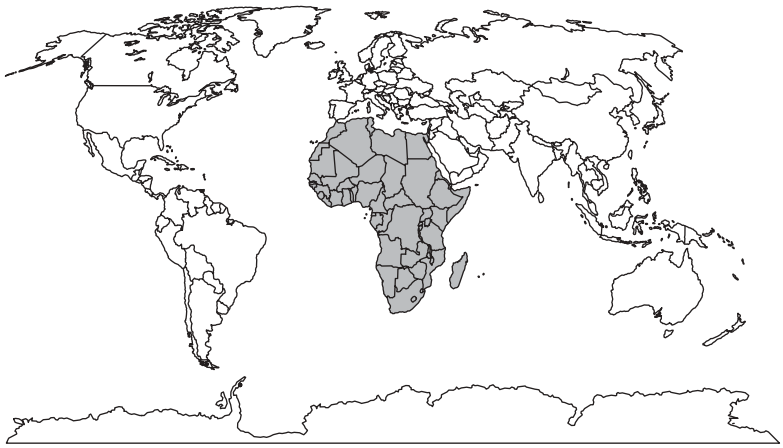
Quantitative representations of the *Market Forces* and *Policy Reform* scenarios are presented in this Annex for:

- 6 UNEP regions
- 21 UNEP subregions
- World

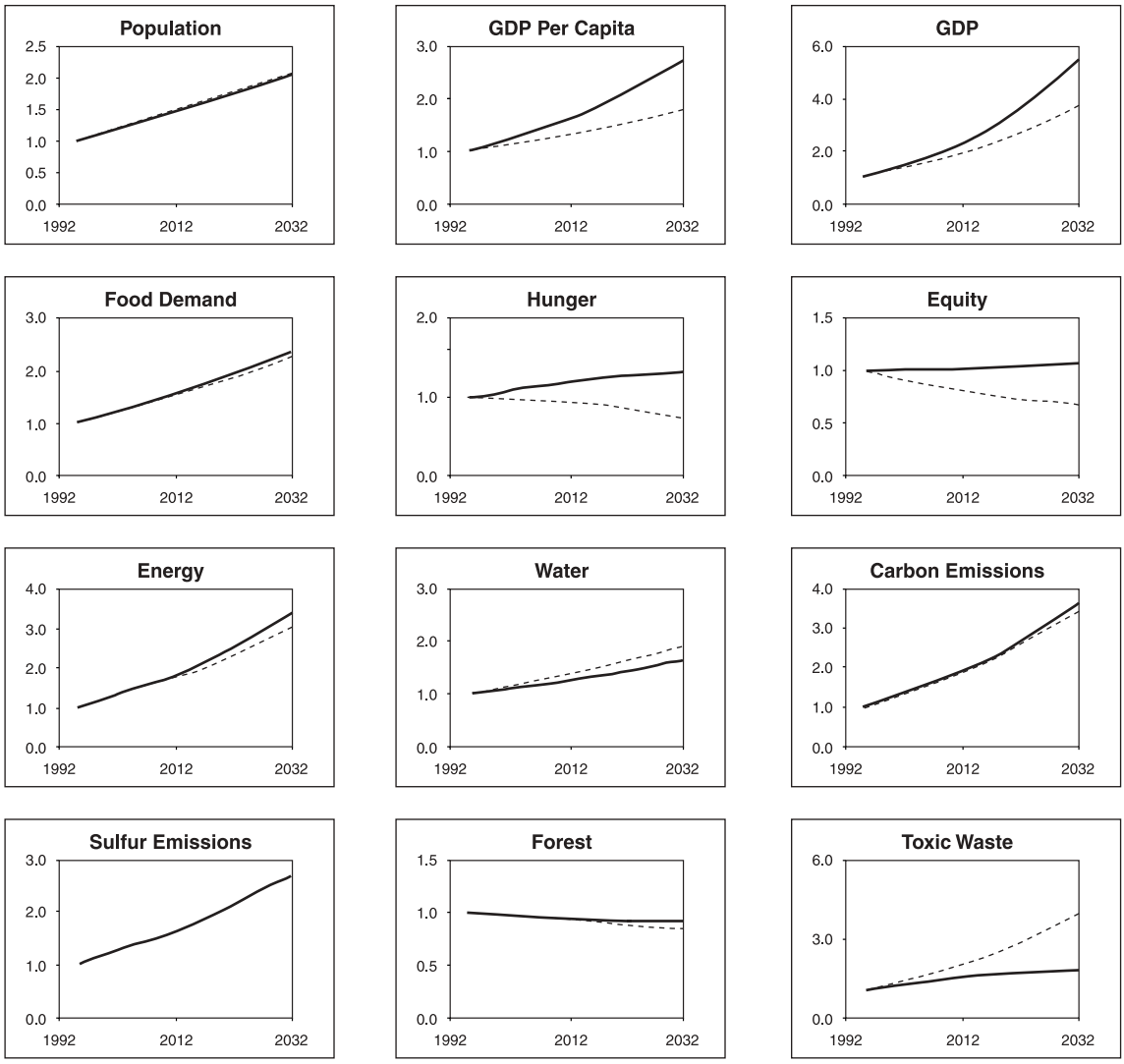
For each, a graphical overview is presented of key indicators followed by more detailed numerical summaries.

This is followed by a *Notes* section that discusses major data sources and assumptions for the scenarios.

Africa



AFRICA



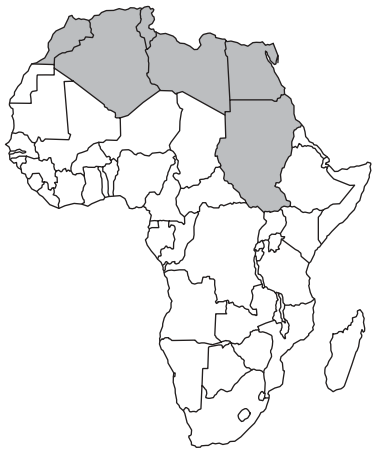
Note: Values indexed to 1 in 1995

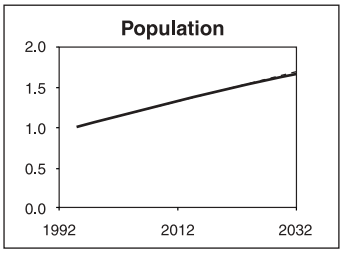
Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	697	1 078	1 063	1 447	1 406
Urbanization (%)	34	47	47	57	57
Economy and Society					
GDP (Billion US$ PPP)	1 376	2 927	3 609	5 170	7 542
Agriculture (%)	21	16	13	12	8
Industry (%)	31	29	29	29	28
Services (%)	48	56	59	60	64
GDP per capita (1995 US$ PPP)	1 974	2 716	3 394	3 574	5 366
Hunger Incidence (% of population)	28	22	17	17	10
National Equity (L20%/H20%)	0.11	0.09	0.12	0.08	0.12
Energy					
Primary Energy Requirement (EJ)	15.9	30.2	31.7	48.8	54.8
Coal	2.7	4.6	4.5	7.0	6.8
Petroleum	4.6	9.3	9.1	15.7	15.0
Natural Gas	1.7	4.8	5.8	9.2	13.3
Uranium	0.1	0.5	0.0	1.2	0.0
Hydropower	0.2	0.3	0.3	0.4	0.5
Renewables	6.6	10.8	11.9	15.3	19.2
Primary Energy Intensity (MJ/$PPP)	12	10	9	9	7
Final Fuel Demand (EJ)	12.4	22.7	24.8	35.9	42.6
Agriculture	0.4	0.6	0.6	0.8	0.7
Households	6.9	11.4	11.7	16.2	17.2
Industry	2.9	6.0	7.1	10.1	13.4
Services	0.3	0.7	0.9	1.3	2.0
Transport	1.9	4.2	4.7	7.5	9.3
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 366	2 481	2 583	2 572	2 738
Share from Animal Products (%)	7	8	8	9	10
Meat and Milk Production (Mt)	34	59	65	85	99
Fraction of Meat from Feedlots (%)	5	9	13	11	18
Fish Production (Mt)	6	9	9	12	11
Crop Production (Mt)	343	572	594	802	773
Total Cropland (Mha)	195	223	232	241	234
Irrigated Cropland (Mha)	12	14	14	16	15
Potential Cultivable Land (Mha)	1 065	1 031	1 039	1 000	1 026
Cereal Harvest Yield (t/ha)	1.09	1.76	1.75	2.26	2.26
Meat and Milk SSR	0.84	0.80	0.78	0.75	0.73
Fish SSR	0.82	0.89	0.89	0.86	0.86
Crop SSR	0.83	0.84	0.82	0.85	0.76
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	151	217	199	289	247
Agriculture (%)	86	79	75	73	68
Industry (%)	6	10	9	13	10
Domestic (%)	9	11	16	14	22
Water Use/Resource Ratio (%)	3	4	4	5	5
Population in Water Stress (million)	188	305	291	428	406
Air					
Carbon Emissions (MtC)	170	350	354	585	616
Sulfur Emissions (MtS)	2.2	3.9	3.9	5.9	6.1
Land and Forest					
Total Land Area (Mha)	2 937	2 937	2 937	2 937	2 937
Built Environment (%)	2	2	2	3	3
Cropland (%)	7	8	8	8	8
Grazing (%)	30	30	30	31	31
Natural Forest (%)	24	22	22	20	22
Plantation (%)	0	0	0	1	1
Other (%)	38	37	37	37	36
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	4	10	8	15	10
Municipal Solid Waste Generation (Mt)	61	135	138	230	241
Recycled Share (%)	5	5	7	6	10
Toxic Waste (Mt)	0.8	1.8	1.4	3.3	1.5

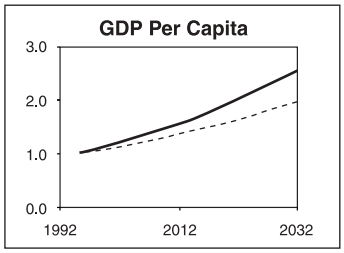
t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

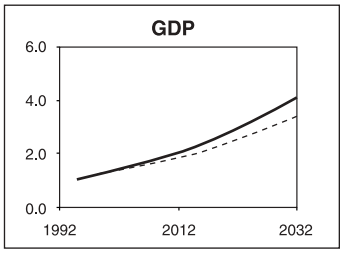
Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

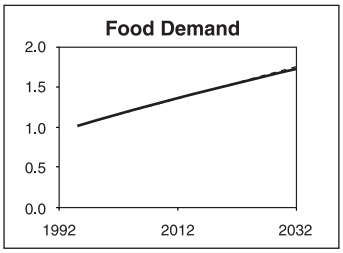
Northern Africa

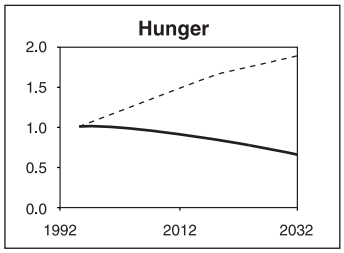


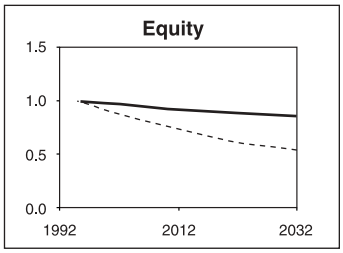


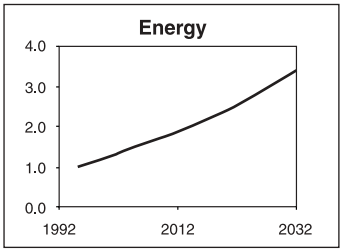


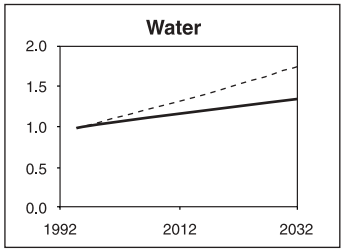


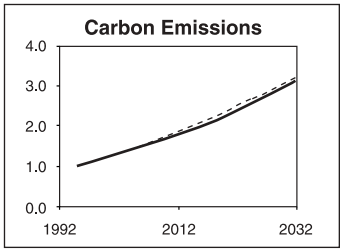


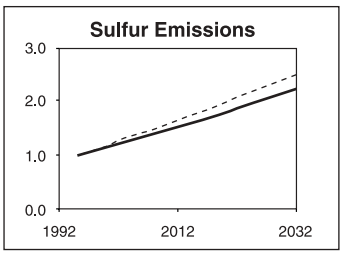


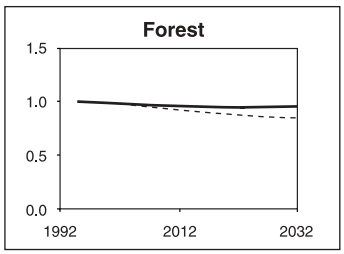


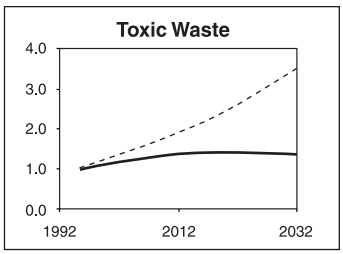


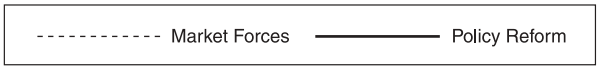












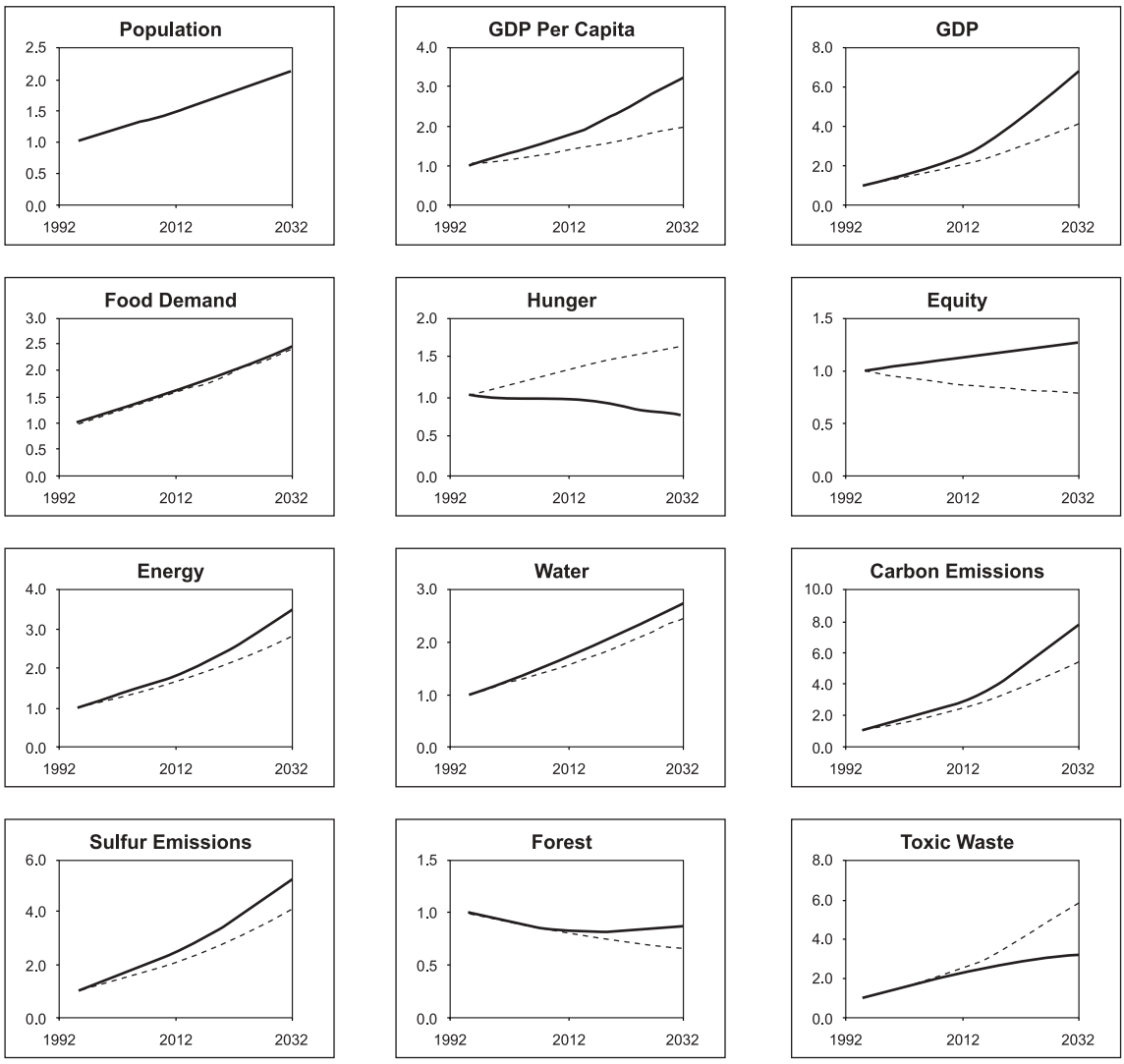
Note: Values indexed to 1 in 1995

Northern Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	157	220	217	267	259
Urbanization (%)	46	58	58	66	66
Economy and Society					
GDP (Billion US$ PPP)	575	1 166	1 319	1 932	2 389
Agriculture (%)	16	11	9	8	6
Industry (%)	31	28	28	27	27
Services (%)	53	62	63	65	67
GDP per capita (1995 US$ PPP)	3 662	5 293	6 073	7 244	9 220
Hunger Incidence (% of population)	7	8	4	7	3
National Equity (L20%/H20%)	0.18	0.12	0.16	0.10	0.15
Energy					
Primary Energy Requirement (EJ)	4.4	9.0	8.8	14.5	14.6
Coal	0.1	0.2	0.2	0.3	0.3
Petroleum	2.4	4.6	4.2	6.8	5.9
Natural Gas	1.5	3.6	3.7	6.3	6.9
Uranium	0.0	0.1	0.0	0.4	0.0
Hydropower	0.0	0.0	0.0	0.0	0.0
Renewables	0.3	0.4	0.6	0.6	1.4
Primary Energy Intensity (MJ/$PPP)	8	8	7	7	6
Final Fuel Demand (EJ)	2.8	5.6	6.0	9.0	10.0
Agriculture	0.0	0.1	0.0	0.1	0.1
Households	1.0	1.8	2.0	2.7	3.0
Industry	1.0	2.2	2.4	3.6	4.1
Services	0.0	0.1	0.2	0.3	0.4
Transport	0.7	1.4	1.4	2.4	2.4
Food and Agriculture					
Average Daily Consumption (kcal/cap)	3 032	3 098	3 120	3 146	3 178
Share from Animal Products (%)	9	10	11	11	12
Meat and Milk Production (Mt)	14	21	22	28	29
Fraction of Meat from Feedlots (%)	9	11	11	12	13
Fish Production (Mt)	1	3	3	3	3
Crop Production (Mt)	81	119	118	156	154
Total Cropland (Mha)	43	44	43	44	43
Irrigated Cropland (Mha)	8	9	9	10	10
Potential Cultivable Land (Mha)	128	123	124	118	122
Cereal Harvest Yield (t/ha)	1.35	1.91	1.92	2.37	2.38
Meat and Milk SSR	0.82	0.78	0.77	0.75	0.75
Fish SSR	1.06	1.44	1.44	1.42	1.41
Crop SSR	0.60	0.61	0.61	0.65	0.66
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	96	131	115	167	128
Agriculture (%)	87	82	84	79	84
Industry (%)	6	9	7	12	7
Domestic (%)	7	8	9	10	9
Water Use/Resource Ratio (%)	33	45	40	58	44
Population in Water Stress (million)	112	175	163	224	199
Air					
Carbon Emissions (MtC)	69	141	136	222	214
Sulfur Emissions (MtS)	0.6	1.1	1.0	1.6	1.4
Land and Forest					
Total Land Area (Mha)	811	811	811	811	811
Built Environment (%)	1	2	2	2	2
Cropland (%)	5	5	5	5	5
Grazing (%)	22	22	22	22	22
Natural Forest (%)	7	6	6	5	6
Plantation (%)	0	0	0	0	0
Other (%)	65	64	64	65	64
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	2	3	3	4	3
Municipal Solid Waste Generation (Mt)	18	35	36	53	56
Recycled Share (%)	13	13	15	14	20
Toxic Waste (Mt)	0.4	0.8	0.5	1.3	0.5

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Western Africa



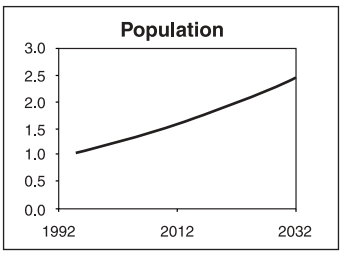
Note: Values indexed to 1 in 1995

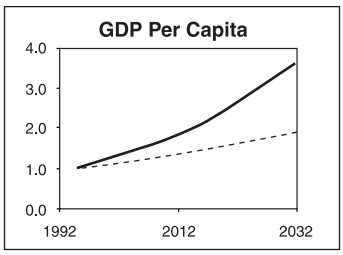
Western Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	196	315	310	428	416
Urbanization (%)	35	51	51	63	63
Economy and Society					
GDP (Billion US$ PPP)	271	620	811	1 143	1 836
Agriculture (%)	32	23	17	17	10
Industry (%)	38	37	37	36	36
Services (%)	30	41	46	47	54
GDP per capita (1995 US$ PPP)	1 385	1 970	2 614	2 671	4 416
Hunger Incidence (% of population)	16	14	9	12	6
National Equity (L20%/H20%)	0.9	0.07	0.10	0.07	0.11
Energy					
Primary Energy Requirement (EJ)	4.0	7.1	7.9	11.2	14.0
Coal	0.0	0.1	0.0	0.2	0.0
Petroleum	0.8	1.3	1.5	2.2	2.8
Natural Gas	0.2	0.7	1.1	1.5	3.4
Uranium	0.0	0.0	0.0	0.1	0.0
Hydropower	0.0	0.1	0.1	0.1	0.1
Renewables	3.0	5.0	5.2	7.1	7.6
Primary Energy Intensity (MJ/$PPP)	15	12	10	10	8
Final Fuel Demand (EJ)	3.5	6.3	6.8	9.5	11.3
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	2.8	4.5	4.6	6.3	6.4
Industry	0.5	1.0	1.3	1.8	2.8
Services	0.0	0.1	0.1	0.2	0.4
Transport	0.3	0.7	0.8	1.2	1.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 515	2 646	2 741	2 748	2 893
Share from Animal Products (%)	4	5	5	5	7
Meat and Milk Production (Mt)	4	8	9	12	15
Fraction of Meat from Feedlots (%)	4	7	12	8	16
Fish Production (Mt)	2	2	2	3	3
Crop Production (Mt)	111	190	189	248	216
Total Cropland (Mha)	65	72	73	73	64
Irrigated Cropland (Mha)	1	1	1	1	1
Potential Cultivable Land (Mha)	200	189	191	178	187
Cereal Harvest Yield (t/ha)	0.93	1.57	1.56	2.03	2.04
Meat and Milk SSR	0.71	0.67	0.66	0.64	0.63
Fish SSR	0.82	0.77	0.77	0.75	0.75
Crop SSR	0.87	0.88	0.83	0.81	0.66
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	11	19	21	28	31
Agriculture (%)	76	63	45	54	35
Industry (%)	6	13	12	17	16
Domestic (%)	17	23	43	28	49
Water Use/Resource Ratio (%)	1	1	2	2	2
Population in Water Stress (million)	0	2	2	5	5
Air					
Carbon Emissions (MtC)	12	33	41	65	95
Sulfur Emissions (MtS)	0.2	0.4	0.5	0.7	0.9
Land and Forest					
Total Land Area (Mha)	606	606	606	606	606
Built Environment (%)	2	3	3	5	4
Cropland (%)	11	12	12	12	11
Grazing (%)	28	28	28	28	28
Natural Forest (%)	15	11	12	9	12
Plantation (%)	0	1	0	1	1
Other (%)	44	45	44	45	44
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	3	2	4	3
Municipal Solid Waste Generation (Mt)	18	42	43	74	77
Recycled Share (%)	2	3	4	3	7
Toxic Waste (Mt)	0.1	0.3	0.3	0.7	0.4

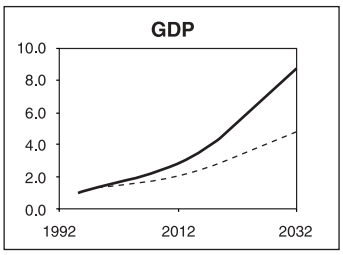
t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

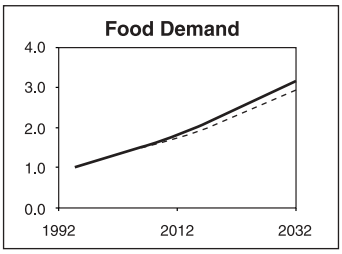
Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

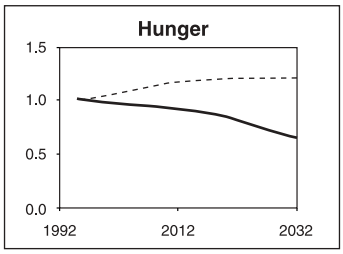
Central Africa

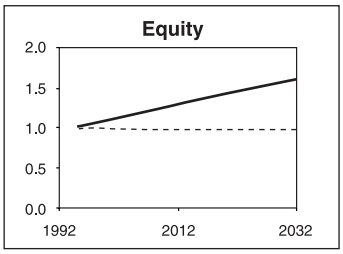


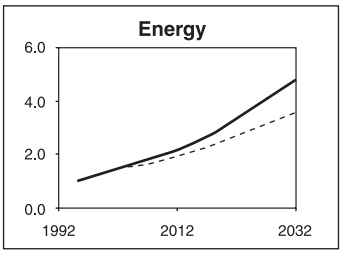


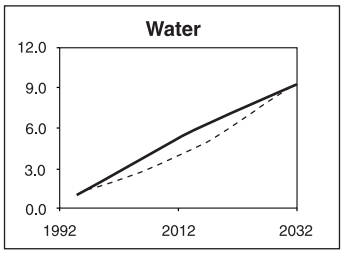


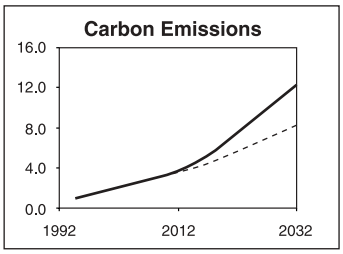


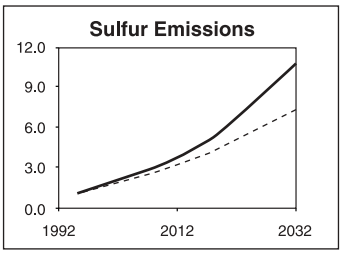


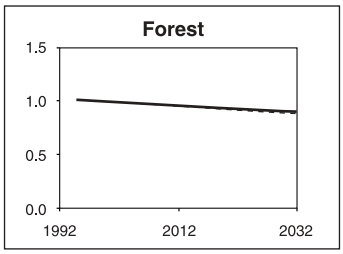


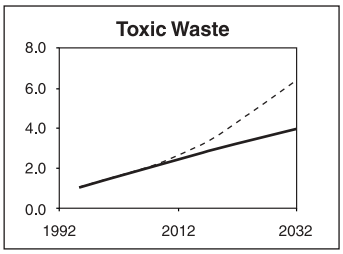


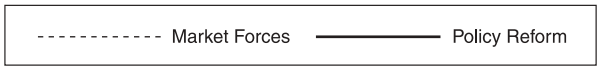












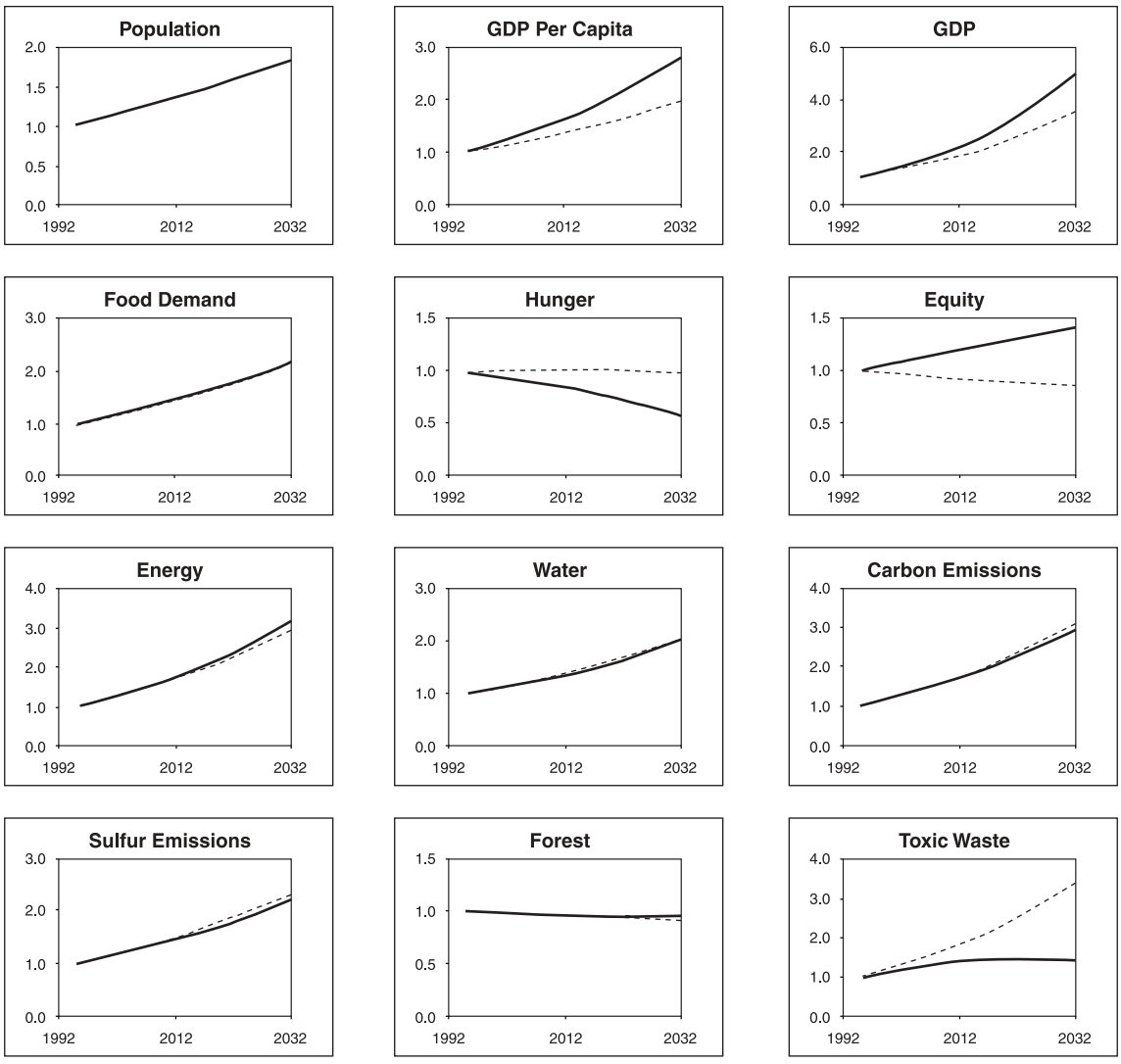
Note: Values indexed to 1 in 1995

Central Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	73	125	123	184	179
Urbanization (%)	33	47	47	57	57
Economy and Society					
GDP (Billion US$ PPP)	66	160	226	318	587
Agriculture (%)	33	24	17	18	10
Industry (%)	28	28	28	28	28
Services (%)	39	48	55	54	62
GDP per capita (1995 US$ PPP)	911	1 284	1 838	1 731	3 282
Hunger Incidence (% of population)	48	33	25	23	13
National Equity (L20%/H20%)	0.06	0.06	0.08	0.06	0.10
Energy					
Primary Energy Requirement (EJ)	0.9	1.9	2.2	3.2	4.3
Coal	0.0	0.0	0.0	0.1	0.0
Petroleum	0.1	0.4	0.5	0.8	1.4
Natural Gas	0.0	0.1	0.1	0.2	0.4
Uranium	0.0	0.0	0.0	0.0	0.0
Hydropower	0.0	0.0	0.0	0.0	0.1
Renewables	0.7	1.3	1.5	2.0	2.5
Primary Energy Intensity (MJ/$PPP)	13	12	10	10	7
Final Fuel Demand (EJ)	0.9	1.7	1.9	2.8	3.8
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	0.6	1.1	1.1	1.7	1.8
Industry	0.2	0.4	0.5	0.8	1.2
Services	0.0	0.0	0.0	0.0	0.0
Transport	0.1	0.2	0.3	0.4	0.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	1 914	2 083	2 236	2 225	2 475
Share from Animal Products (%)	3	4	5	4	6
Meat and Milk Production (Mt)	1	2	2	3	4
Fraction of Meat from Feedlots (%)	1	7	20	10	30
Fish Production (Mt)	0	1	1	1	1
Crop Production (Mt)	28	53	59	85	93
Total Cropland (Mha)	21	27	31	35	38
Irrigated Cropland (Mha)	0	0	0	0	0
Potential Cultivable Land (Mha)	312	308	309	303	306
Cereal Harvest Yield (t/ha)	0.86	1.45	1.45	1.87	1.88
Meat and Milk SSR	0.80	0.67	0.64	0.60	0.55
Fish SSR	0.66	0.59	0.59	0.55	0.55
Crop SSR	0.98	0.95	0.90	0.95	0.80
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	1	5	7	11	11
Agriculture (%)	38	11	7	7	4
Industry (%)	16	66	45	72	35
Domestic (%)	46	23	48	21	61
Water Use/Resource Ratio (%)	0	0	0	0	0
Population in Water Stress (million)	0	0	0	0	0
Air					
Carbon Emissions (MtC)	3	10	12	21	32
Sulfur Emissions (MtS)	0.0	0.1	0.1	0.2	0.3
Land and Forest					
Total Land Area (Mha)	524	524	524	524	524
Built Environment (%)	1	2	2	2	2
Cropland (%)	4	5	6	7	7
Grazing (%)	15	17	17	18	18
Natural Forest (%)	62	58	59	55	56
Plantation (%)	0	0	0	0	0
Other (%)	18	18	16	18	16
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	0	0	1	1
Municipal Solid Waste Generation (Mt)	6	15	15	28	29
Recycled Share (%)	2	2	3	3	6
Toxic Waste (Mt)	0.0	0.1	0.1	0.2	0.1

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Southern Africa



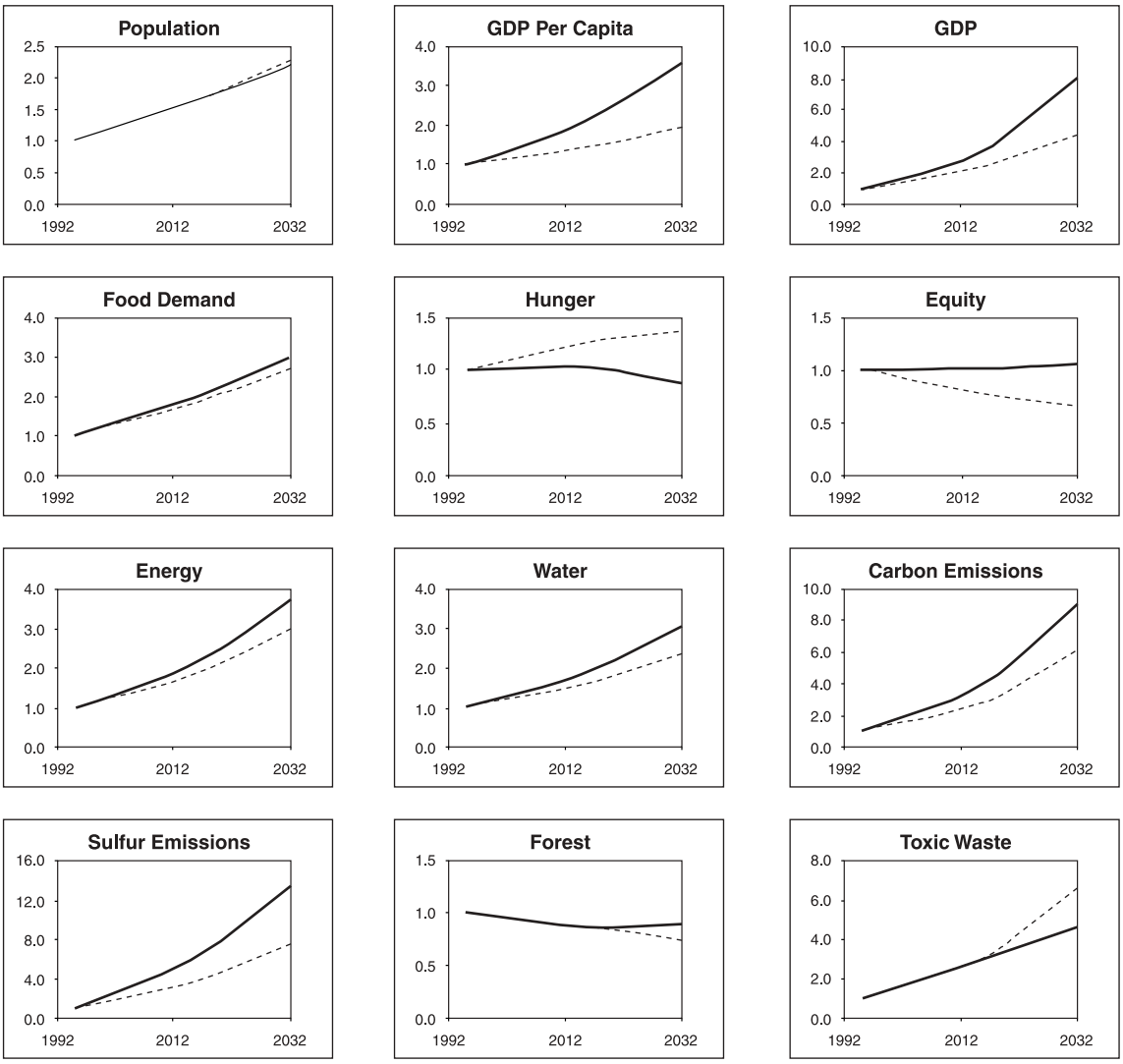
Note: Values indexed to 1 in 1995

Southern Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	130	186	184	244	237
Urbanization (%)	35	49	49	60	60
Economy and Society					
GDP (Billion US$ PPP)	325	655	799	1 160	1 640
Agriculture (%)	12	9	8	7	5
Industry (%)	31	30	30	29	29
Services (%)	56	61	63	64	66
GDP per capita (1995 US$ PPP)	2 491	3 522	4 353	4 755	6 918
Hunger Incidence (% of population)	39	28	23	21	13
National Equity (L20%/H20%)	0.08	0.07	0.09	0.07	0.11
Energy					
Primary Energy Requirement (EJ)	5.6	10.2	10.4	16.5	17.6
Coal	2.6	4.3	4.3	6.3	6.4
Petroleum	1.2	2.7	2.3	5.1	3.6
Natural Gas	0.0	0.3	0.8	1.0	2.4
Uranium	0.1	0.3	0.0	0.5	0.0
Hydropower	0.0	0.1	0.1	0.2	0.3
Renewables	1.6	2.4	2.9	3.4	5.0
Primary Energy Intensity (MJ/$PPP)	17	16	13	14	11
Final Fuel Demand (EJ)	4.0	7.2	7.9	11.5	13.6
Agriculture	0.3	0.4	0.4	0.5	0.5
Households	1.6	2.4	2.5	3.3	3.5
Industry	1.2	2.3	2.6	3.8	4.7
Services	0.2	0.4	0.5	0.8	1.1
Transport	0.8	1.7	1.9	3.1	3.8
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 180	2 337	2 428	2 464	2 609
Share from Animal Products (%)	9	10	10	11	12
Meat and Milk Production (Mt)	7	12	13	18	20
Fraction of Meat from Feedlots (%)	7	12	14	15	19
Fish Production (Mt)	1	2	2	3	3
Crop Production (Mt)	67	106	117	155	160
Total Cropland (Mha)	38	43	46	47	48
Irrigated Cropland (Mha)	2	2	2	2	2
Potential Cultivable Land (Mha)	320	314	316	308	313
Cereal Harvest Yield (t/ha)	1.12	1.81	1.80	2.33	2.34
Meat and Milk SSR	0.93	0.92	0.91	0.88	0.86
Fish SSR	0.65	0.63	0.63	0.61	0.61
Crop SSR	0.95	0.95	1.01	1.01	0.99
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	20	30	28	41	41
Agriculture (%)	77	72	66	66	59
Industry (%)	7	9	9	11	13
Domestic (%)	16	19	24	23	28
Water Use/Resource Ratio (%)	3	4	4	5	5
Population in Water Stress (million)	19	27	24	47	46
Air					
Carbon Emissions (MtC)	83	156	153	257	246
Sulfur Emissions (MtS)	1.3	2.2	2.1	3.1	3.0
Land and Forest					
Total Land Area (Mha)	680	680	680	680	680
Built Environment (%)	1	2	2	2	2
Cropland (%)	6	6	7	7	7
Grazing (%)	49	49	49	49	49
Natural Forest (%)	24	23	23	21	22
Plantation (%)	0	1	1	1	2
Other (%)	20	20	19	19	18
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	1	2	2	3	2
Municipal Solid Waste Generation (Mt)	12	24	25	41	44
Recycled Share (%)	2	3	5	4	10
Toxic Waste (Mt)	0.3	0.5	0.4	0.9	0.4

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Eastern Africa



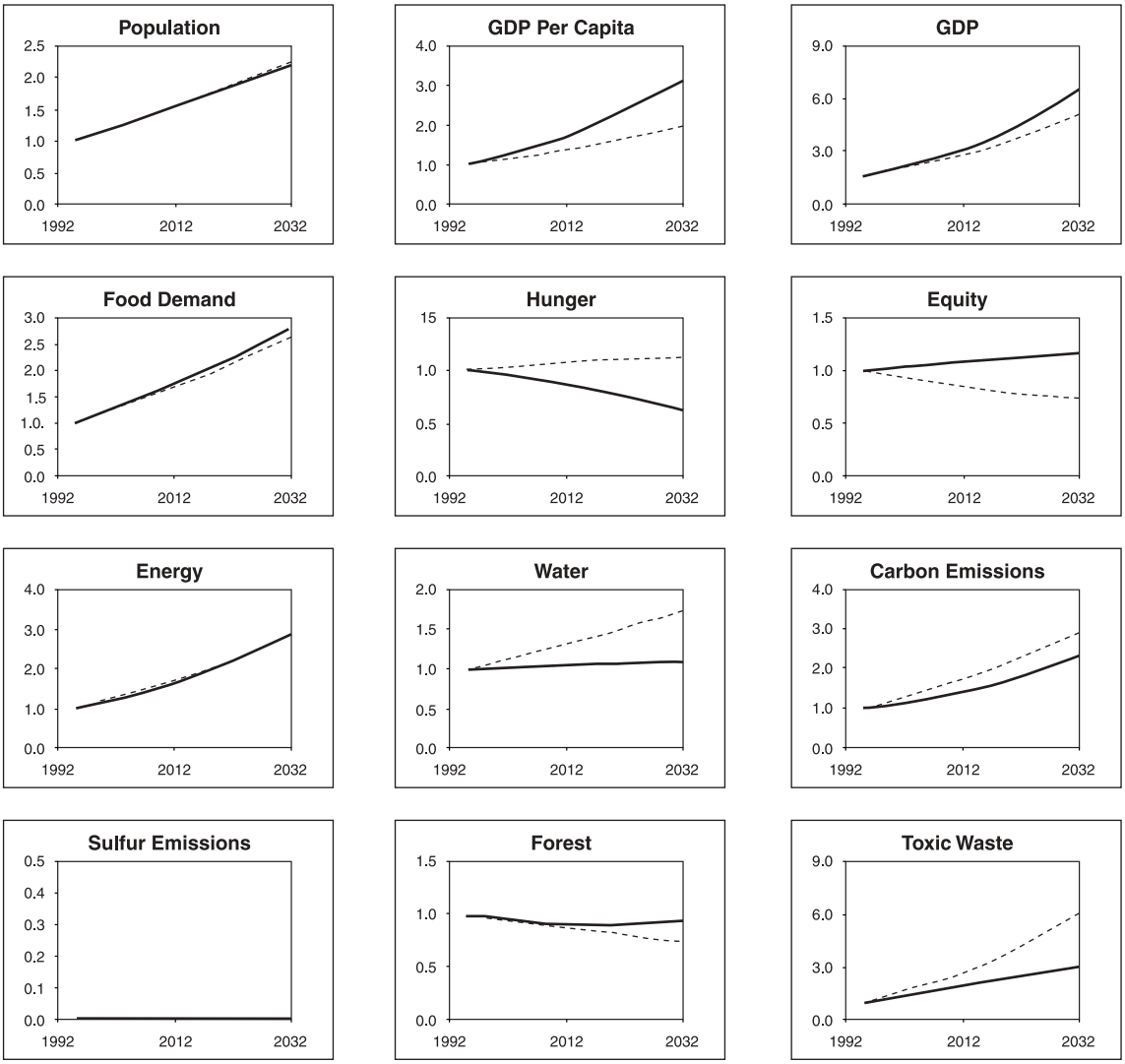
Note: Values indexed to 1 in 1995

Eastern Africa	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	125	206	203	288	280
Urbanization (%)	17	28	28	36	36
Economy and Society					
GDP (Billion US$ PPP)	112	263	371	499	908
Agriculture (%)	44	31	22	23	12
Industry (%)	14	15	15	15	16
Services (%)	42	55	63	62	72
GDP per capita (1995 US$ PPP)	898	1 278	1 829	1 734	3 246
Hunger Incidence (% of population)	47	36	30	28	19
National Equity (L20%/H20%)	0.13	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	1.1	2.1	2.3	3.4	4.3
Coal	0.0	0.0	0.0	0.1	0.0
Petroleum	0.2	0.4	0.6	0.8	1.3
Natural Gas	0.0	0.0	0.0	0.2	0.2
Uranium	0.0	0.0	0.0	0.0	0.0
Hydropower	0.0	0.0	0.0	0.0	0.0
Renewables	0.9	1.6	1.7	2.3	2.7
Primary Energy Intensity (MJ/$PPP)	10	8	6	7	5
Final Fuel Demand (EJ)	1.1	2.0	2.2	3.1	3.9
Agriculture	0.1	0.1	0.1	0.2	0.2
Households	0.9	1.5	1.6	2.2	2.4
Industry	0.1	0.1	0.2	0.2	0.4
Services	0.0	0.0	0.0	0.1	0.1
Transport	0.1	0.2	0.3	0.4	0.8
Food and Agriculture					
Average Daily Consumption (kcal/cap)	1 804	1 982	2 156	2 130	2 413
Share from Animal Products (%)	9	10	11	11	13
Meat and Milk Production (Mt)	8	15	17	22	28
Fraction of Meat from Feedlots (%)	3	7	13	9	16
Fish Production (Mt)	0	1	1	1	1
Crop Production (Mt)	45	81	90	122	126
Total Cropland (Mha)	26	30	34	35	36
Irrigated Cropland (Mha)	1	1	1	1	1
Potential Cultivable Land (Mha)	76	70	71	64	68
Cereal Harvest Yield (t/ha)	1.20	2.03	2.02	2.62	2.63
Meat and Milk SSR	0.91	0.86	0.82	0.77	0.73
Fish SSR	1.12	1.51	1.51	1.50	1.49
Crop SSR	0.97	0.92	0.87	0.92	0.78
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	6	10	11	14	19
Agriculture (%)	85	73	63	62	36
Industry (%)	2	8	15	14	10
Domestic (%)	13	19	23	24	54
Water Use/Resource Ratio (%)	5	8	9	12	15
Population in Water Stress (million)	57	101	102	152	155
Air					
Carbon Emissions (MtC)	3	9	12	20	29
Sulfur Emissions (MtS)	0.0	0.1	0.2	0.2	0.4
Land and Forest					
Total Land Area (Mha)	257	257	257	257	257
Built Environment (%)	3	5	5	7	7
Cropland (%)	10	12	13	14	14
Grazing (%)	37	38	38	39	39
Natural Forest (%)	21	17	17	13	17
Plantation (%)	0	1	1	2	2
Other (%)	29	27	26	25	21
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	1	1	2	1
Municipal Solid Waste Generation (Mt)	5	15	15	28	29
Recycled Share (%)	2	2	3	3	6
Toxic Waste (Mt)	0.0	0.1	0.1	0.2	0.1

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Western Indian Ocean



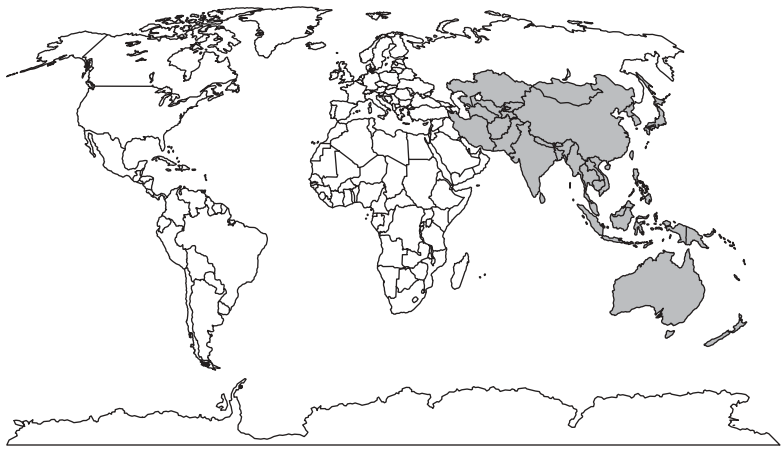
Note: Values indexed to 1 in 1995

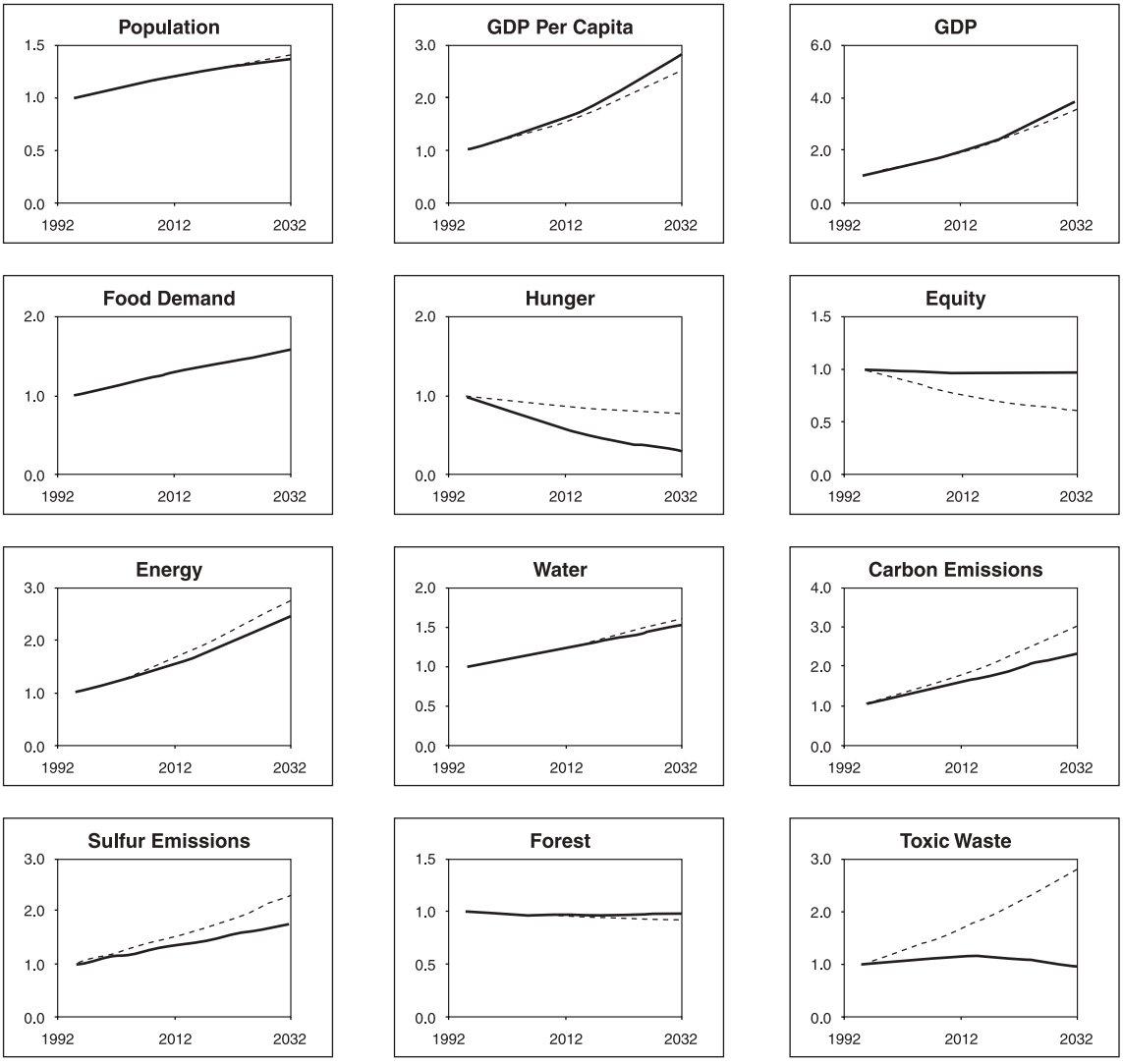
West Indian Ocean	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	16	27	26	36	35
Urbanization (%)	30	45	45	56	56
Economy and Society					
GDP (Billion US$ PPP)	27	64	82	118	183
Agriculture (%)	19	14	11	10	7
Industry (%)	25	25	25	25	25
Services (%)	56	61	64	65	68
GDP per capita (1995 US$ PPP)	1 678	2 394	3 117	3 250	5 196
Hunger Incidence (% of population)	37	25	19	18	11
National Equity (L20%/H20%)	0.10	0.08	0.11	0.07	0.12
Energy					
Primary Energy Requirement (EJ)	0.1	0.2	0.2	0.3	0.3
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	0.1	0.2	0.1	0.3	0.2
Natural Gas	0.0	0.0	0.0	0.0	0.0
Uranium	0.0	0.0	0.0	0.0	0.0
Hydropower	0.0	0.0	0.0	0.0	0.0
Renewables	0.0	0.0	0.0	0.0	0.1
Primary Energy Intensity (MJ/$PPP)	0	3	2	2	1
Final Fuel Demand (EJ)	na	na	na	na	na
Agriculture	na	na	na	na	na
Households	na	na	na	na	na
Industry	na	na	na	na	na
Services	na	na	na	na	na
Transport	na	na	na	na	na
Food and Agriculture					
Average Daily Consumption (kcal/cap)	1 963	2 136	2 259	2 278	2 479
Share from Animal Products (%)	9	11	12	12	13
Meat and Milk Production (Mt)	1	1	2	2	2
Fraction of Meat from Feedlots (%)	3	17	20	23	28
Fish Production (Mt)	0	0	0	0	0
Crop Production (Mt)	12	23	21	36	24
Total Cropland (Mha)	3	6	5	7	5
Irrigated Cropland (Mha)	1	1	1	1	1
Potential Cultivable Land (Mha)	29	28	28	27	28
Cereal Harvest Yield (t/ha)	1.97	2.68	2.61	3.22	3.20
Meat and Milk SSR	0.84	0.73	0.71	0.66	0.64
Fish SSR	1.17	1.55	1.54	1.53	1.52
Crop SSR	1.52	1.42	1.17	1.46	0.88
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	17	23	18	29	18
Agriculture (%)	99	98	95	97	91
Industry (%)	0	0	0	0	1
Domestic (%)	1	2	5	3	8
Water Use/Resource Ratio (%)	5	7	5	8	5
Population in Water Stress (million)	0	0	0	1	0
Air					
Carbon Emissions (MtC)	7	13	10	20	16
Sulfur Emissions (MtS)	na	na	na	na	na
Land and Forest					
Total Land Area (Mha)	59	59	59	59	59
Built Environment (%)	2	3	3	4	4
Cropland (%)	6	7	9	8	8
Grazing (%)	41	45	45	49	49
Natural Forest (%)	40	34	35	29	36
Plantation (%)	0	0	0	0	0
Other (%)	12	11	8	10	3
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	0	0	0	0
Municipal Solid Waste Generation (Mt)	1	3	3	6	6
Recycled Share (%)	2	3	4	3	8
Toxic Waste (Mt)	0.0	0.0	0.0	0.1	0.0

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Asia and the Pacific





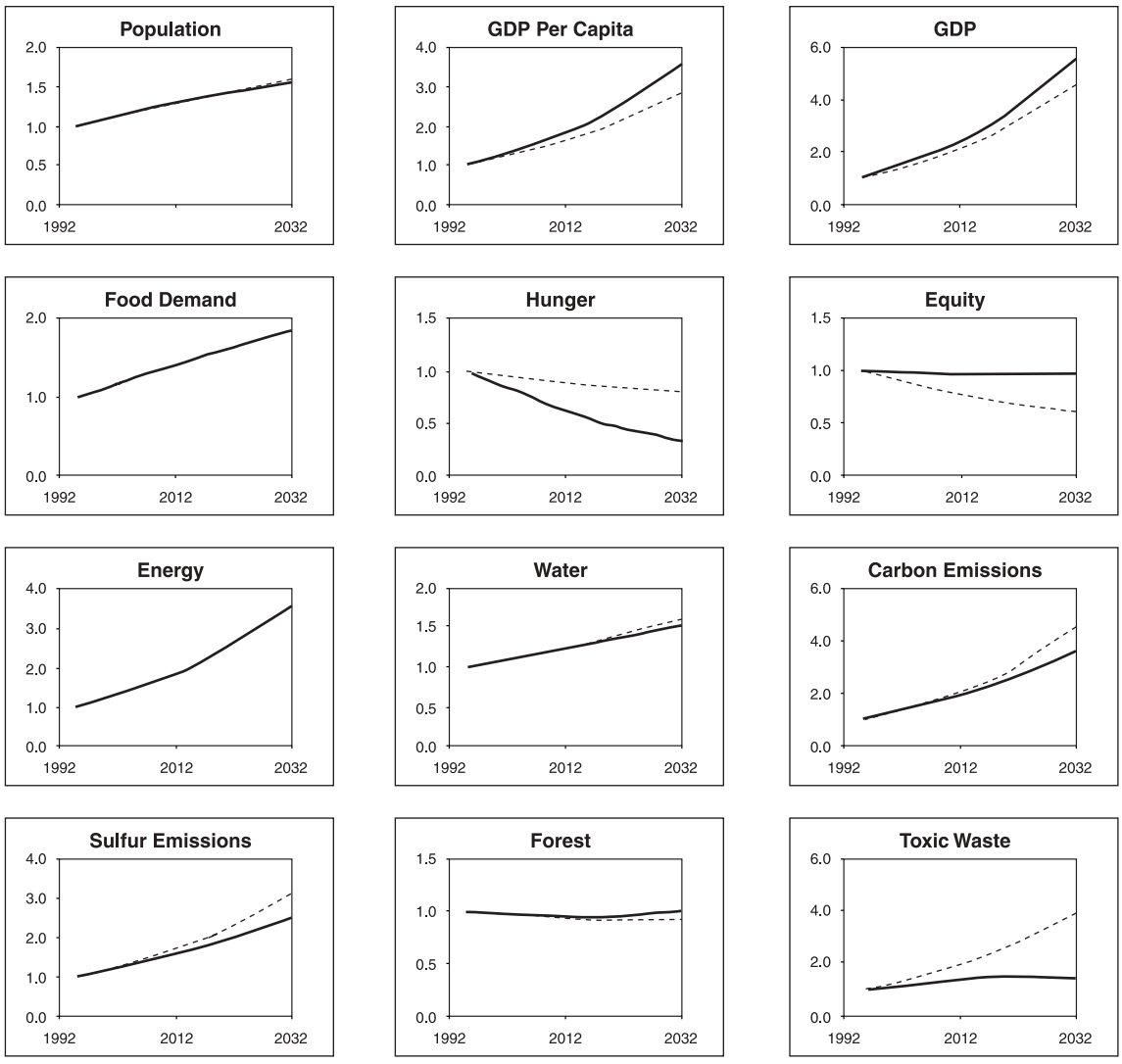
Note: Values indexed to 1 in 1995

Asia and the Pacific	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	3 289	4 121	4 068	4 644	4 516
Urbanization (%)	33	47	47	58	58
Economy and Society					
GDP (Billion US$ PPP)	12 142	25 210	26 194	42 859	46 789
Agriculture (%)	16	9	9	6	5
Industry (%)	39	36	36	34	33
Services (%)	45	54	55	60	62
GDP per capita (1995 US$ PPP)	3 692	6 117	6 439	9 229	10 361
Hunger Incidence (% of population)	16	11	7	9	4
National Equity (L20%/H20%)	0.14	0.10	0.14	0.09	0.14
Energy					
Primary Energy Requirement (EJ)	124.7	224.1	209.4	346.6	306.6
Coal	40.8	69.9	59.7	103.6	72.3
Petroleum	41.3	83.7	67.4	136.3	95.5
Natural Gas	13.0	29.8	40.5	54.4	76.8
Uranium	4.5	8.7	1.3	16.0	0.6
Hydropower	1.9	3.7	3.9	6.3	5.6
Renewables	23.2	28.3	36.6	30.1	55.8
Primary Energy Intensity (MJ/$PPP)	10	9	8	8	7
Final Fuel Demand (EJ)	94.6	168.0	163.7	257.1	245.3
Agriculture	2.8	3.2	3.1	3.4	3.2
Households	31.7	46.7	47.2	62.5	63.6
Industry	39.3	70.4	71.3	105.8	104.0
Services	5.1	11.8	12.1	20.7	21.5
Transport	15.8	35.9	30.0	64.8	53.0
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 510	2 705	2 729	2 843	2 877
Share from Animal Products (%)	12	13	14	15	15
Meat and Milk Production (Mt)	245	380	390	506	525
Fraction of Meat from Feedlots (%)	16	23	27	26	34
Fish Production (Mt)	69	81	80	87	85
Crop Production (Mt)	2 155	2 930	2 884	3 411	3 299
Total Cropland (Mha)	558	574	574	556	548
Irrigated Cropland (Mha)	166	184	184	197	196
Potential Cultivable Land (Mha)	790	748	756	708	732
Cereal Harvest Yield (t/ha)	2.91	3.89	3.83	4.58	4.52
Meat and Milk SSR	1.00	0.97	0.97	0.95	0.95
Fish SSR	0.86	0.85	0.85	0.85	0.86
Crop SSR	0.99	0.96	0.93	0.93	0.87
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	1 525	1 995	1 951	2 465	2 338
Agriculture (%)	87	82	80	76	73
Industry (%)	7	9	10	13	13
Domestic (%)	6	9	10	11	13
Water Use/Resource Ratio (%)	9	12	12	15	14
Population in Water Stress (million)	787	1 333	1 275	1 935	1 748
Air					
Carbon Emissions (MtC)	1 954	3 698	3 249	5 882	4 575
Sulfur Emissions (MtS)	26.9	43.4	37.3	62.3	46.8
Land and Forest					
Total Land Area (Mha)	3 463	3 463	3 463	3 463	3 463
Built Environment (%)	3	4	4	5	5
Cropland (%)	16	17	17	16	16
Grazing (%)	38	38	38	37	37
Natural Forest (%)	20	19	19	18	19
Plantation (%)	1	1	1	2	2
Other (%)	23	22	21	22	21
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	42	58	48	65	42
Municipal Solid Waste Generation (Mt)	254	507	500	830	839
Recycled Share (%)	9	12	14	14	21
Toxic Waste (Mt)	11.7	21.1	13.3	33.1	11.2

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

South Asia



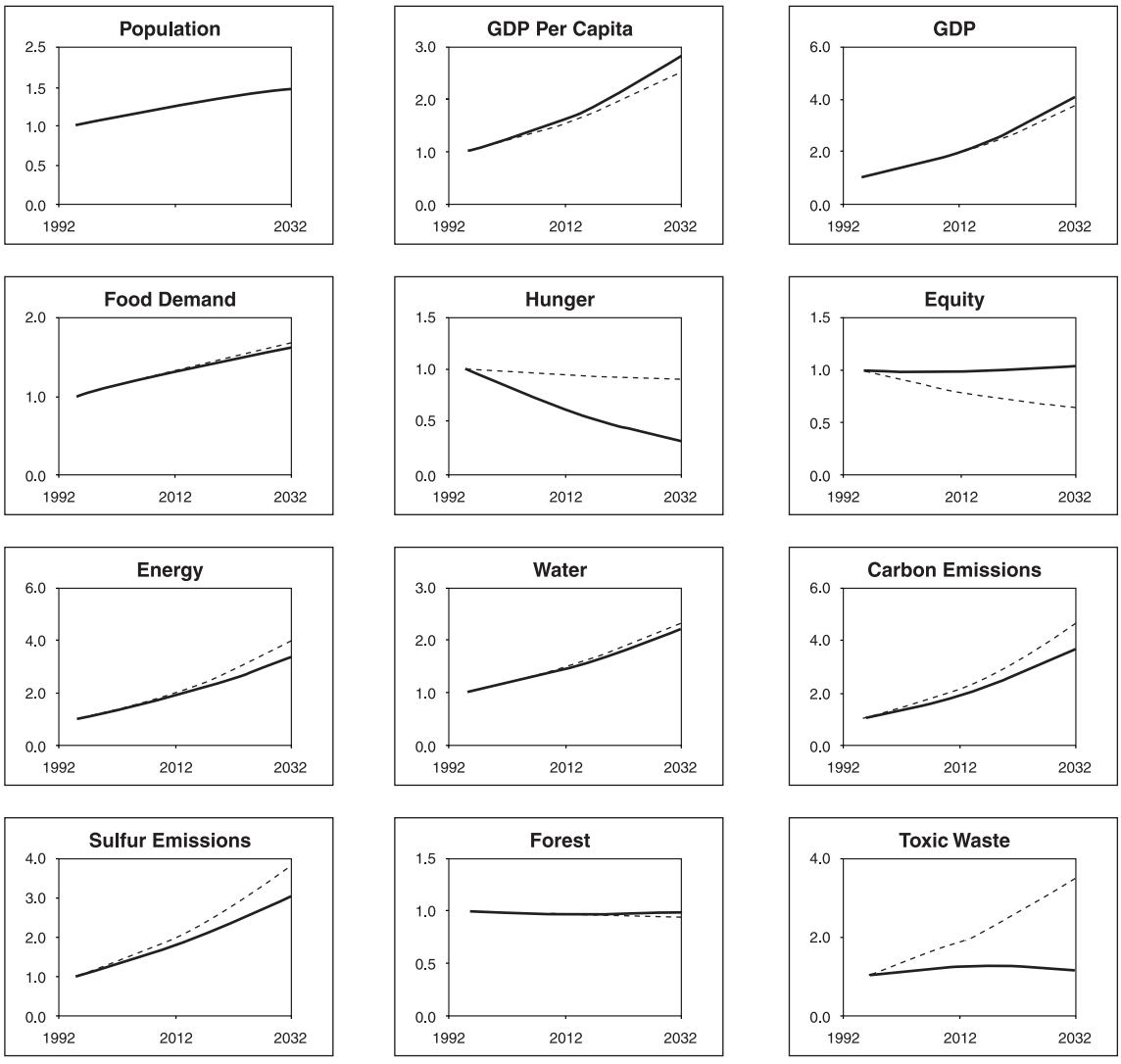
Note: Values indexed to 1 in 1995

South Asia	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	1 312	1 774	1 750	2 102	2 042
Urbanization (%)	28	41	41	53	53
Economy and Society					
GDP (Billion US$ PPP)	2 283	5 471	6 139	10 479	12 771
Agriculture (%)	29	16	14	10	8
Industry (%)	28	27	27	27	27
Services (%)	43	57	59	63	65
GDP per capita (1995 US$ PPP)	1 741	3 084	3 508	4 986	6 255
Hunger Incidence (% of population)	23	15	10	11	5
National Equity (L20%/H20%)	0.15	0.11	0.14	0.09	0.14
Energy					
Primary Energy Requirement (EJ)	27.7	55.7	57.0	98.3	100.1
Coal	5.9	9.9	9.5	17.9	14.1
Petroleum	7.8	21.2	17.1	42.4	27.7
Natural Gas	3.6	10.0	12.1	21.0	25.6
Uranium	0.1	0.3	0.0	0.5	0.0
Hydropower	0.4	1.0	1.1	1.9	2.1
Renewables	9.9	13.3	17.2	14.7	30.7
Primary Energy Intensity (MJ/$PPP)	12	10	9	9	8
Final Fuel Demand (EJ)	21.7	44.6	46.2	77.9	82.7
Agriculture	0.6	0.8	0.8	0.9	0.9
Households	10.8	16.7	17.0	22.9	23.8
Industry	6.7	15.7	17.3	28.7	32.9
Services	0.4	1.4	1.7	3.2	4.0
Transport	3.2	10.0	9.5	22.0	21.1
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 321	2 557	2 588	2 726	2 771
Share from Animal Products (%)	8	9	10	11	12
Meat and Milk Production (Mt)	103	179	187	259	274
Fraction of Meat from Feedlots (%)	3	4	12	4	21
Fish Production (Mt)	7	10	10	11	11
Crop Production (Mt)	787	1 098	1 067	1 338	1 263
Total Cropland (Mha)	231	228	225	214	202
Irrigated Cropland (Mha)	84	94	94	102	102
Potential Cultivable Land (Mha)	250	235	237	221	226
Cereal Harvest Yield (t/ha)	2.12	3.08	3.01	3.84	3.80
Meat and Milk SSR	0.99	0.94	0.94	0.91	0.91
Fish SSR	0.99	0.96	0.96	0.94	0.95
Crop SSR	1.01	0.96	0.89	0.94	0.81
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	666	874	861	1 092	1 068
Agriculture (%)	94	91	87	86	82
Industry (%)	3	5	5	7	7
Domestic (%)	3	5	8	7	10
Water Use/Resource Ratio (%)	112	16	16	20	20
Population in Water Stress (million)	417	638	620	932	885
Air					
Carbon Emissions (MtC)	344	794	729	1 555	1 229
Sulfur Emissions (MtS)	4.8	8.8	8.1	14.8	11.7
Land and Forest					
Total Land Area (Mha)	640	640	640	640	640
Built Environment (%)	6	9	9	12	12
Cropland (%)	36	36	35	33	32
Grazing (%)	15	13	15	13	15
Natural Forest (%)	15	13	14	13	15
Plantation (%)	1	1	1	1	1
Other (%)	29	28	27	28	27
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	14	22	18	26	17
Municipal Solid Waste Generation (Mt)	58	130	134	237	254
Recycled Share (%)	11	12	13	13	17
Toxic Waste (Mt)	2.1	4.5	3.0	8.0	3.0

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Southeast Asia



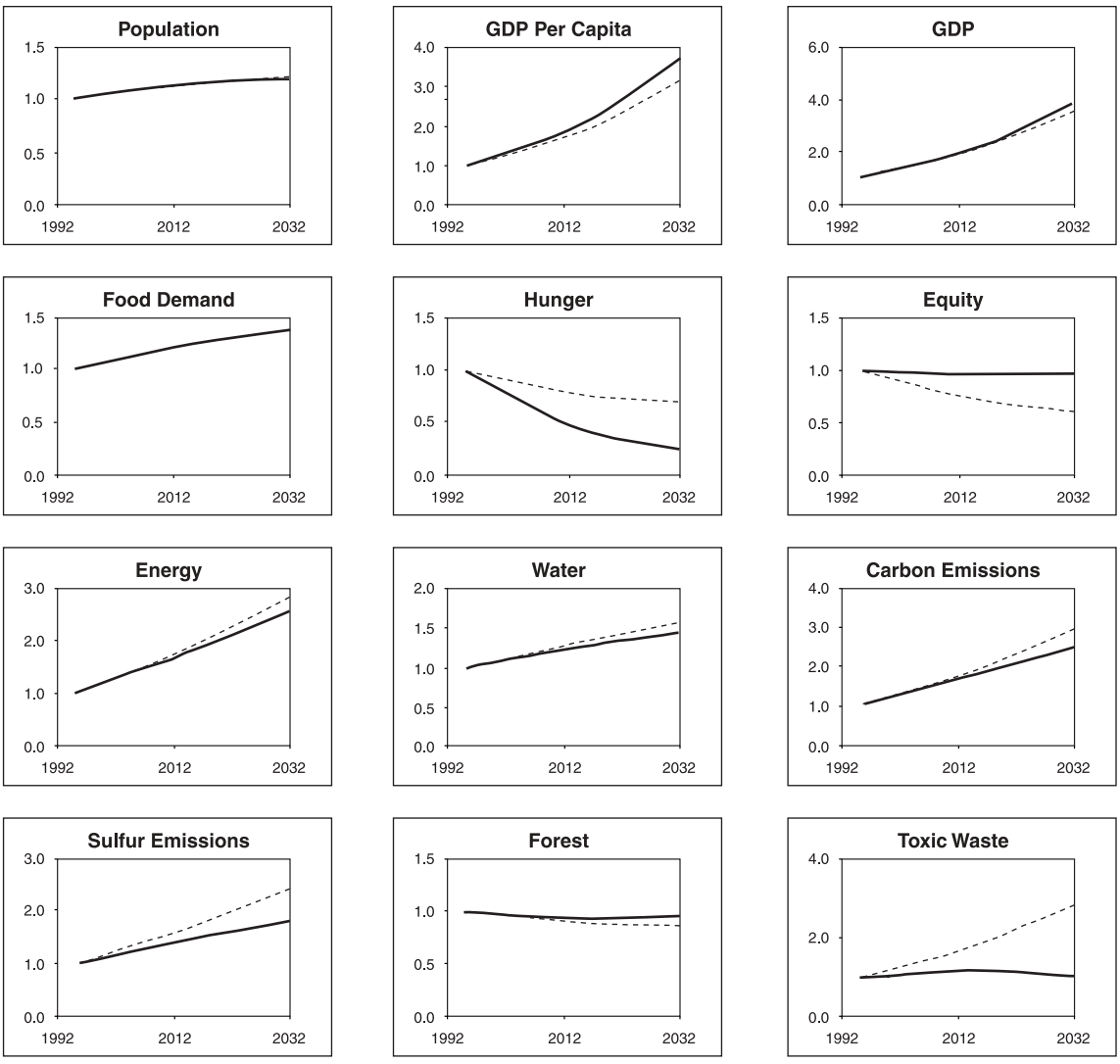
Note: Values indexed to 1 in 1995

Southeast Asia	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	480	620	612	719	699
Urbanization (%)	34	49	49	61	61
Economy and Society					
GDP (Billion US$ PPP)	2 305	4 911	5 161	8 656	9 372
Agriculture (%)	15	9	8	5	5
Industry (%)	40	37	37	34	33
Services (%)	45	55	55	61	62
GDP per capita (1995 US$ PPP)	4 805	7 917	8 432	12 031	13 407
Hunger Incidence (% of population)	13	9	6	8	3
National Equity (L20%/H20%)	0.13	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	12.5	27.4	25.4	50.1	41.7
Coal	0.7	1.8	1.4	4.0	2.1
Petroleum	5.4	12.5	11.2	22.4	18.5
Natural Gas	2.3	6.2	6.1	12.7	11.4
Uranium	0.0	0.8	0.0	3.5	0.0
Hydropower	0.1	0.2	0.2	0.4	0.4
Renewables	4.0	5.9	6.6	7.1	9.3
Primary Energy Intensity (MJ/$PPP)	5	6	5	6	4
Final Fuel Demand (EJ)	9.6	19.8	19.9	34.3	33.6
Agriculture	0.2	0.3	0.3	0.3	0.3
Households	4.3	7.6	7.6	11.3	11.3
Industry	2.4	6.2	6.2	12.1	11.4
Services	0.2	0.6	0.7	1.7	1.8
Transport	2.4	5.2	5.1	8.9	8.9
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 575	2 747	2 756	2 870	2 880
Share from Animal Products (%)	7	9	9	10	11
Meat and Milk Production (Mt)	12	21	22	31	32
Fraction of Meat from Feedlots (%)	17	31	33	41	43
Fish Production (Mt)	14	17	17	20	19
Crop Production (Mt)	418	556	581	644	692
Total Cropland (Mha)	89	95	100	94	98
Irrigated Cropland (Mha)	15	17	17	19	19
Potential Cultivable Land (Mha)	141	135	135	127	130
Cereal Harvest Yield (t/ha)	3.07	4.27	4.25	5.16	5.24
Meat and Milk SSR	0.69	0.70	0.70	0.71	0.72
Fish SSR	0.97	0.93	0.93	0.92	0.92
Crop SSR	1.25	1.15	1.20	1.06	1.16
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	119	188	182	278	263
Agriculture (%)	76	63	60	52	48
Industry (%)	11	20	21	28	29
Domestic (%)	13	17	20	20	22
Water Use/Resource Ratio (%)	2	3	3	5	5
Population in Water Stress (million)	16	69	65	132	120
Air					
Carbon Emissions (MtC)	155	375	335	714	568
Sulfur Emissions (MtS)	1.8	4.0	3.6	6.9	5.5
Land and Forest					
Total Land Area (Mha)	436	436	436	436	436
Built Environment (%)	3	5	5	7	7
Cropland (%)	20	22	23	22	23
Grazing (%)	4	4	4	4	3
Natural Forest (%)	52	49	50	45	48
Plantation (%)	1	2	1	5	5
Other (%)	20	18	17	17	15
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	3	6	5	7	5
Municipal Solid Waste Generation (Mt)	42	91	92	157	161
Recycled Share (%)	11	13	16	15	24
Toxic Waste (Mt)	1.6	3.4	2.1	5.7	1.9

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Northwest Pacific and East Asia



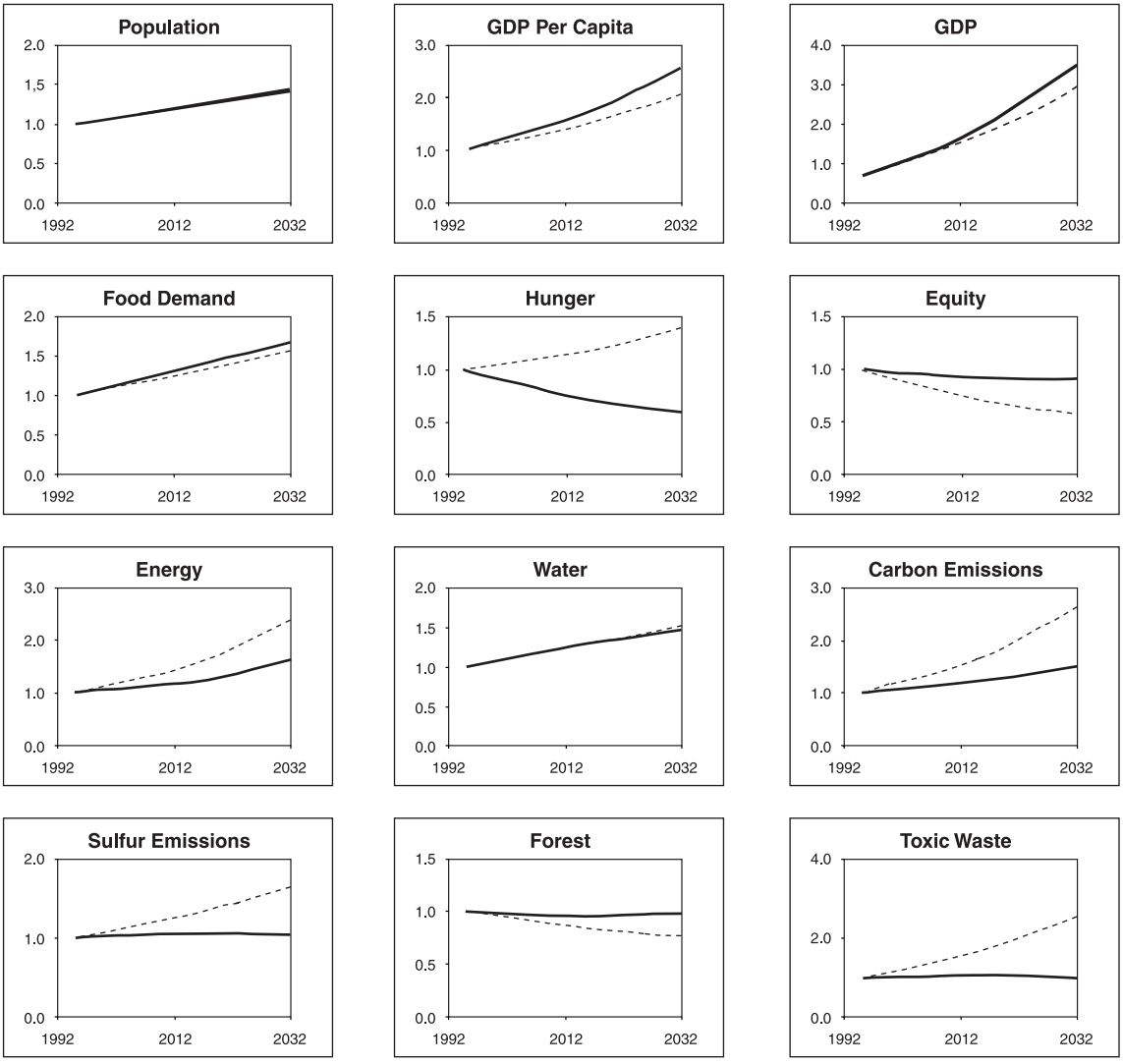
Note: Values indexed to 1 in 1995

Northwest Pacific and East Asia	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	1 290	1 499	1 479	1 587	1 542
Urbanization (%)	33	48	48	61	61
Economy and Society					
GDP (Billion US$ PPP)	4 220	9 165	9 984	16 252	18 819
Agriculture (%)	19	10	9	6	5
Industry (%)	47	43	42	39	37
Services (%)	33	47	49	56	58
GDP per capita (1995 US$ PPP)	3 271	6 112	6 748	10 204	12 204
Hunger Incidence (% of population)	14	9	5	8	3
National Equity (L20%/H20%)	0.12	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	54.6	102.5	99.8	73.7	139.7
Coal	28.8	51.3	44.4	50.1	52.4
Petroleum	13.5	31.2	28.1	12.0	41.2
Natural Gas	1.5	6.3	15.6	7.4	32.4
Uranium	1.3	3.5	0.0	3.3	0.0
Hydropower	0.8	1.9	1.9	7.2	2.4
Renewables	8.7	8.3	9.8	9	11.3
Primary Energy Intensity (MJ/$PPP)	13	11	10	11	7
Final Fuel Demand (EJ)	43.3	76.6	77.1	2.9	108.9
Agriculture	1.3	1.5	1.4	1.5	1.4
Households	13.2	19.0	19.2	24.8	25.3
Industry	21.8	38.1	39.1	53.3	51.0
Services	2.3	6.6	7.3	12.0	13.2
Transport	4.8	11.5	10.0	21.3	18.0
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 648	2 845	2 865	2 974	3 003
Share from Animal Products (%)	16	18	19	20	21
Meat and Milk Production (Mt)	79	115	117	142	144
Fraction of Meat from Feedlots (%)	32	45	46	51	52
Fish Production (Mt)	39	45	44	47	46
Crop Production (Mt)	811	1 086	1 040	1 184	1 077
Total Cropland (Mha)	139	142	135	129	116
Irrigated Cropland (Mha)	52	56	56	56	56
Potential Cultivable Land (Mha)	177	158	163	140	155
Cereal Harvest Yield (t/ha)	4.63	5.71	5.74	6.43	6.52
Meat and Milk SSR	0.98	0.98	0.98	0.99	1.00
Fish SSR	0.88	0.87	0.87	0.87	0.87
Crop SSR	0.89	0.89	0.86	0.85	0.78
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	508	660	642	794	725
Agriculture (%)	85	78	76	69	66
Industry (%)	9	12	13	17	18
Domestic (%)	6	10	12	14	17
Water Use/Resource Ratio (%)	17	22	22	27	25
Population in Water Stress (million)	283	548	514	782	659
Air					
Carbon Emissions (MtC)	980	1 904	1 777	2 881	2 433
Sulfur Emissions (MtS)	14.0	24.1	20.5	34.0	25.5
Land and Forest					
Total Land Area (Mha)	1 111	1 111	1 111	1 111	1 111
Built Environment (%)	3	5	5	6	6
Cropland (%)	12	13	12	12	10
Grazing (%)	47	47	47	47	47
Natural Forest (%)	12	11	12	10	12
Plantation (%)	2	2	2	2	2
Other (%)	25	23	23	23	23
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	21	26	21	26	16
Municipal Solid Waste Generation (Mt)	81	174	180	297	319
Recycled Share (%)	11	13	15	15	24
Toxic Waste (Mt)	5.6	10.1	6.5	15.8	5.4

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Central Asia



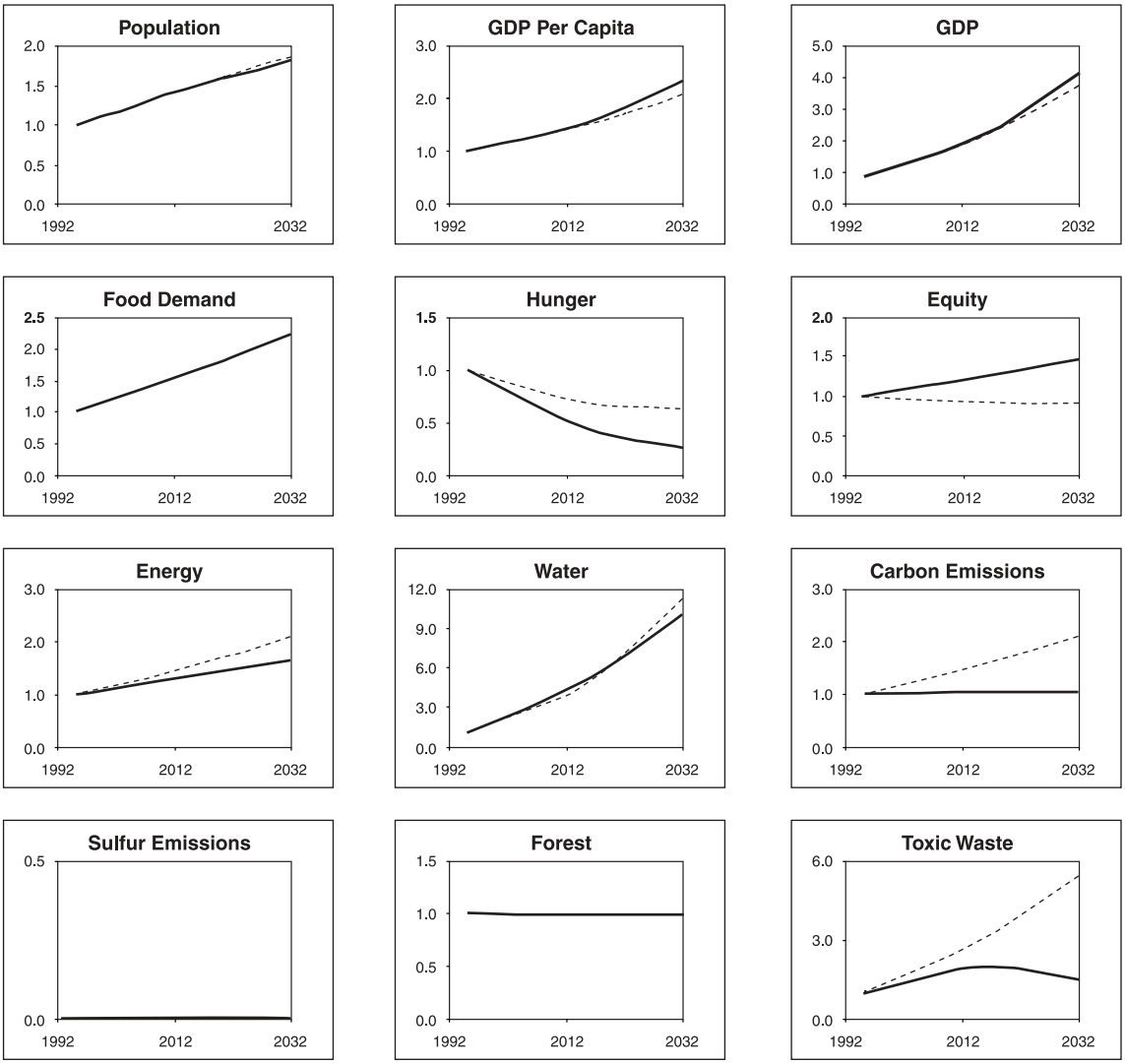
Note: Values indexed to 1 in 1995

Central Asia	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	53	66	65	77	75
Urbanization (%)	46	57	57	63	63
Economy and Society					
GDP (Billion US$ PPP)	134	244	271	394	475
Agriculture (%)	25	17	15	12	10
Industry (%)	31	31	31	31	31
Services (%)	43	52	54	57	60
GDP per capita (1995 US$ PPP)	2 514	3 717	4 189	5 122	6 365
Hunger Incidence (% of population)	12	11	7	11	5
National Equity (L20%/H20%)	0.16	0.11	0.15	0.09	0.15
Energy					
Primary Energy Requirement (EJ)	4.9	7.4	5.5	11,8	8.0
Coal	1.4	1.9	1.6	2.5	1.8
Petroleum	1.0	1.8	0.6	3.9	0.9
Natural Gas	2.4	3.3	3.1	4.6	4.1
Uranium	0.0	0.2	0.0	0.5	0.0
Hydropower	0.1	0.2	0.2	0.2	0.2
Renewables	0.0	0.0	0.4	0.1	1.1
Primary Energy Intensity (MJ/$PPP)	37	30	22	30	17
Final Fuel Demand (EJ)	2.8	5.4	4.7	9.0	6.8
Agriculture	0.1	0.2	0.2	0.2	0.2
Households	1.0	1.2	1.2	1.5	1.5
Industry	1.2	2.1	2.3	3.3	3.7
Services	0.2	0.4	0.4	0.7	0.8
Transport	0.3	1.4	0.5	3.4	0.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 666	2 792	2 996	2 882	3 163
Share from Animal Products (%)	19	20	20	21	22
Meat and Milk Production (Mt)	13	17	18	21	23
Fraction of Meat from Feedlots (%)	10	18	29	25	39
Fish Production (Mt)	0	0	0	0	0
Crop Production (Mt)	27	42	42	51	50
Total Cropland (Mha)	44	45	44	44	44
Irrigated Cropland (Mha)	10	12	12	13	13
Potential Cultivable Land (Mha)	46	46	46	45	45
Cereal Harvest Yield (t/ha)	0.69	1.21	1.21	1.50	1.50
Meat and Milk SSR	0.99	0.96	0.95	0.93	0.93
Fish SSR	1.07	1.44	1.44	1.42	1.42
Crop SSR	0.67	0.68	0.54	0.62	0.47
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	132	170	171	200	194
Agriculture (%)	95	95	94	94	94
Industry (%)	2	3	3	3	3
Domestic (%)	3	3	3	3	3
Water Use/Resource Ratio (%)	60	77	77	90	87
Population in Water Stress (million)	46	60	59	74	71
Air					
Carbon Emissions (MtC)	79	131	96	206	118
Sulfur Emissions (MtS)	1.1	1.4	1.1	1.7	1.1
Land and Forest					
Total Land Area (Mha)	389	389	389	389	389
Built Environment (%)	1	1	1	1	1
Cropland (%)	11	11	11	11	11
Grazing (%)	65	66	65	67	65
Natural Forest (%)	4	4	4	3	4
Plantation (%)	0	0	0	0	0
Other (%)	19	18	19	18	19
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	3	3	3	4	2
Municipal Solid Waste Generation (Mt)	8	13	13	18	19
Recycled Share (%)	0	1	3	2	7
Toxic Waste (Mt)	0.2	0.3	0.2	0.4	0.1

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

South Pacific



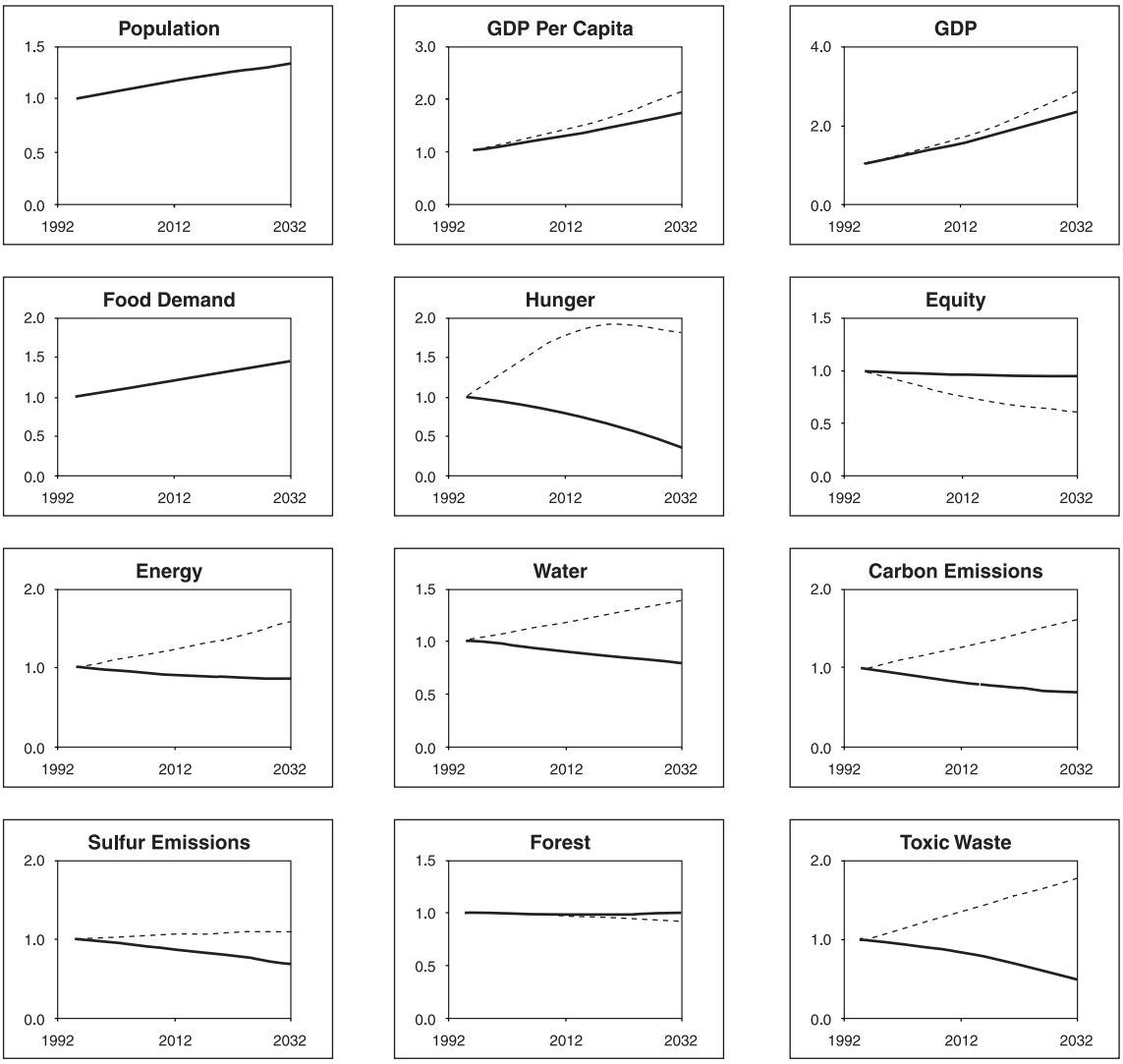
Note: Values indexed to 1 in 1995

South Pacific	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	7	10	10	13	12
Urbanization (%)	20	31	31	40	40
Economy and Society					
GDP (Billion US$ PPP)	45	100	102	175	190
Agriculture (%)	17	10	10	6	5
Industry (%)	39	37	37	33	32
Services (%)	43	53	54	61	62
GDP per capita (1995 US$ PPP)	6 538	9 737	10 103	13 606	15 238
Hunger Incidence (% of population)	22	10	7	8	3
National Equity (L20%/H20%)	0.07	0.06	0.09	0.06	0.10
Energy					
Primary Energy Requirement (EJ)	0.2	0.2	0.2	0.3	0.3
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	0.1	0.2	0.2	0.3	0.2
Natural Gas	0.0	0.0	0.0	0.0	0.0
Uranium	0.0	0.0	0.0	0.0	0.0
Hydropower	0.0	0.0	0.0	0.0	0.0
Renewables	0.0	0.0	0.1	0.0	0.1
Primary Energy Intensity (MJ/$PPP)	0	3	2	2	1
Final Fuel Demand (EJ)	na	na	na	na	na
Agriculture	na	na	na	na	na
Households	na	na	na	na	na
Industry	na	na	na	na	na
Services	na	na	na	na	na
Transport	na	na	na	na	na
Food and Agriculture					
Average Daily Consumption (kcal/cap)	1 831	2 030	2 048	2 190	2 243
Share from Animal Products (%)	19	20	20	21	22
Meat and Milk Production (Mt)	0	0	0	0	0
Fraction of Meat from Feedlots (%)	2	5	6	7	10
Fish Production (Mt)	0	0	0	0	0
Crop Production (Mt)	5	9	9	12	12
Total Cropland (Mha)	1	1	1	1	1
Irrigated Cropland (Mha)	0	0	0	0	0
Potential Cultivable Land (Mha)	13	13	13	13	13
Cereal Harvest Yield (t/ha)	2.36	3.30	3.29	3.93	3.88
Meat and Milk SSR	0.49	0.44	0.44	0.41	0.41
Fish SSR	1.48	1.89	1.89	1.87	1.87
Crop SSR	3.86	3.92	4.01	3.97	3.96
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	0	1	1	1	1
Agriculture (%)	57	16	15	8	7
Industry (%)	14	21	22	27	14
Domestic (%)	30	63	63	65	80
Water Use/Resource Ratio (%)	0	0	0	0	0
Population in Water Stress (million)	0	0	0	0	0
Air					
Carbon Emissions (MtC)	11	18	12	24	12
Sulfur Emissions (MtS)	na	na	na	na	na
Land and Forest					
Total Land Area (Mha)	54	54	54	54	54
Built Environment (%)	0	1	1	1	1
Cropland (%)	1	2	2	2	2
Grazing (%)	1	1	1	1	1
Natural Forest (%)	88	87	87	85	88
Plantation (%)	0	0	0	2	0
Other (%)	9	9	9	9	8
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	0	0	0	0
Municipal Solid Waste Generation (Mt)	0	1	1	2	2
Recycled Share (%)	11	13	16	15	24
Toxic Waste (Mt)	0.0	0.1	0.0	0.1	0.0

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Australia and New Zealand



Note: Values indexed to 1 in 1995

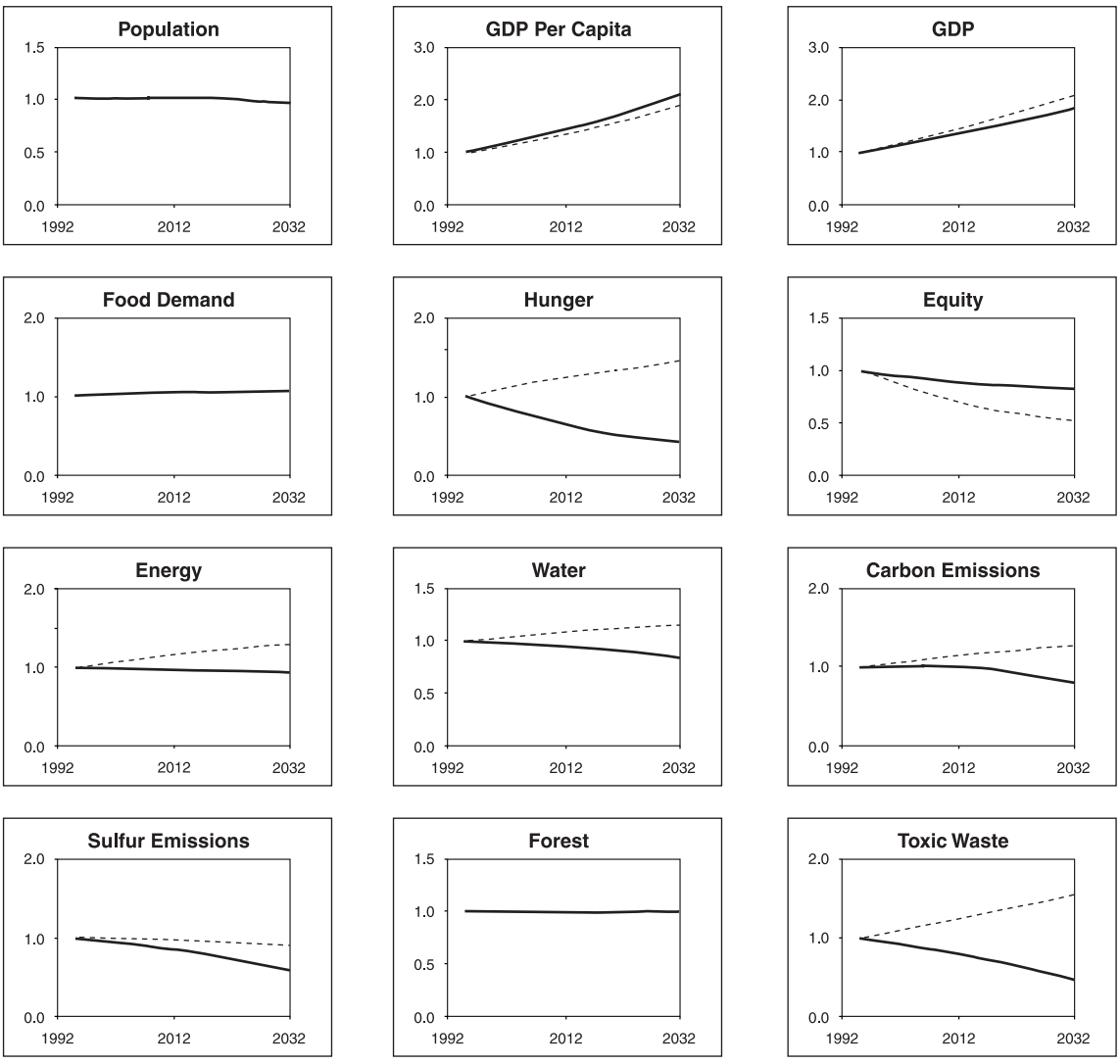
Australia and New Zealand	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	22	26	26	29	29
Urbanization (%)	85	88	88	91	91
Economy and Society					
GDP (Billion US$ PPP)	412	747	667	1 179	954
Agriculture (%)	3	2	2	1	2
Industry (%)	28	25	25	24	24
Services (%)	69	73	73	75	75
GDP per capita (1995 US$ PPP)	19 056	28 875	25 817	40 803	33 008
Hunger Incidence (% of population)	1	2	1	2	0
National Equity (L20%/H20%)	0.15	0.11	0.14	0.09	0.14
Energy					
Primary Energy Requirement (EJ)	4.8	6.1	4.3	7.5	4.1
Coal	1.5	1,9	1.1	2.2	0.9
Petroleum	1.9	2.7	1.5	3.5	1.2
Natural Gas	0.9	1.1	0.9	1.2	0.9
Uranium	0.0	0.0	0.0	0.0	0.0
Hydropower	0.2	0.2	0.2	0.2	0.2
Renewables	0.2	0.3	0.6	0.4	0.8
Primary Energy Intensity (MJ/$PPP)	12	8	6	6	4
Final Fuel Demand (EJ)	3.2	4.4	3.3	5.5	3.3
Agriculture	0.1	0.1	0.1	0.1	0.1
Households	0.4	0.4	0.4	0.4	0.4
Industry	1.3	1.6	1.3	2.0	1.2
Services	0.2	0.3	0.3	0.5	0.3
Transport	1.2	1.9	1.3	2.5	1.3
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 933	3 096	3 096	3 211	3 211
Share from Animal Products (%)	36	35	35	34	34
Meat and Milk Production (Mt)	23	30	31	36	37
Fraction of Meat from Feedlots (%)	5	8	9	12	13
Fish Production (Mt)	1	1	1	1	1
Crop Production (Mt)	71	103	109	144	167
Total Cropland (Mha)	50	59	64	70	83
Irrigated Cropland (Mha)	3	3	3	3	3
Potential Cultivable Land (Mha)	154	153	153	152	153
Cereal Harvest Yield (t/ha)	1.90	2.39	2.38	2.86	2.89
Meat and Milk SSR	2.34	2.50	2.51	2.61	2.64
Fish SSR	1.17	1.52	1.52	1.51	1.50
Crop SSR	2.56	2.52	2.62	2.62	2.89
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	17	20	15	23	13
Agriculture (%)	35	35	47	37	61
Industry (%)	2	2	3	2	4
Domestic (%)	63	63	50	61	35
Water Use/Resource Ratio (%)	2	3	2	3	2
Population in Water Stress (million)	0	0	0	0	0
Air					
Carbon Emissions (MtC)	85	112	68	137	58
Sulfur Emissions (MtS)	1.6	1.7	1.4	1.8	1.1
Land and Forest					
Total Land Area (Mha)	795	795	795	795	795
Built Environment (%)	0	0	0	0	0
Cropland (%)	6	7	8	9	10
Grazing (%)	54	53	53	53	53
Natural Forest (%)	19	18	19	17	19
Plantation (%)	0	0	0	0	0
Other (%)	21	21	19	20	17
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	1	1	1	2	2
Municipal Solid Waste Generation (Mt)	14	23	20	34	25
Recycled Share (%)	0	3	7	10	20
Toxic Waste (Mt)	0.3	0.4	0.2	0.4	0.1

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Europe

EUROPE



Note: Values indexed to 1 in 1995

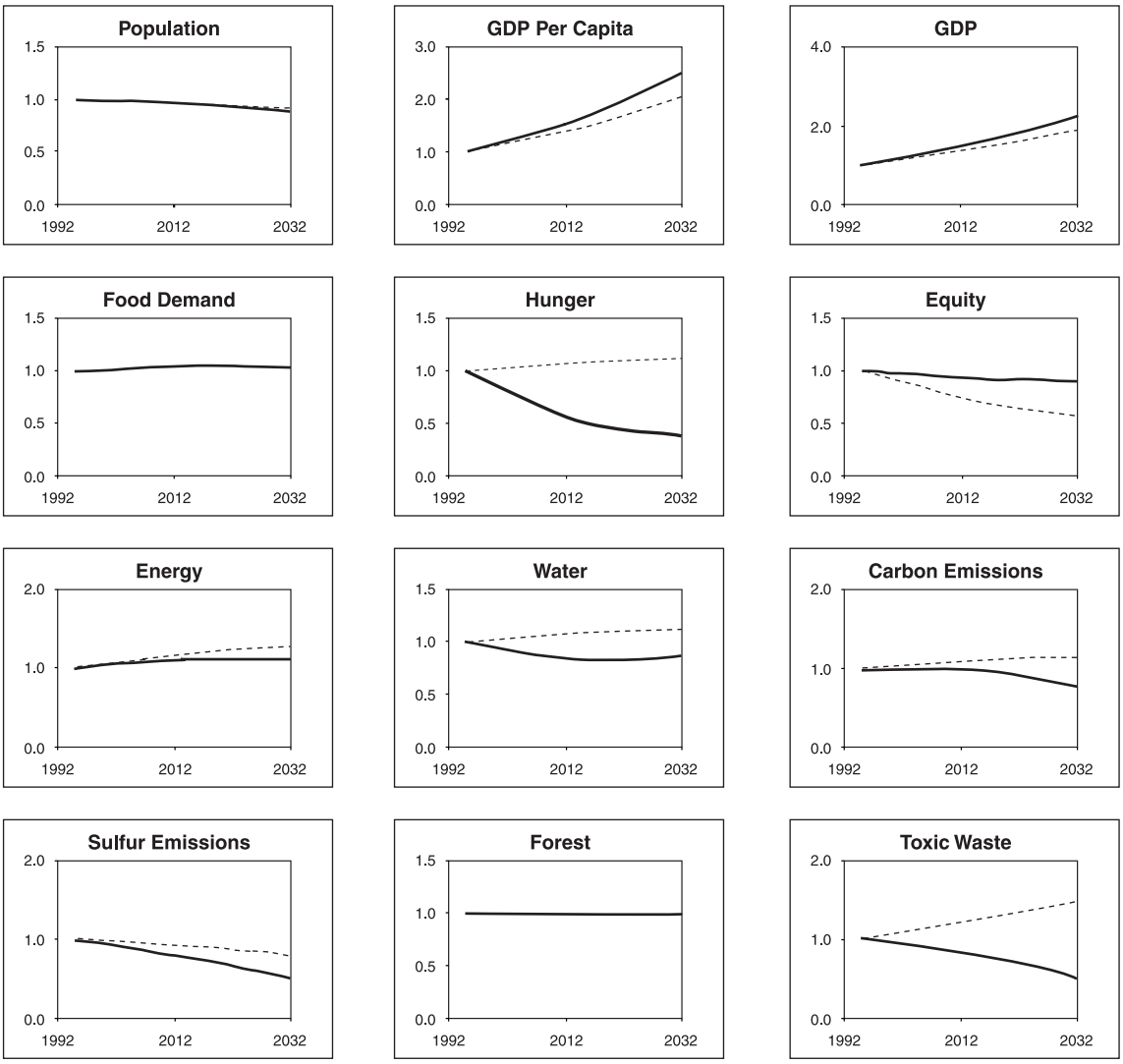
Europe	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	812	825	820	807	795
Urbanization (%)	73	80	80	85	85
Economy and Society					
GDP (Billion US$ PPP)	9 487	14 540	13 623	19 878	17 636
Agriculture (%)	4	3	3	2	2
Industry (%)	33	30	30	29	29
Services (%)	62	67	67	69	69
GDP per capita (1995 US$ PPP)	11 690	17 615	16 620	24 643	22 195
Hunger Incidence (% of population)	2	3	1	3	1
National Equity (L20%/H20%)	0.19	0.12	0.16	0.10	0.15
Energy					
Primary Energy Requirement (EJ)	115.9	136.9	112.4	149.8	107.3
Coal	22.8	24.9	20.5	26.0	14.1
Petroleum	42.0	53.2	42.0	59.1	33.2
Natural Gas	33.5	39.1	39.5	43.2	38.4
Uranium	11.7	12.7	2.8	12.9	4.0
Hydropower	2.7	3.0	2.8	3.3	2.9
Renewables	3.2	4.1	4.8	5.2	14.8
Primary Energy Intensity (MJ/$PPP)	12	9	8	8	6
Final Fuel Demand (EJ)	80.8	95.4	84.9	105.8	83.6
Agriculture	3.9	3.7	3.5	3.2	2.9
Households	23.6	22.2	21.5	20.3	19.0
Industry	29.9	36.1	33.5	39.9	33.7
Services	5.7	8.0	7.0	10.1	7.8
Transport	17.8	25.5	19.4	32.3	20.2
Food and Agriculture					
Average Daily Consumption (kcal/cap)	3 058	3 200	3 224	3 293	3 333
Share from Animal Products (%)	27	27	27	27	28
Meat and Milk Production (Mt)	318	362	368	402	415
Fraction of Meat from Feedlots (%)	31	36	37	40	41
Fish Production (Mt)	19	21	21	20	20
Crop Production (Mt)	895	1 100	1 168	1 235	1 406
Total Cropland (Mha)	349	360	396	361	438
Irrigated Cropland (Mha)	31	33	33	35	35
Potential Cultivable Land (Mha)	637	633	635	630	635
Cereal Harvest Yield (t/ha)	2.73	3,48	3.45	4.03	3.99
Meat and Milk SSR	1.07	1.13	1.14	1,23	1.26
Fish SSR	0.83	0.89	0.89	0.88	0.88
Crop SSR	0.95	1.02	1.07	1.07	1.18
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	516	569	483	602	429
Agriculture (%)	34	35	40	36	46
Industry (%)	52	52	46	51	38
Domestic (%)	14	13	15	13	16
Water Use/Resource Ratio (%)	6	7	6	7	5
Population in Water Stress (million)	205	225	192	230	164
Air					
Carbon Emissions (MtC)	1 869	2 171	1 852	2 383	1 504
Sulfur Emissions (MtS)	20.2	19.5	16.8	18.3	12.1
Land and Forest					
Total Land Area (Mha)	2 359	2 359	2 359	2 359	2 359
Built Environment (%)	2	2	2	2	2
Cropland (%)	15	15	17	15	19
Grazing (%)	8	8	8	8	8
Natural Forest (%)	40	40	40	39	40
Plantation (%)	1	1	1	2	2
Other (%)	35	34	32	34	30
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	11	16	14	18	15
Municipal Solid Waste Generation (Mt)	255	330	303	396	338
Recycled Share (%)	7	18	20	26	31
Toxic Waste (Mt)	7.3	9.3	5.5	11.2	3.3

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Eastern Europe

EUROPE Eastern Europe



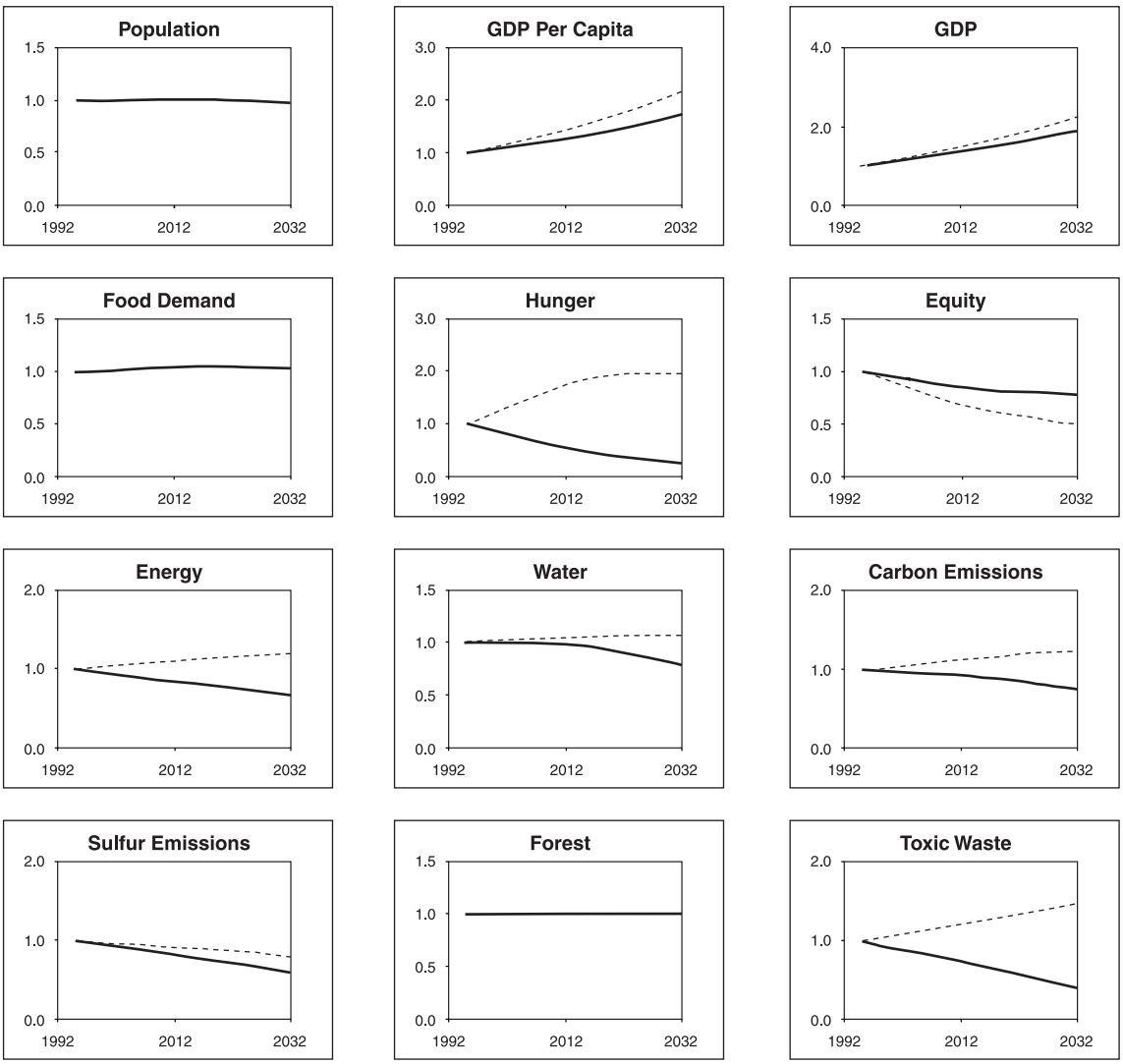
Note: Values indexed to 1 in 1995

Eastern Europe	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	231	223	220	211	205
Urbanization (%)	73	80	80	85	85
Economy and Society					
GDP (Billion US$ PPP)	931	1 330	1 469	1 734	2 070
Agriculture (%)	11	7	7	5	4
Industry (%)	38	35	35	34	33
Services (%)	51	58	59	61	63
GDP per capita (1995 US$ PPP)	4 034	5 967	6 683	8 227	10 105
Hunger Incidence (% of population)	6	7	4	7	3
National Equity (L20%/H20%)	0.16	0.11	0.15	0.09	0.15
Energy					
Primary Energy Requirement (EJ)	37.4	44.4	41.3	47.1	41.2
Coal	7.5	7.4	5.5	7.1	3.2
Petroleum	8.2	12.6	11.2	14.0	8.3
Natural Gas	18.4	20.2	20.7	21.2	19.5
Uranium	1.9	2.6	1.6	3.2	2.6
Hydropower	0.7	0.8	0.8	0.8	0.9
Renewables	0.7	0.8	1.4	0.8	6.8
Primary Energy Intensity (MJ/$PPP)	40	33	28	27	20
Final Fuel Demand (EJ)	25.8	30.1	30.1	32.6	31.0
Agriculture	2.3	2.1	2.0	1.8	1.6
Households	9.5	8.8	8.6	7.9	7.2
Industry	10.8	14.0	14.8	15.9	16.3
Services	1.0	1.6	1.7	2.0	2.2
Transport	2.1	3.6	3.0	5.0	3.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 727	2 975	3 031	3 116	3 183
Share from Animal Products (%)	23	24	24	25	25
Meat and Milk Production (Mt)	78	92	94	103	107
Fraction of Meat from Feedlots (%)	32	38	39	42	44
Fish Production (Mt)	5	6	6	6	6
Crop Production (Mt)	211	319	354	364	451
Total Cropland (Mha)	179	193	221	193	252
Irrigated Cropland (Mha)	10	11	11	11	11
Potential Cultivable Land (Mha)	370	369	369	368	369
Cereal Harvest Yield (t/ha)	1.48	2.37	2.36	2.81	2.80
Meat and Milk SSR	0.98	1.05	1.06	1.16	1.19
Fish SSR	1.18	1.57	1.57	1.55	1.55
Crop SSR	0.82	1.04	1.11	1.09	1.27
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	150	163	124	169	129
Agriculture (%)	27	29	34	31	37
Industry (%)	58	57	49	55	47
Domestic (%)	15	14	17	14	16
Water Use/Resource Ratio (%)	3	3	3	4	3
Population in Water Stress (million)	24	32	22	32	22
Air					
Carbon Emissions (MtC)	638	701	630	731	494
Sulfur Emissions (MtS)	8.2	7.3	6.2	6.4	4.0
Land and Forest					
Total Land Area (Mha)	1 789	1 789	1 789	1 789	1 789
Built Environment (%)	1	1	1	1	1
Cropland (%)	10	11	12	11	14
Grazing (%)	6	6	6	6	6
Natural Forest (%)	43	42	42	42	43
Plantation (%)	1	1	1	1	1
Other (%)	41	39	38	39	36
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	2	5	5	6	6
Municipal Solid Waste Generation (Mt)	43	50	52	55	60
Recycled Share (%)	0	2	4	4	12
Toxic Waste (Mt)	1.2	1.5	1.0	1.8	0.6

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Western Europe



Note: Values indexed to 1 in 1995

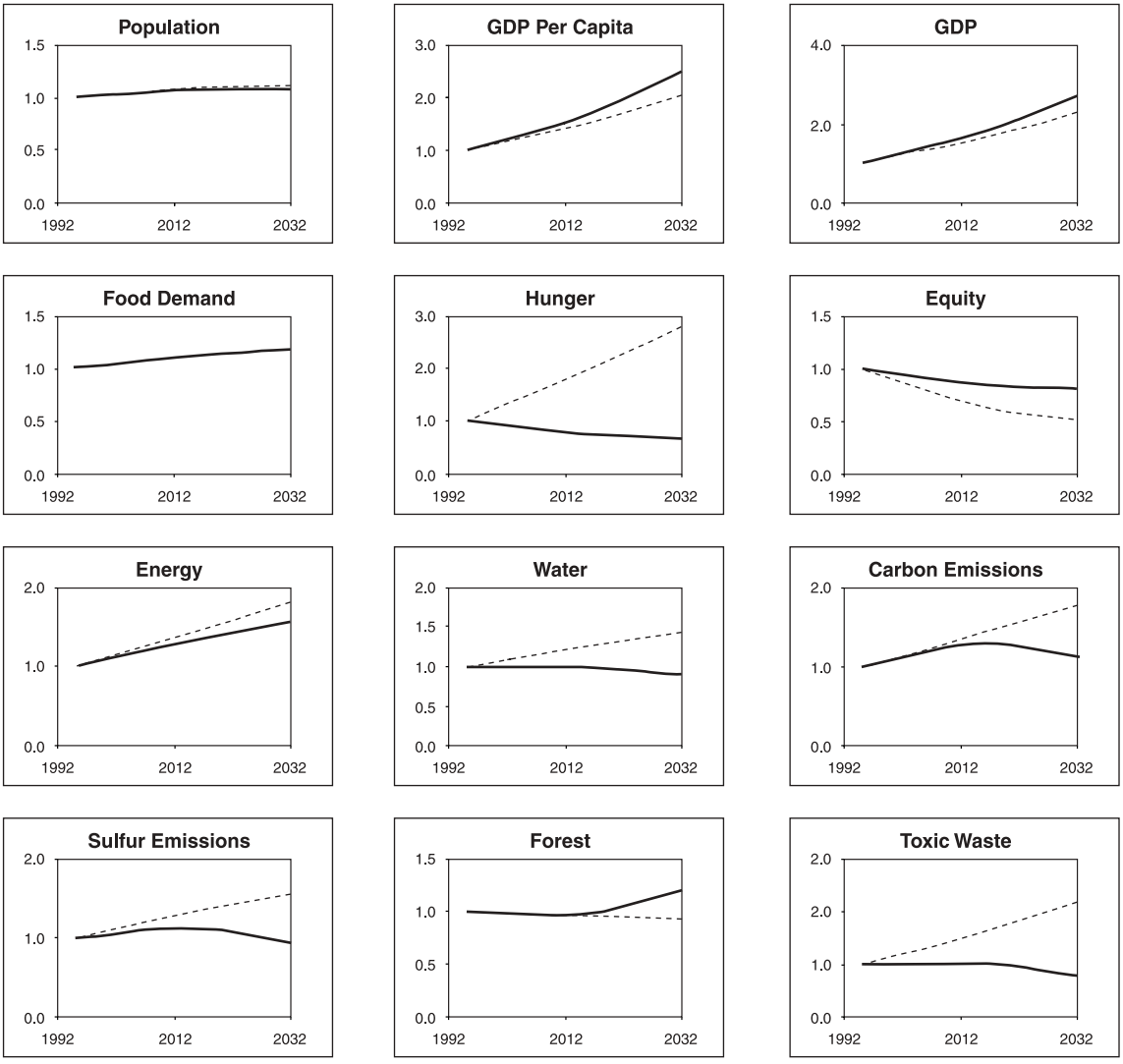
Western Europe	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	390	395	395	382	382
Urbanization (%)	78	83	83	87	87
Economy and Society					
GDP (Billion US$ PPP)	7 511	11 526	10 305	15 752	12 745
Agriculture (%)	3	2	2	1	2
Industry (%)	32	29	29	28	28
Services (%)	65	69	69	71	71
GDP per capita (1995 US$ PPP)	19 270	29 200	26 107	41 256	33 379
Hunger Incidence (% of population)	0	1	0	1	0
National Equity (L20%/H20%)	0.21	0.13	0.18	0.10	0.16
Energy					
Primary Energy Requirement (EJ)	63.2	70.8	50.7	75.1	42.1
Coal	9.4	9.5	8.6	9.5	6.4
Petroleum	29.3	33.9	24.9	36.3	19.5
Natural Gas	12.0	14.2	12.8	16.1	11.7
Uranium	9.1	8.6	0.6	7.4	0.0
Hydropower	1.6	1.9	1.6	2.1	1.5
Renewables	1.8	2.7	2.4	3.8	2.9
Primary Energy Intensity (MJ/$PPP)	8	6	5	5	3
Final Fuel Demand (EJ)	45.0	50.9	40.0	54.9	34.4
Agriculture	1.1	1.0	0.9	0.9	0.8
Households	11.0	9.7	9.3	8.3	7.7
Industry	14.9	16.0	12.4	16.6	10.2
Services	4.0	5.3	4.1	6.5	3.9
Transport	14.0	18.9	13.3	22.6	11.9
Food and Agriculture					
Average Daily Consumption (kcal/cap)	3 221	3 320	3 320	3 378	3 378
Share from Animal Products (%)	32	31	31	31	31
Meat and Milk Production (Mt)	183	198	200	212	218
Fraction of Meat from Feedlots (%)	28	30	30	32	33
Fish Production (Mt)	13	13	13	13	13
Crop Production (Mt)	442	481	512	519	610
Total Cropland (Mha)	89	86	94	86	106
Irrigated Cropland (Mha)	12	13	13	13	13
Potential Cultivable Land (Mha)	143	142	143	142	143
Cereal Harvest Yield (t/ha)	4.98	5.81	5.79	6.50	6.45
Meat and Milk SSR	1.11	1.16	1.17	1.27	1.30
Fish SSR	0.78	0.78	0.78	0.78	0.78
Crop SSR	1.00	1.02	1.07	1.06	1.22
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	259	273	254	279	203
Agriculture (%)	32	33	36	35	43
Industry (%)	55	54	50	53	41
Domestic (%)	13	13	14	12	16
Water Use/Resource Ratio (%)	13	13	12	14	10
Population in Water Stress (million)	153	143	137	140	114
Air					
Carbon Emissions (MtC)	960	1 083	867	1 170	703
Sulfur Emissions (MtS)	9.1	8.2	7.2	7.3	5.3
Land and Forest					
Total Land Area (Mha)	360	360	360	360	360
Built Environment (%)	6	7	6	7	6
Cropland (%)	25	24	26	24	29
Grazing (%)	17	17	17	16	16
Natural Forest (%)	32	32	32	31	32
Plantation (%)	2	2	2	4	2
Other (%)	20	18	17	18	14
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	6	7	6	7	6
Municipal Solid Waste Generation (Mt)	151	209	178	260	193
Recycled Share (%)	11	26	30	37	43
Toxic Waste (Mt)	5.2	6.4	3.6	7.5	2.0

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Central Europe

EUROPE Central Europe



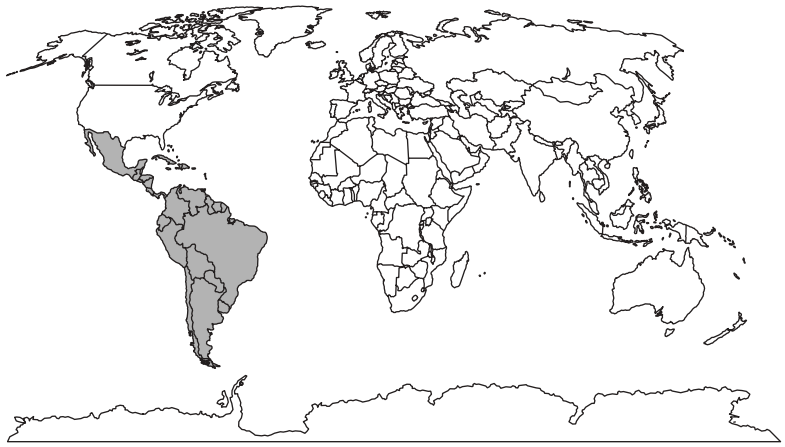
Note: Values indexed to 1 in 1995

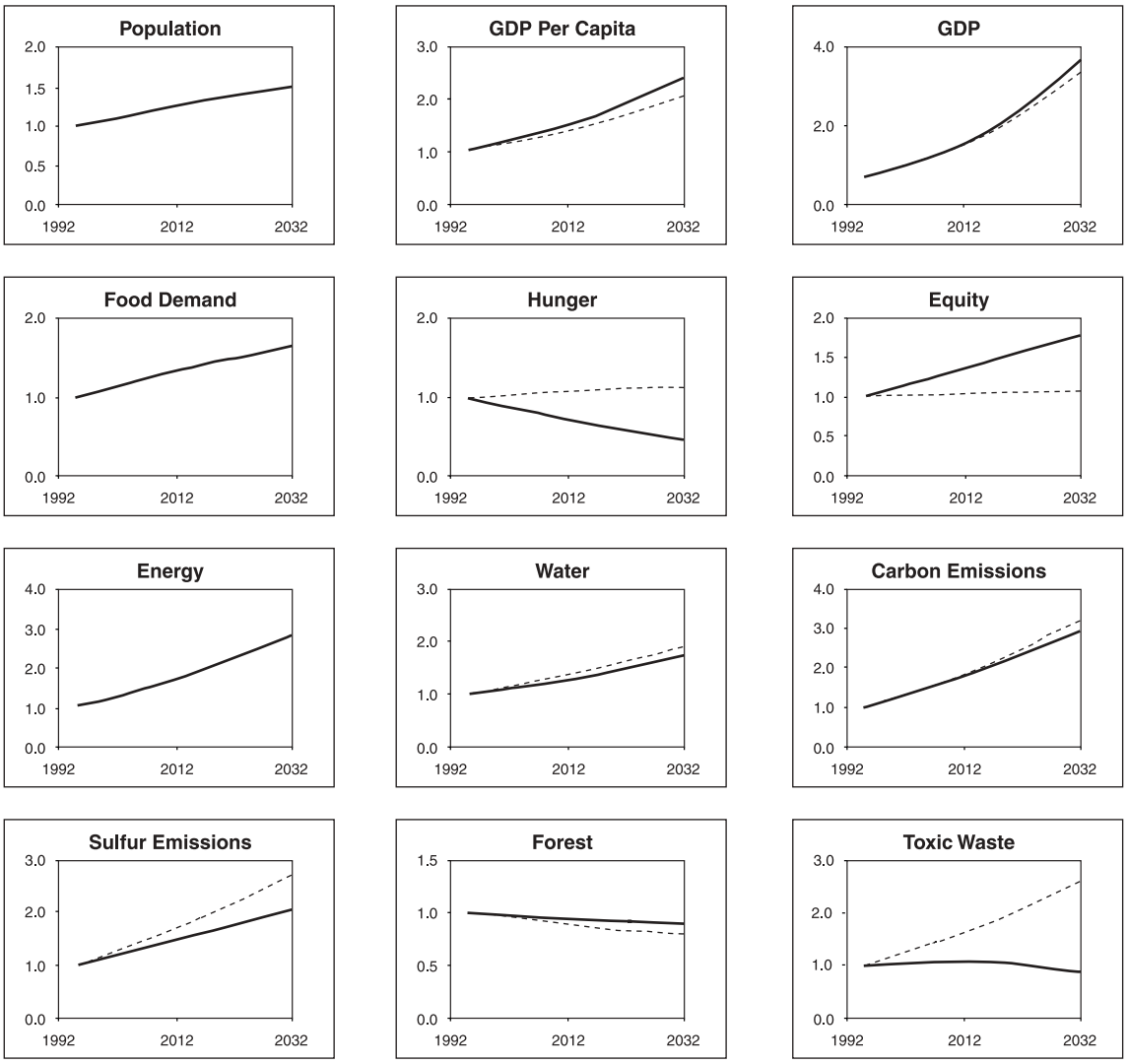
Central Europe	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	191	208	205	214	208
Urbanization (%)	64	75	75	82	82
Economy and Society					
GDP (Billion US$ PPP)	1 046	1 684	1 848	2 392	2 821
Agriculture (%)	12	8	7	6	4
Industry (%)	35	31	31	30	29
Services (%)	53	61	62	64	66
GDP per capita (1995 US$ PPP)	5 471	8 100	9 013	11 176	13 569
Hunger Incidence (% of population)	1	3	1	4	1
National Equity (L20%/H20%)	0.18	0.12	0.15	0.09	0.15
Energy					
Primary Energy Requirement (EJ)	15.3	21.7	20.4	27.6	24.0
Coal	5.9	8.0	6.4	9.4	4.5
Petroleum	4.5	6.6	5.9	8.7	5.3
Natural Gas	3.1	4.7	6.1	6.0	7.2
Uranium	0.8	1.5	0.6	2.3	1.4
Hydropower	0.3	0.4	0.4	0.5	0.5
Renewables	0.7	0.6	1.0	0.6	5.1
Primary Energy Intensity (MJ/$PPP)	15	13	11	12	8
Final Fuel Demand (EJ)	10.1	14.5	14.8	18.3	18.1
Agriculture	0.5	0.5	0.5	0.5	0.5
Households	3.1	3.7	3.7	4.1	4.1
Industry	4.2	6.1	6.3	7.5	7.3
Services	0.6	1.1	1.2	1.6	1.7
Transport	1.7	3.0	3.1	4.7	4.5
Food and Agriculture					
Average Daily Consumption (kcal/cap)	3 126	3 214	3 244	3 316	3 396
Share from Animal Products (%)	20	21	22	22	23
Meat and Milk Production (Mt)	57	72	73	87	91
Fraction of Meat from Feedlots (%)	38	45	46	50	52
Fish Production (Mt)	2	2	2	2	2
Crop Production (Mt)	242	301	302	352	346
Total Cropland (Mha)	80	81	81	82	80
Irrigated Cropland (Mha)	9	10	10	10	10
Potential Cultivable Land (Mha)	124	122	123	120	122
Cereal Harvest Yield (t/ha)	2.86	3.64	3.63	4.29	4.29
Meat and Milk SSR	1.06	1.12	1.14	1.23	1.26
Fish SSR	0.56	0.58	0.58	0.58	0.58
Crop SSR	0.99	1.03	1.02	1.06	1.02
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	107	133	105	154	97
Agriculture (%)	49	45	55	42	64
Industry (%)	39	43	30	44	18
Domestic (%)	12	13	16	13	17
Water Use/Resource Ratio (%)	9	11	8	12	8
Population in Water Stress (million)	28	50	33	59	28
Air					
Carbon Emissions (MtC)	272	387	354	482	307
Sulfur Emissions (MtS)	3.0	4.0	3.4	4.7	2.8
Land and Forest					
Total Land Area (Mha)	209	209	209	209	209
Built Environment (%)	4	4	4	5	5
Cropland (%)	38	38	39	39	38
Grazing (%)	16	16	16	16	16
Natural Forest (%)	28	27	27	26	27
Plantation (%)	2	2	2	2	8
Other (%)	14	13	12	12	6
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	3	4	3	5	3
Municipal Solid Waste Generation (Mt)	60	72	73	81	85
Recycled Share (%)	0	3	7	6	17
Toxic Waste (Mt)	0.9	1.4	0.9	2.0	0.7

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Latin America and the Caribbean





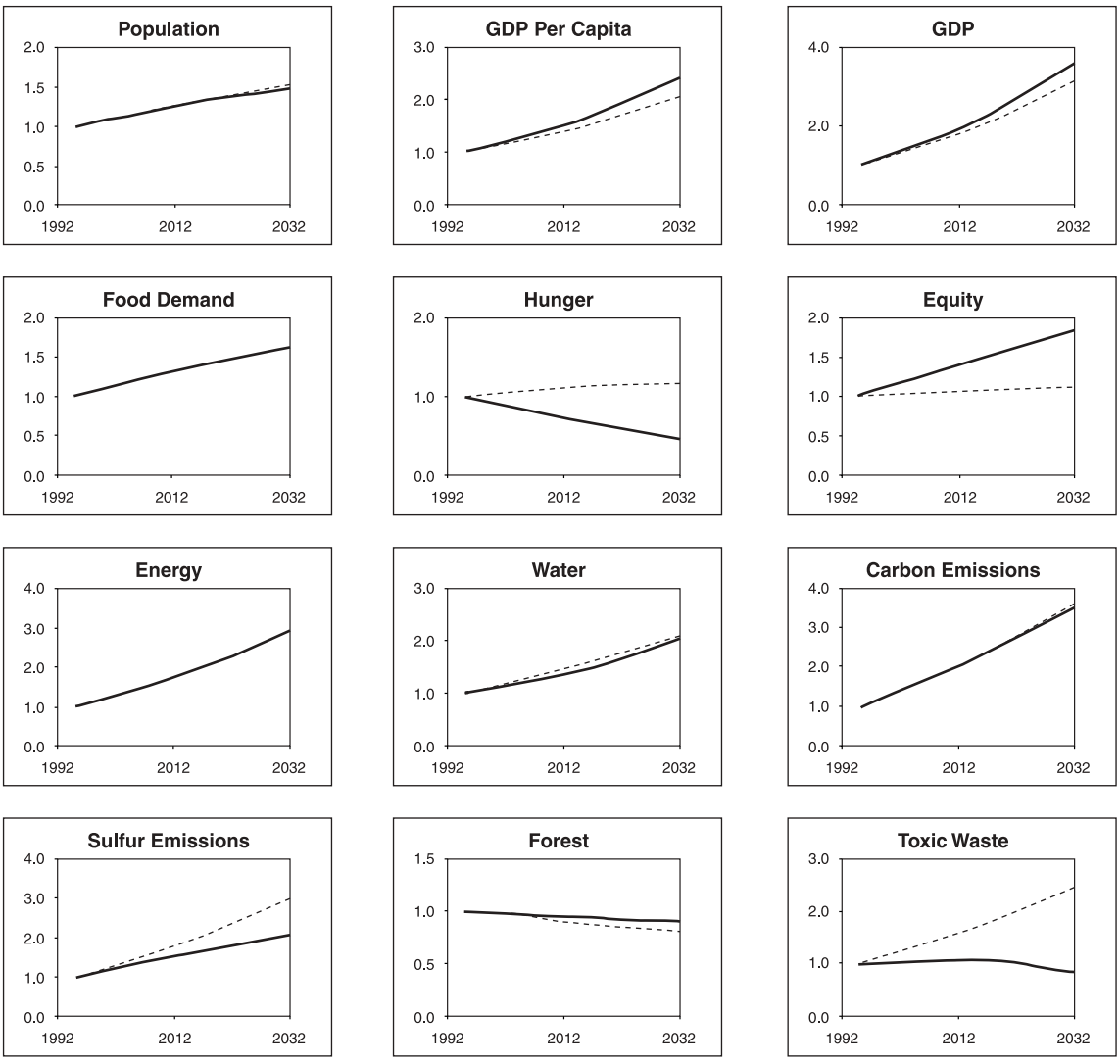
Note: Values indexed to 1 in 1995

Latin America and the Caribbean	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	480	631	623	736	715
Urbanization (%)	74	81	81	86	86
Economy and Society					
GDP (Billion US$ PPP)	2 753	5 372	5 760	8 746	9 867
Agriculture (%)	11	7	7	5	4
Industry (%)	33	30	30	29	29
Services (%)	56	63	63	66	67
GDP per capita (1995 US$ PPP)	5 736	8 512	9 250	11 880	13 795
Hunger Incidence (% of population)	11	9	6	8	3
National Equity (L20%/H20%)	0.05	0.05	0.07	0.05	0.09
Energy					
Primary Energy Requirement (EJ)	23.3	43.7	43.2	67.3	65.2
Coal	0.8	2.1	1.5	4.0	2.0
Petroleum	12.0	21.0	20.1	30.8	28.1
Natural Gas	4.1	10.1	11.2	17.2	19.2
Uranium	0.2	1.0	0.0	2.5	0.2
Hydropower	1.8	2.9	3.0	4.3	4.6
Renewables	4.4	6.6	7.3	8.4	11.1
Primary Energy Intensity (MJ/$PPP)	8	8	7	8	7
Final Fuel Demand (EJ)	17.0	31.9	32.8	48.7	49.3
Agriculture	0.7	0.9	0.9	1.0	0.9
Households	3.2	6.4	6.7	10.0	10.7
Industry	7.0	13.0	13.3	19.4	19.0
Services	0.7	1.7	1.9	3.2	3.5
Transport	5.4	10.0	10.0	15.0	15.2
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 650	2 781	2 808	2 876	2 918
Share from Animal Products (%)	17	19	19	20	20
Meat and Milk Production (Mt)	79	120	122	151	153
Fraction of Meat from Feedlots (%)	12	18	29	20	34
Fish Production (Mt)	22	30	29	34	33
Crop Production (Mt)	837	1 033	1 029	1 314	1 339
Total Cropland (Mha)	155	166	203	172	206
Irrigated Cropland (Mha)	18	20	20	22	21
Potential Cultivable Land (Mha)	976	958	963	940	959
Cereal Harvest Yield (t/ha)	2.55	2.97	2.89	3.31	3.25
Meat and Milk SSR	0.93	0.95	0.95	0.93	0.93
Fish SSR	2.82	2.90	2.90	2.81	2.82
Crop SSR	1.61	1.14	1.19	1.18	1.25
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	201	292	267	388	353
Agriculture (%)	74	65	63	59	55
Industry (%)	10	18	18	23	25
Domestic (%)	16	17	19	18	20
Water Use/Resource Ratio (%)	1	2	2	3	3
Population in Water Stress (million)	42	77	72	107	95
Air					
Carbon Emissions (MtC)	287	586	566	917	838
Sulfur Emissions (MtS)	3.1	5.6	4.8	8.4	6.4
Land and Forest					
Total Land Area (Mha)	2 017	2 017	2 017	2 017	2 017
Built Environment (%)	1	2	2	2	2
Cropland (%)	8	8	10	9	10
Grazing (%)	30	35	33	39	35
Natural Forest (%)	50	43	46	39	44
Plantation (%)	0	0	0	1	1
Other (%)	12	11	9	10	8
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	5	8	8	10	8
Municipal Solid Waste Generation (Mt)	91	153	156	223	235
Recycled Share (%)	15	16	19	17	26
Toxic Waste (Mt)	3.0	5.2	3.3	7.8	2.6

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

South America



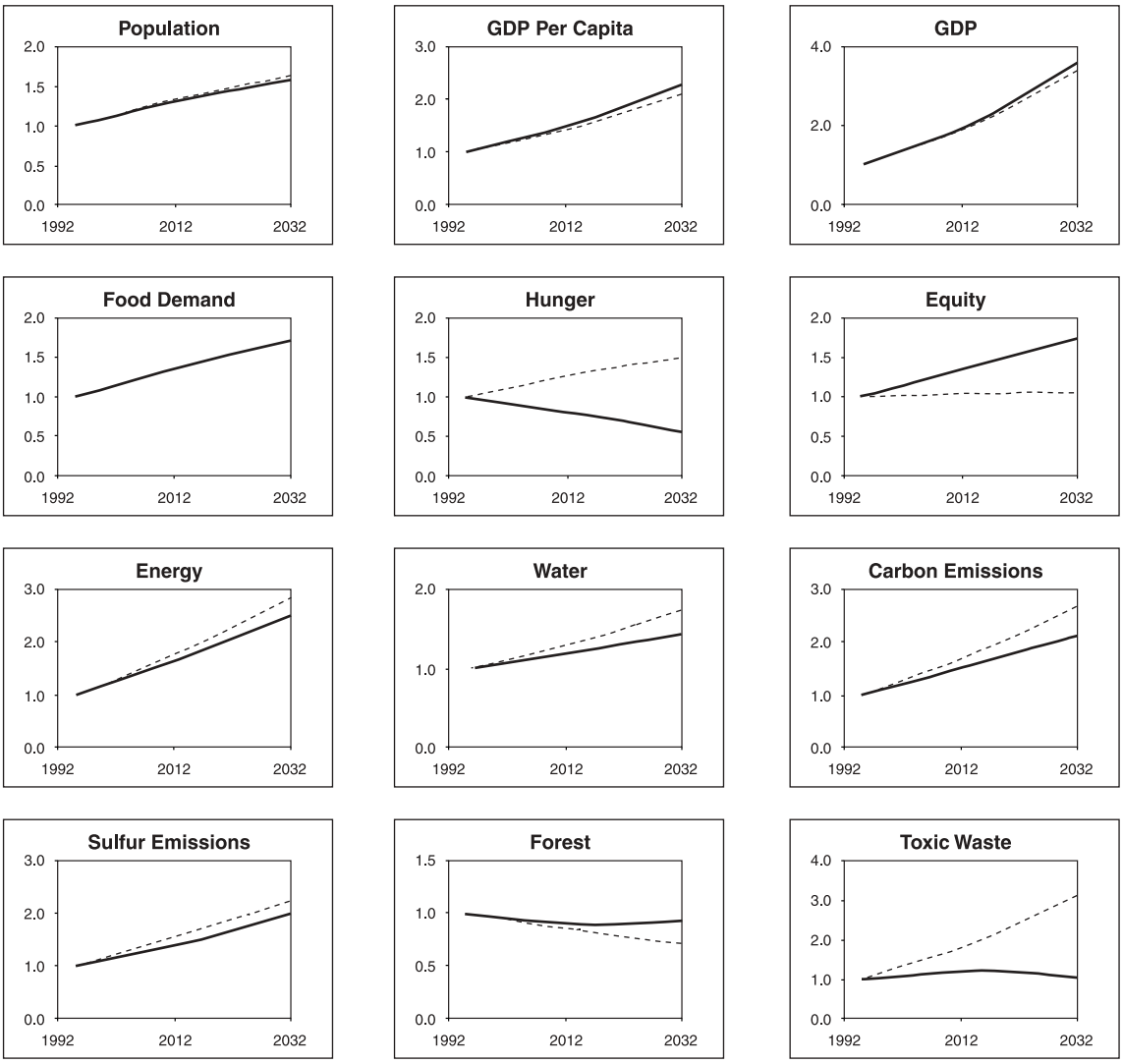
Note: Values indexed to 1 in 1995

South America	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	321	418	413	487	473
Urbanization (%)	78	85	85	90	90
Economy and Society					
GDP (Billion US$ PPP)	1 915	3 690	3 996	5 976	6 865
Agriculture (%)	12	7	7	5	4
Industry (%)	36	32	32	31	30
Services (%)	53	60	61	64	66
GDP per capita (1995 US$ PPP)	5 973	8 820	9 679	12 284	14 524
Hunger Incidence (% of population)	10	9	5	8	3
National Equity (L20%/H20%)	0.05	0.05	0.07	0.05	0.09
Energy					
Primary Energy Requirement (EJ)	15.3	29.0	29.1	45.3	44.7
Coal	0.5	1.7	1.2	3.7	1.6
Petroleum	7.1	12.5	12.6	19.1	18.5
Natural Gas	2.5	6.6	7.9	10.8	14.0
Uranium	0.1	0.7	0.0	1.8	0.2
Hydropower	1.6	2.5	2.6	3.6	3.8
Renewables	3.4	5.0	4.8	6.3	6.8
Primary Energy Intensity (MJ/$PPP)	8	8	7	8	7
Final Fuel Demand (EJ)	11.0	20.8	21.7	32.0	33.0
Agriculture	0.6	0.7	0.7	0.8	0.7
Households	2.0	4.1	4.4	6.6	7.2
Industry	4.4	8.2	8.4	12.2	11.7
Services	0.6	1.3	1.4	2.3	2.6
Transport	3.4	6.5	6.8	10.1	10.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 669	2 794	2 822	2 887	2 929
Share from Animal Products (%)	19	20	21	22	22
Meat and Milk Production (Mt)	61	94	95	118	119
Fraction of Meat from Feedlots (%)	11	15	29	16	33
Fish Production (Mt)	20	27	26	30	29
Crop Production (Mt)	643	767	754	975	990
Total Cropland (Mha)	111	116	153	118	158
Irrigated Cropland (Mha)	10	11	11	12	12
Potential Cultivable Land (Mha)	901	887	892	875	889
Cereal Harvest Yield (t/ha)	2.62	3.09	2.93	3.46	3.29
Meat and Milk SSR	0.96	1.01	1.01	1.00	1.00
Fish SSR	3.35	3.37	3.38	3.27	3.28
Crop SSR	1.78	1.15	1.20	1.19	1.28
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	105	164	150	223	218
Agriculture (%)	64	52	50	46	43
Industry (%)	13	25	26	32	34
Domestic (%)	24	23	24	23	23
Water Use/Resource Ratio (%)	1	1	1	2	2
Population in Water Stress (million)	4	10	9	17	16
Air					
Carbon Emissions (MtC)	164	366	373	596	576
Sulfur Emissions (MtS)	2.0	3.8	3.2	6.0	4.1
Land and Forest					
Total Land Area (Mha)	1 752	1 752	1 752	1 752	1 752
Built Environment (%)	1	1	1	2	1
Cropland (%)	6	7	9	7	9
Grazing (%)	29	35	32	39	34
Natural Forest (%)	53	47	50	42	47
Plantation (%)	0	0	0	1	1
Other (%)	11	10	8	10	7
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	3	5	5	7	6
Municipal Solid Waste Generation (Mt)	64	106	109	154	164
Recycled Share (%)	15	16	19	17	27
Toxic Waste (Mt)	2.3	3.8	2.4	5.6	1.9

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Meso-America



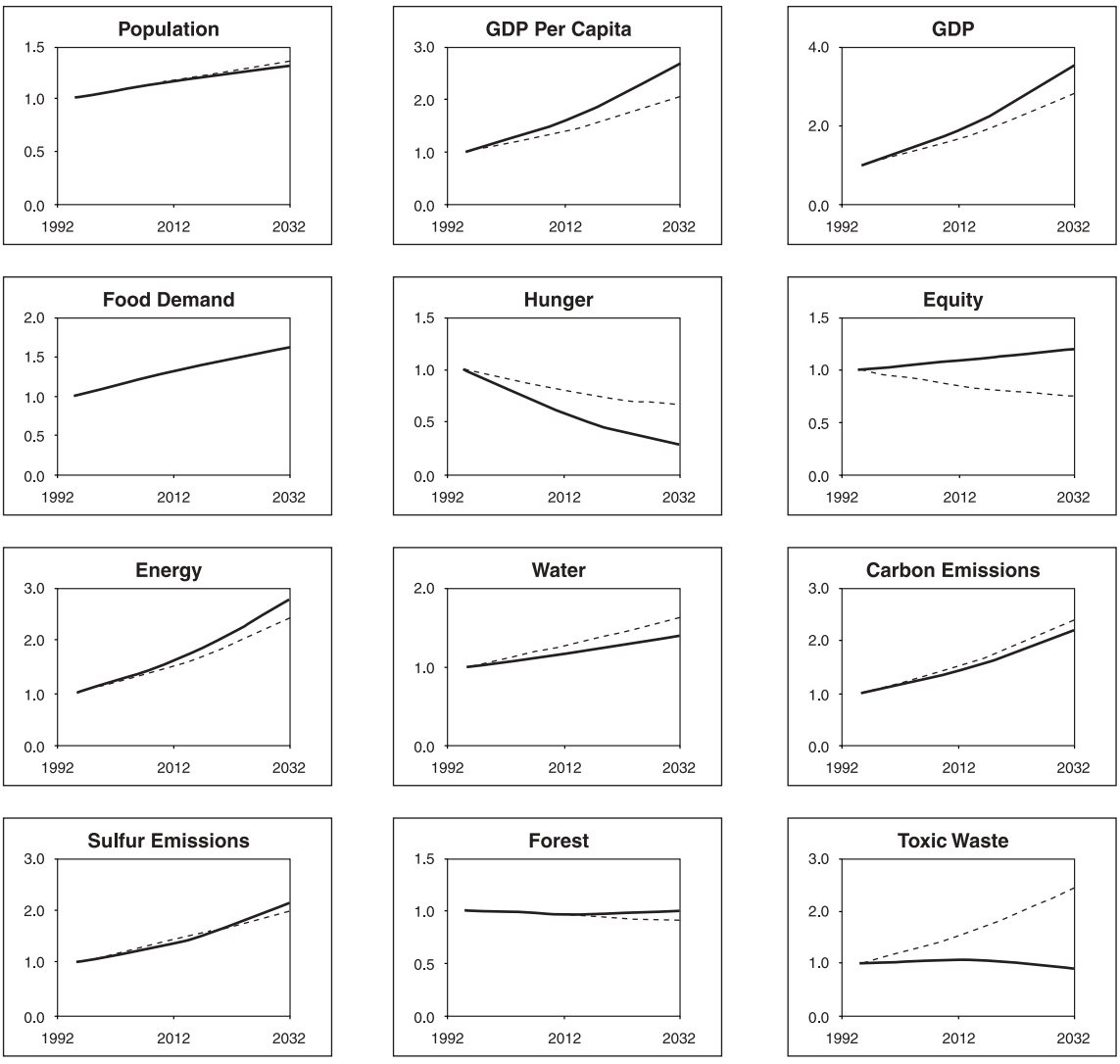
Note: Values indexed to 1 in 1995

Meso-America	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	123	169	167	200	195
Urbanization (%)	68	76	76	81	81
Economy and Society					
GDP (Billion US$ PPP)	724	1 477	1 529	2 449	2 597
Agriculture (%)	9	6	6	4	4
Industry (%)	25	26	26	26	26
Services (%)	66	68	69	70	70
GDP per capita (1995 US$ PPP)	5 877	8 745	9 177	12 217	13 334
Hunger Incidence (% of population)	8	8	5	8	3
National Equity (L20%/H20%)	0.05	0.05	0.07	0.06	0.09
Energy					
Primary Energy Requirement (EJ)	6.5	12.2	11.4	18.3	16.2
Coal	0.2	0.3	0.3	0.3	0.4
Petroleum	4.1	7.4	6.4	10.1	8.1
Natural Gas	1.2	2.8	2.6	5.2	4.1
Uranium	0.1	0.3	0.0	0.6	0.0
Hydropower	0.1	0.4	0.4	0.7	0.7
Renewables	0.7	1.0	1.7	1.4	2.9
Primary Energy Intensity (MJ/$PPP)	9	8	7	7	6
Final Fuel Demand (EJ)	4.9	9.2	8.9	13.7	12.8
Agriculture	0.1	0.1	0.1	0.2	0.2
Households	1.0	1.9	2.0	3.0	3.0
Industry	1.9	3.6	3.6	5.5	5.2
Services	0.2	0.4	0.4	0.8	0.8
Transport	1.7	3.1	2.8	4.3	3.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 817	2 923	2 938	2 999	3 023
Share from Animal Products (%)	14	15	16	17	17
Meat and Milk Production (Mt)	16	23	23	30	30
Fraction of Meat from Feedlots (%)	18	30	31	37	37
Fish Production (Mt)	2	3	3	3	3
Crop Production (Mt)	142	199	205	257	262
Total Cropland (Mha)	36	43	42	46	41
Irrigated Cropland (Mha)	7	7	7	8	8
Potential Cultivable Land (Mha)	63	58	60	54	59
Cereal Harvest Yield (t/ha)	2.40	2.74	2.78	3.02	3.17
Meat and Milk SSR	0.88	0.82	0.82	0.79	0.79
Fish SSR	1.21	1.51	1.51	1.49	1.49
Crop SSR	1.08	1.01	1.05	1.05	1.09
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	84	114	103	146	119
Agriculture (%)	86	80	79	75	75
Industry (%)	8	11	10	14	11
Domestic (%)	6	9	11	11	13
Water Use/Resource Ratio (%)	8	11	10	14	12
Population in Water Stress (million)	32	58	55	76	68
Air					
Carbon Emissions (MtC)	105	190	166	278	222
Sulfur Emissions (MtS)	1.0	1.6	1.5	2.2	2.0
Land and Forest					
Total Land Area (Mha)	242	242	242	242	242
Built Environment (%)	3	4	4	5	4
Cropland (%)	15	18	17	19	17
Grazing (%)	38	41	41	43	43
Natural Forest (%)	29	24	26	20	27
Plantation (%)	0	0	0	0	0
Other (%)	15	14	12	13	9
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	2	3	2	3	2
Municipal Solid Waste Generation (Mt)	21	38	39	57	59
Recycled Share (%)	15	16	18	17	25
Toxic Waste (Mt)	0.6	1.2	0.8	2.0	0.6

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Caribbean



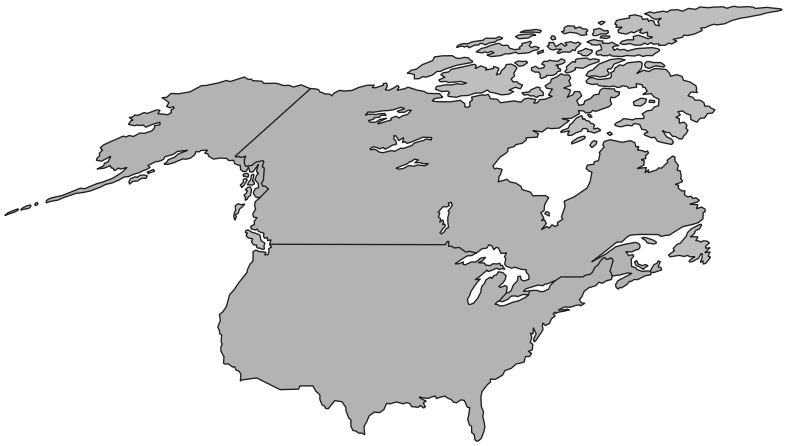
Note: Values indexed to 1 in 1995

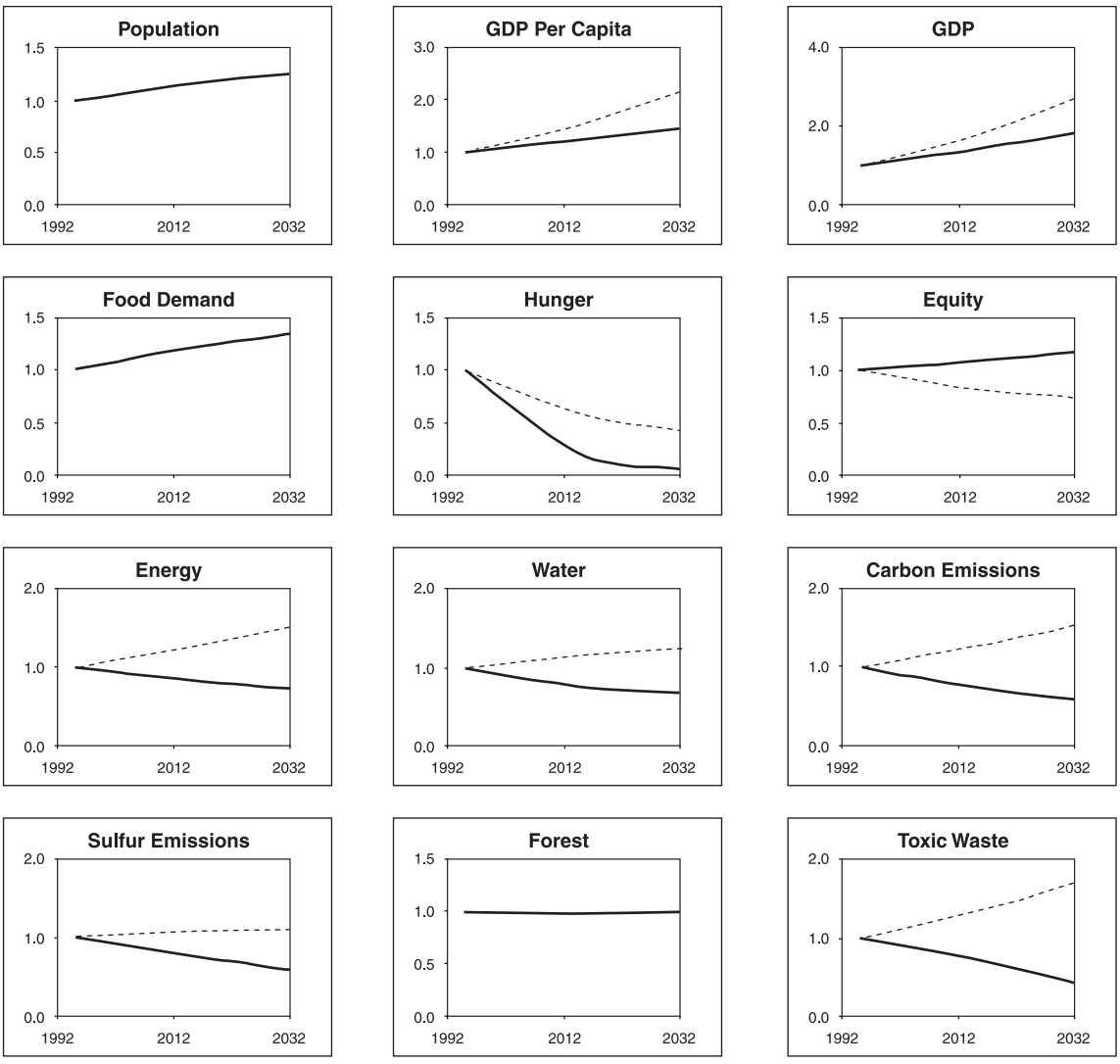
Caribbean	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	36	44	43	49	48
Urbanization (%)	62	70	70	76	76
Economy and Society					
GDP (Billion US$ PPP)	114	205	235	321	405
Agriculture (%)	14	10	8	7	6
Industry (%)	28	25	25	25	26
Services (%)	58	65	66	68	69
GDP per capita (1995 US$ PPP)	3 156	4 673	5 435	6 516	8 469
Hunger Incidence (% of population)	30	19	13	15	7
National Equity (L20%/H20%)	0.09	0.08	0.10	0.07	0.11
Energy					
Primary Energy Requirement (EJ)	1.5	2.5	2.7	3.7	4.2
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	0.8	1.2	1.1	1.6	1.5
Natural Gas	0.4	0.7	0.7	1.2	1.1
Uranium	0.0	0.0	0.0	0.1	0.0
Hydropower	0.0	0.0	0.1	0.1	0.1
Renewables	0.3	0.5	0.8	0.8	1.5
Primary Energy Intensity (MJ/$PPP)	13	12	11	12	10
Final Fuel Demand (EJ)	1.1	1.9	2.2	2.9	3.4
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	0.2	0.3	0.3	0.4	0.5
Industry	0.7	1.2	1.4	1.8	2.1
Services	0.0	0.0	0.0	0.1	0.1
Transport	0.2	0.4	0.4	0.6	0.8
Food and Agriculture					
Average Daily Consumption (kcal/cap)	1 919	2 112	2 183	2 267	2 382
Share from Animal Products (%)	12	14	14	15	16
Meat and Milk Production (Mt)	2	3	3	4	4
Fraction of Meat from Feedlots (%)	24	37	41	44	50
Fish Production (Mt)	0	0	0	0	0
Crop Production (Mt)	52	67	70	83	87
Total Cropland (Mha)	8	7	8	7	8
Irrigated Cropland (Mha)	1	2	2	2	2
Potential Cultivable Land (Mha)	12	12	12	12	12
Cereal Harvest Yield (t/ha)	1.74	2.00	1.96	2.23	2.27
Meat and Milk SSR	0.61	0.58	0.58	0.57	0.56
Fish SSR	0.46	0.45	0.45	0.45	0.45
Crop SSR	1.82	1.64	1.63	1.63	1.61
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	12	15	14	19	16
Agriculture (%)	88	85	78	82	74
Industry (%)	3	4	4	6	5
Domestic (%)	8	10	17	12	20
Water Use/Resource Ratio (%)	15	19	18	24	21
Population in Water Stress (million)	7	9	8	14	10
Air					
Carbon Emissions (MtC)	18	30	28	43	40
Sulfur Emissions (MtS)	0.1	0.2	0.2	0.3	0.3
Land and Forest					
Total Land Area (Mha)	23	23	23	23	23
Built Environment (%)	8	10	10	11	11
Cropland (%)	33	32	34	32	33
Grazing (%)	23	25	24	26	24
Natural Forest (%)	19	18	18	16	17
Plantation (%)	1	1	1	2	2
Other (%)	17	15	14	13	12
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	0	0	0	0
Municipal Solid Waste Generation (Mt)	6	8	9	11	12
Recycled Share (%)	15	15	17	16	21
Toxic Waste (Mt)	0.1	0.2	0.1	0.3	0.1

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

North America





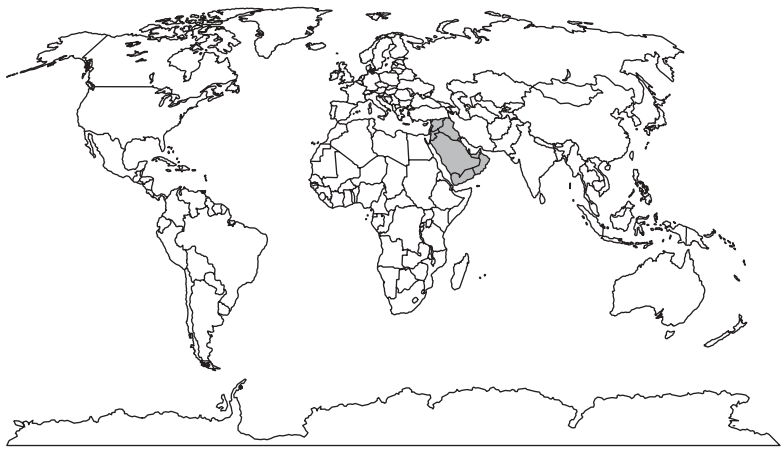
Note: Values indexed to 1 in 1995

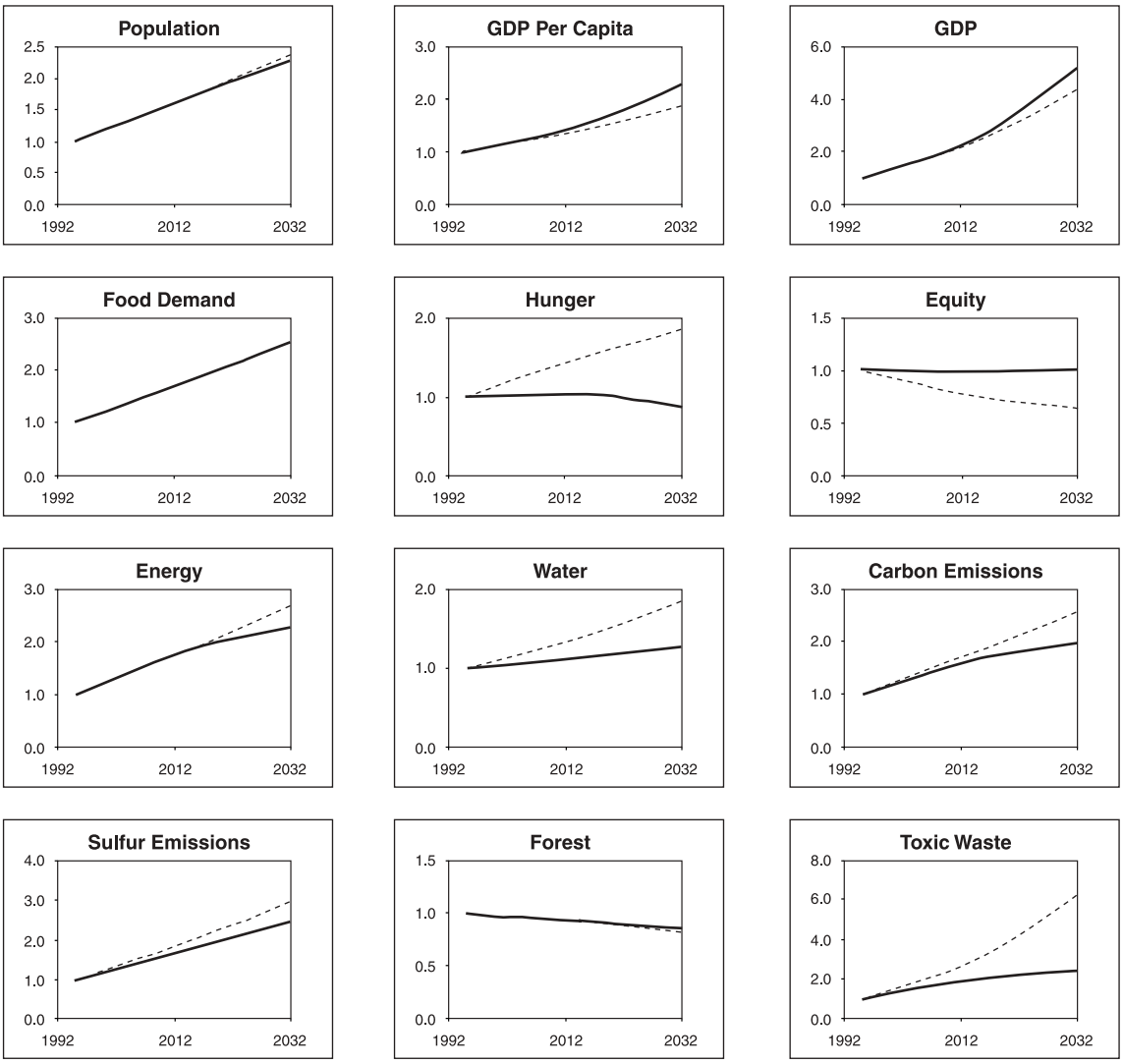
North America	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	297	343	343	374	374
Urbanization (%)	76	82	82	86	86
Economy and Society					
GDP (Billion US$ PPP)	7 851	13 757	11 034	21 135	14 137
Agriculture (%)	2	1	2	1	1
Industry (%)	26	24	24	23	23
Services (%)	72	74	74	76	76
GDP per capita (1995 US$ PPP)	26 466	40 105	32 165	56 445	37 755
Hunger Incidence (% of population)	2	1	0	1	0
National Equity (L20%/H20%)	0.10	0.08	0.11	0.07	0.12
Energy					
Primary Energy Requirement (EJ)	99.0	124.4	81.7	147.9	71.1
Coal	20.5	22.5	15.4	23.8	11.6
Petroleum	40.2	55.2	27.4	69.2	19.9
Natural Gas	23.8	29.0	20.3	34.7	17.6
Uranium	8.9	9.8	3.6	9.8	2.3
Hydropower	2.3	2.7	2.4	2.9	2.4
Renewables	3.3	5.2	12.5	7.5	17.3
Primary Energy Intensity (MJ/$PPP)	13	9	7	7	5
Final Fuel Demand (EJ)	66.4	86.6	62.0	106.1	57.0
Agriculture	0.8	0.8	0.8	0.8	0.7
Households	11.6	11.7	11.2	11.3	10.5
Industry	20.7	24.8	18.1	28.3	15.6
Services	8.2	10.7	8.5	13.4	8.5
Transport	25.1	38.5	23.4	52.1	21.7
Food and Agriculture					
Average Daily Consumption (kcal/cap)	3 275	3 442	3 442	3 519	3 519
Share from Animal Products (%)	32	32	32	31	32
Meat and Milk Production (Mt)	124	148	149	164	165
Fraction of Meat from Feedlots (%)	43	47	47	49	49
Fish Production (Mt)	7	8	8	8	8
Crop Production (Mt)	537	655	716	793	974
Total Cropland (Mha)	227	235	257	250	303
Irrigated Cropland (Mha)	22	23	23	23	23
Potential Cultivable Land (Mha)	479	476	478	474	477
Cereal Harvest Yield (t/ha)	4.19	4.76	4.76	5.38	5.50
Meat and Milk SSR	1.00	1.00	1.00	0.99	0.99
Fish SSR	0.85	0.84	0.84	0.83	0.83
Crop SSR	1.25	1.25	1.36	1.35	1.65
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	589	671	445	729	391
Agriculture (%)	34	33	46	34	55
Industry (%)	56	57	43	57	34
Domestic (%)	10	10	11	9	12
Water Use/Resource Ratio (%)	11	12	8	14	7
Population in Water Stress (million)	72	108	60	126	45
Air					
Carbon Emissions (MtC)	1 605	2 033	1 192	2 439	919
Sulfur Emissions (MtS)	12.8	13.7	9.9	14.0	7.6
Land and Forest					
Total Land Area (Mha)	1 838	1 838	1 838	1 838	1 838
Built Environment (%)	2	2	2	3	2
Cropland (%)	12	13	14	14	17
Grazing (%)	15	14	14	14	14
Natural Forest (%)	40	38	38	34	36
Plantation (%)	1	2	2	5	4
Other (%)	31	30	29	29	26
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	8	11	10	13	10
Municipal Solid Waste Generation (Mt)	207	327	264	457	309
Recycled Share (%)	22	34	37	43	48
Toxic Waste (Mt)	3.9	5.3	2.9	6.6	1.7

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

West Asia





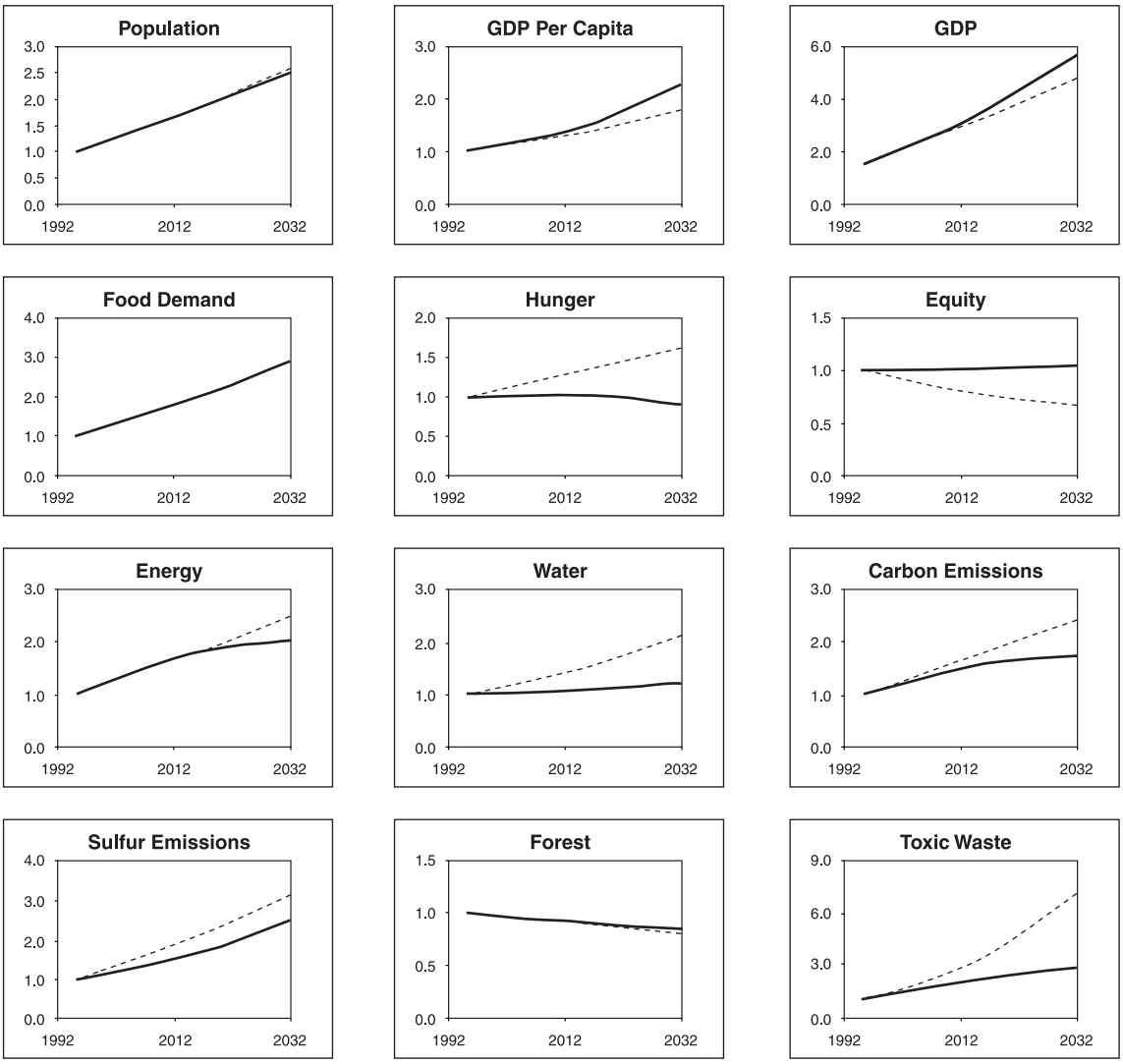
Note: Values indexed to 1 in 1995

West Asia	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	84	146	144	199	194
Urbanization (%)	72	79	79	85	85
Economy and Society					
GDP (Billion US$ PPP)	637	1 549	1 636	2 817	3 348
Agriculture (%)	12	8	7	5	4
Industry (%)	42	24	25	25	26
Services (%)	46	68	68	70	70
GDP per capita (1995 US$ PPP)	7 552	10 607	11 354	14 123	17 273
Hunger Incidence (% of population)	12	11	7	10	5
National Equity (L20%/H20%)	0.13	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	8.8	16.4	16.4	23.7	20.1
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	5.3	9.7	8.4	13.8	9.8
Natural Gas	3.5	6.2	6.6	8.4	7.2
Uranium	0.0	0.3	0.0	0.8	0.0
Hydropower	0.0	0.0	0.0	0.1	0.1
Renewables	0.0	0.2	1.3	0.6	3.1
Primary Energy Intensity (MJ/$PPP)	14	11	10	8	6
Final Fuel Demand (EJ)	5.1	11.0	10.9	17.0	15.0
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	1.8	3.2	3.1	4.3	3.7
Industry	1.6	3.8	3.9	5.9	4.3
Services	0.1	0.5	0.5	0.9	0.8
Transport	1.5	3.4	3.3	5.9	6.1
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 494	2 610	2 637	2 699	2 767
Share from Animal Products (%)	10	12	12	13	13
Meat and Milk Production (Mt)	5	9	9	13	14
Fraction of Meat from Feedlots (%)	47	49	49	51	51
Fish Production (Mt)	0	1	1	1	1
Crop Production (Mt)	34	52	47	68	57
Total Cropland (Mha)	17	16	17	15	16
Irrigated Cropland (Mha)	7	8	7	9	7
Potential Cultivable Land (Mha)	18	17	17	15	16
Cereal Harvest Yield (t/ha)	1.46	2.24	2.11	2.89	2.58
Meat and Milk SSR	0.64	0.57	0.57	0.55	0.54
Fish SSR	0.58	0.55	0.55	0.54	0.54
Crop SSR	0.47	0.42	0.38	0.40	0.34
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	80	113	92	148	103
Agriculture (%)	90	83	80	77	72
Industry (%)	4	7	9	10	13
Domestic (%)	6	10	12	13	16
Water Use/Resource Ratio (%)	51	72	59	95	66
Population in Water Stress (million)	75	135	131	190	178
Air					
Carbon Emissions (MtC)	144	265	244	371	286
Sulfur Emissions (MtS)	0.8	1.6	1.4	2.4	2.0
Land and Forest					
Total Land Area (Mha)	372	372	372	372	372
Built Environment (%)	1	2	2	3	3
Cropland (%)	5	4	4	4	4
Grazing (%)	40	40	40	40	40
Natural Forest (%)	1	1	1	1	1
Plantation (%)	0	0	0	0	0
Other (%)	52	52	52	51	51
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	1	1	1	1	1
Municipal Solid Waste Generation (Mt)	15	36	37	63	71
Recycled Share (%)	13	14	18	16	32
Toxic Waste (Mt)	0.3	0.8	0.5	1.7	0.7

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Arabian Peninsula



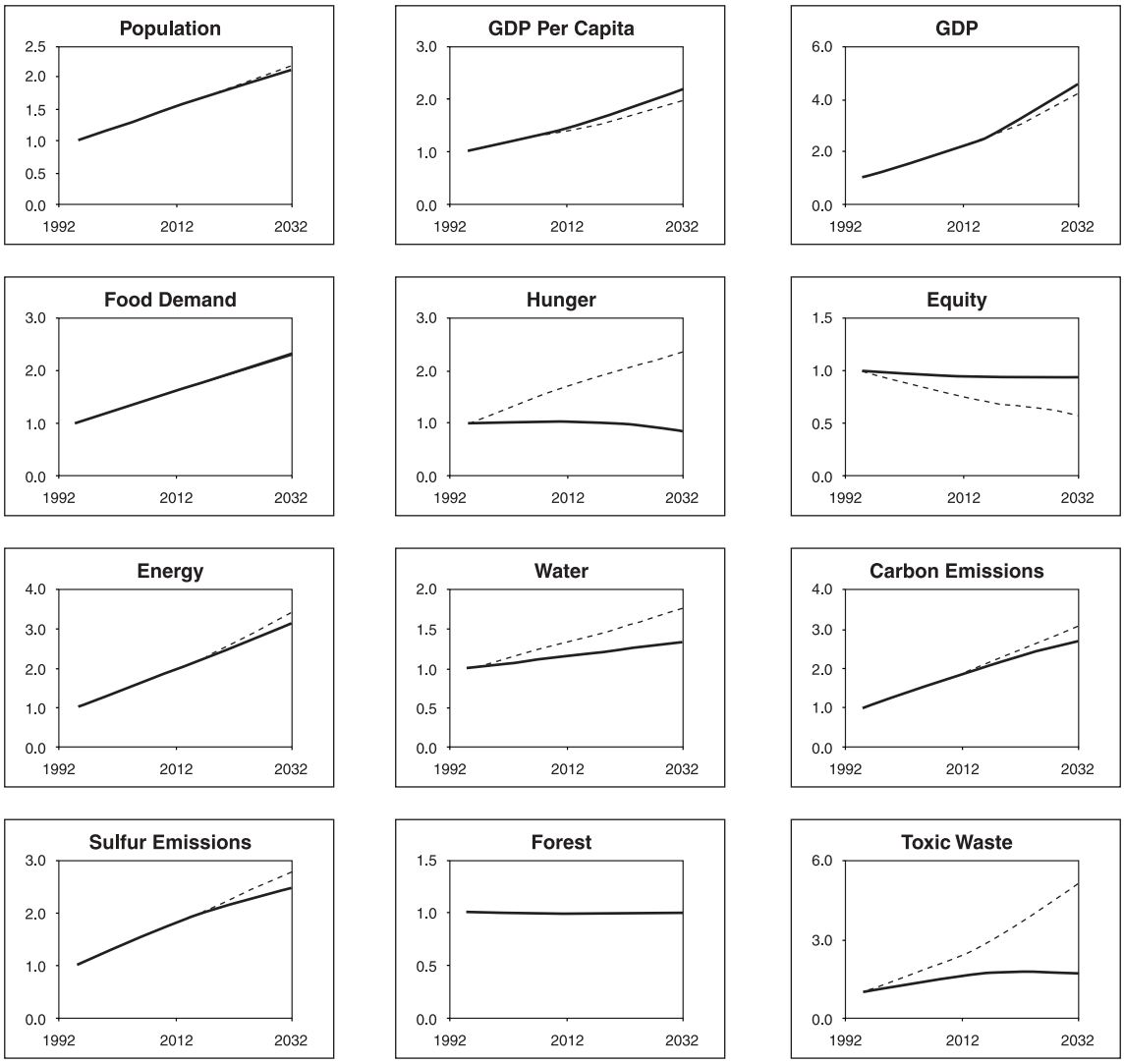
Note: Values indexed to 1 in 1995

Arabian Peninsula	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	40	73	72	104	101
Urbanization (%)	76	81	81	86	86
Economy and Society					
GDP (Billion US$ PPP)	413	1 017	1 081	1 871	2 330
Agriculture (%)	5	4	4	3	2
Industry (%)	52	24	25	25	26
Services (%)	43	72	72	72	72
GDP per capita (1995 US$ PPP)	10 223	13 848	14 919	17 952	23 013
Hunger Incidence (% of population)	17	12	10	10	6
National Equity (L20%/H20%)	0.13	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	6.9	12.2	12.1	17.0	13.9
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	3.6	6.4	5.2	9.3	5.8
Natural Gas	3.2	5.4	5.8	6.7	5.8
Uranium	0.0	0.2	0.0	0.6	0.0
Hydropower	0.0	0.0	0.0	0.0	0.0
Renewables	0.0	0.1	1.1	0.4	2.4
Primary Energy Intensity (MJ/$PPP)	17	12	11	9	6
Final Fuel Demand (EJ)	3.5	7.8	7.8	12.0	10.1
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	1.3	2.2	2.1	2.8	2.2
Industry	1.2	2.9	2.9	4.3	2.7
Services	0.1	0.5	0.4	0.7	0.6
Transport	0.9	2.3	2.2	4.1	4.6
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 307	2 437	2 475	2 541	2 647
Share from Animal Products (%)	13	14	14	15	16
Meat and Milk Production (Mt)	2	3	4	5	6
Fraction of Meat from Feedlots (%)	61	63	63	64	65
Fish Production (Mt)	0	0	0	1	1
Crop Production (Mt)	9	14	12	19	15
Total Cropland (Mha)	6	5	5	5	5
Irrigated Cropland (Mha)	2	3	2	3	2
Potential Cultivable Land (Mha)	6	5	5	5	5
Cereal Harvest Yield (t/ha)	2.42	3.65	3.46	4.72	4.30
Meat and Milk SSR	0.48	0.41	0.41	0.39	0.39
Fish SSR	0.63	0.59	0.59	0.57	0.57
Crop SSR	0.28	0.24	0.21	0.23	0.18
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	22	33	24	47	27
Agriculture (%)	88	77	71	66	57
Industry (%)	1	5	6	10	13
Domestic (%)	11	18	23	24	30
Water Use/Resource Ratio (%)	282	420	308	596	341
Population in Water Stress (million)	40	73	72	104	101
Air					
Carbon Emissions (MtC)	107	189	169	257	187
Sulfur Emissions (MtS)	0.5	1.0	0.8	1.5	1.2
Land and Forest					
Total Land Area (Mha)	300	300	300	300	300
Built Environment (%)	1	1	1	2	2
Cropland (%)	2	2	2	2	2
Grazing (%)	46	46	46	46	46
Natural Forest (%)	1	1	1	1	1
Plantation (%)	0	0	0	0	0
Other (%)	50	50	50	49	49
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	0	0	0	0
Municipal Solid Waste Generation (Mt)	8	20	21	37	44
Recycled Share (%)	13	15	20	17	39
Toxic Waste (Mt)	0.2	0.5	0.4	1.1	0.5

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Mashriq



Note: Values indexed to 1 in 1995

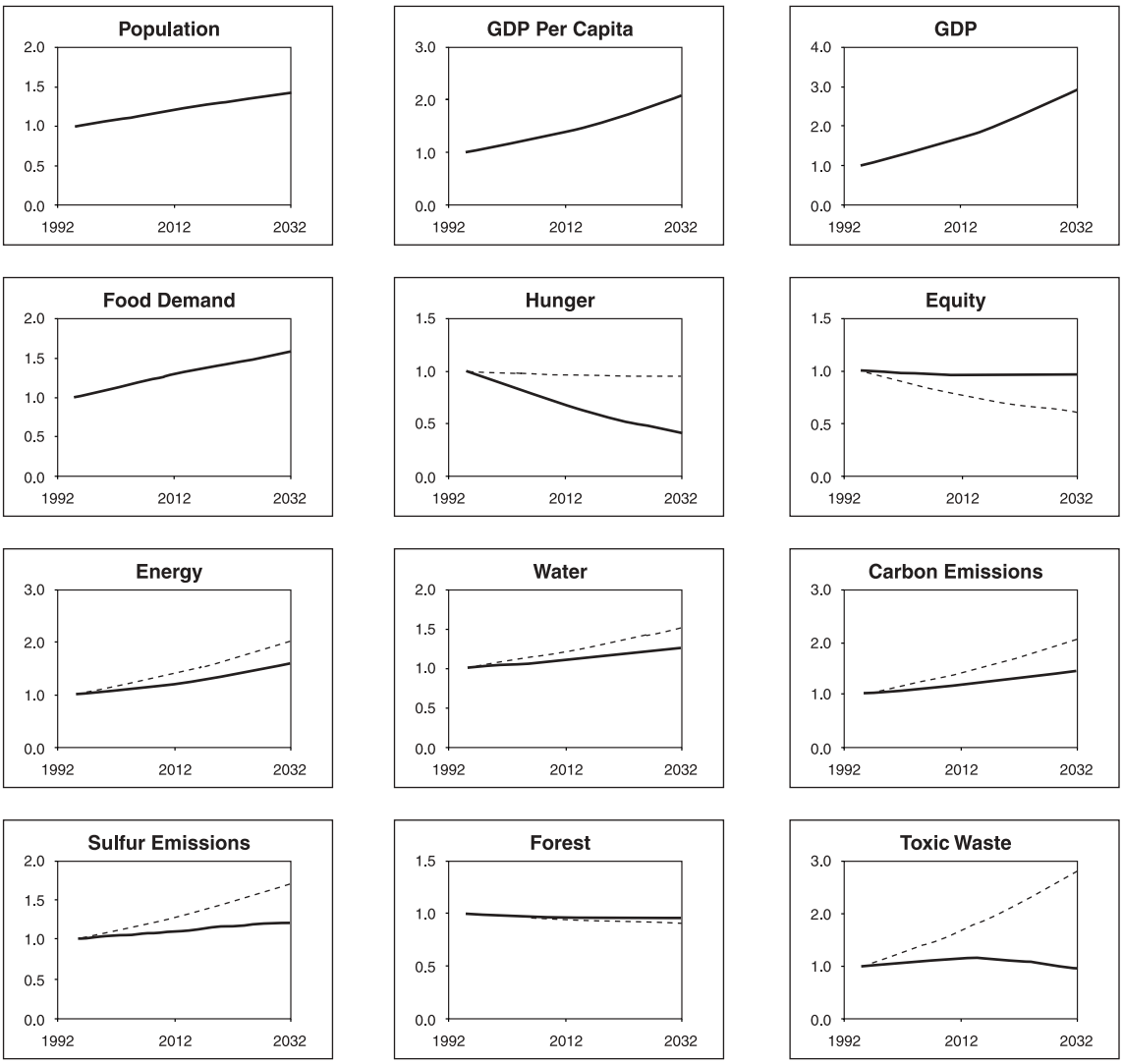
Mashriq	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	44	73	72	95	93
Urbanization (%)	68	76	76	83	83
Economy and Society					
GDP (Billion US$ PPP)	224	531	554	947	1 018
Agriculture (%)	24	15	14	10	9
Industry (%)	25	25	25	25	25
Services (%)	52	60	61	65	66
GDP per capita (1995 US$ PPP)	5 094	7 326	7 743	9 936	10 997
Hunger Incidence (% of population)	8	9	5	9	3
National Equity (L20%/H20%)	0.15	0.11	0.14	0.09	0.14
Energy					
Primary Energy Requirement (EJ)	2.0	4.3	4.2	6.7	6.2
Coal	0.0	0.0	0.0	0.0	0.0
Petroleum	1.7	3.3	3.2	4.5	4.0
Natural Gas	0.2	0.8	0.8	1.7	1.4
Uranium	0.0	0.1	0.0	0.2	0.0
Hydropower	0.0	0.0	0.0	0.1	0.1
Renewables	0.0	0.1	0.2	0.2	0.7
Primary Energy Intensity (MJ/$PPP)	9	8	8	7	6
Final Fuel Demand (EJ)	1.5	3.2	3.1	5.0	4.8
Agriculture	0.0	0.0	0.0	0.0	0.0
Households	0.5	1.0	1.0	1.5	1.5
Industry	0.4	0.9	1.0	1.6	1.6
Services	0.0	0.1	0.1	0.2	0.2
Transport	0.6	1.2	1.1	1.7	1.5
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 667	2 785	2 801	2 871	2 898
Share from Animal Products (%)	8	10	10	11	11
Meat and Milk Production (Mt)	3	6	6	8	8
Fraction of Meat from Feedlots (%)	32	35	35	36	36
Fish Production (Mt)	0	0	0	0	0
Crop Production (Mt)	24	38	34	50	42
Total Cropland (Mha)	12	11	11	10	11
Irrigated Cropland (Mha)	5	5	5	6	5
Potential Cultivable Land (Mha)	12	11	11	10	11
Cereal Harvest Yield (t/ha)	1.26	1.94	1.82	2.49	2.23
Meat and Milk SSR	0.81	0.76	0.76	0.73	0.73
Fish SSR	0.37	0.36	0.36	0.35	0.35
Crop SSR	0.62	0.57	0.52	0.56	0.49
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	58	80	68	102	77
Agriculture (%)	91	86	83	83	77
Industry (%)	5	8	10	10	13
Domestic (%)	4	6	7	7	10
Water Use/Resource Ratio (%)	39	54	46	69	52
Population in Water Stress (million)	35	62	58	86	77
Air					
Carbon Emissions (MtC)	37	77	75	114	100
Sulfur Emissions (MtS)	0.3	0.6	0.6	0.9	0.8
Land and Forest					
Total Land Area (Mha)	72	72	72	72	72
Built Environment (%)	4	6	6	8	8
Cropland (%)	16	15	16	14	16
Grazing (%)	18	18	18	18	18
Natural Forest (%)	1	1	1	1	1
Plantation (%)	0	0	0	0	0
Other (%)	61	59	59	58	57
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	0	1	0	1	1
Municipal Solid Waste Generation (Mt)	8	16	16	26	26
Recycled Share (%)	13	13	16	15	21
Toxic Waste (Mt)	0.1	0.3	0.2	0.6	0.2

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

World

WORLD



Note: Values indexed to 1 in 1995

World	1995	2015		2032	
		Market Forces	Policy Reform	Market Forces	Policy Reform
Demography					
Population (million)	5 659	7 145	7 061	8 207	8 000
Urbanization (%)	45	56	56	65	65
Economy and Society					
GDP (Billion US$ PPP)	32 247	63 354	61 856	100 605	99 319
Agriculture (%)	9	6	6	4	4
Industry (%)	34	31	31	29	30
Services (%)	57	63	62	66	66
GDP per capita (1995 US$ PPP)	6 052	8 867	8 760	12 258	12 415
Hunger Incidence (% of population)	15	11	7	10	4
National Equity (L20%/H20%)	0.14	0.10	0.13	0.08	0.13
Energy					
Primary Energy Requirement (EJ)	387.7	575.8	494.7	784.2	625.0
Coal	87.6	124.0	101.7	164.5	106.7
Petroleum	145.4	232.2	174.4	324.8	201.6
Natural Gas	79.5	118.8	124.0	167.1	172.4
Uranium	25.4	32.9	7.8	43.2	7.1
Hydropower	8.9	12.6	12.5	17.4	16.1
Renewables	40.7	55.2	74.4	67.1	121.2
Primary Energy Intensity (MJ/$PPP)	11	9	8	8	6
Final Fuel Demand (EJ)	276.3	415.8	379.2	570.6	492.8
Agriculture	8.6	9.2	8.8	9.2	8.5
Households	78.8	101.5	101.5	124.7	124.8
Industry	101.4	154.1	147.1	209.5	189.9
Services	20.1	33.5	30.8	49.6	44.1
Transport	67.3	117.5	91.0	177.5	125.5
Food and Agriculture					
Average Daily Consumption (kcal/cap)	2 622	2 769	2 804	2 870	2 929
Share from Animal Products (%)	16	16	16	17	17
Meat and Milk Production (Mt)	805	1 078	1 103	1 321	1 371
Fraction of Meat from Feedlots (%)	21	26	30	28	35
Fish Production (Mt)	122	149	147	161	158
Crop Production (Mt)	4 800	6 343	6 438	7 623	7 849
Total Cropland (Mha)	1 502	1 574	1 678	1 594	1 746
Irrigated Cropland (Mha)	256	282	281	301	298
Potential Cultivable Land (Mha)	3 965	3 863	3 888	3 767	3 845
Cereal Harvest Yield (t/ha)	2.74	3.53	3.48	4.11	4.10
Meat and Milk SSR	1.01	1.00	1.00	1.00	1.00
Fish SSR	0.97	1.00	1.00	1.00	1.00
Crop SSR	1.05	1.00	1.00	1.00	1.00
Environmental Pressures					
Water					
Total Water Withdrawals (billion m^3)	3 061	3 856	3 437	4 622	3 861
Agriculture (%)	67	65	68	62	66
Industry (%)	24	25	20	26	19
Domestic (%)	9	10	12	12	15
Water Use/Resource Ratio (%)	6	8	7	9	8
Population in Water Stress (million)	1 369	2 183	2 021	3 016	2 636
Air					
Carbon Emissions (MtC)	6 029	9 103	7 456	12 577	8 739
Sulfur Emissions (MtS)	66.1	87.8	74.1	111.3	80.8
Land and Forest					
Total Land Area (Mha)	12 985	12 985	12 985	12 985	12 985
Built Environment (%)	2	3	3	3	3
Cropland (%)	12	12	13	12	13
Grazing (%)	26	27	27	28	27
Natural Forest (%)	31	29	30	27	29
Plantation (%)	1	1	1	2	2
Other (%)	29	28	27	28	25
Waste and Material Use					
Nitrogen Fertilizer Consumption (Mt)	71	103	88	122	86
Municipal Solid Waste Generation (Mt)	883	1 488	1 398	2 199	2 032
Recycled Share (%)	12	18	20	22	27
Toxic Waste (Mt)	27.1	43.6	26.9	63.7	21.0

t: metric tonnes; ha: hectare, J: Joules; SSR: Self Sufficiency Ratio = Production/Requirements

Mt = 10^6t; Mha = 10^6ha; EJ = 10^{18}J

Notes for Illustrative Scenarios

The following comments explain the graphs presented for each region.

Population

- *Market Forces* figures from mid-range projections of the United Nations (1998 revision). *Policy Reform* populations in developing and transitional regions and transitional lower by 2.0 per cent in 2015, by 3.4 per cent in 2032. Population growth is lower due both to declines in fertility rates associated with declining poverty and through more active family-planning efforts.
- Urbanisation patterns in 1995 from WRI (1994; 1996b). Scenario patterns based on projections to 2025 in WRI (1994; 1996b).

GDP per Capita

- *Market Forces* assumptions consistent with mid-range economic scenarios from major institutions, such as those of the World Bank and OECD. *Policy Reform* assumptions are constrained by the goal of reducing poverty. They also reflect more rapid convergence between developed and developing countries. In the OECD regions, differences in values and lifestyle choices between the Market *Forces* and *Policy Reform* scenarios lead to relatively lower income growth in *Policy Reform*, while in non-OECD countries, equity considerations, as well as development patterns characterized by convergence to industrialized country norms, are reflected in faster income growth in *Policy Reform* relative to *Market Forces*.

Note: Local currencies are converted to a common currency using 'purchasing power parity,' which in contrast to the more common "market exchange rates" takes into account relative prices for a similar basket of goods when comparing currency values.

GDP

- GDP data in 1995 from WRI (1998). The *Market Forces* scenario follows typical mid-range patterns. In the *Policy Reform* scenario, changes in income and income distribution are constrained by the goal of reducing poverty.
- Structure of economic output changes gradually in developed regions toward a greater share for services and, in the industrial sector, a lower share for heavy industry. Developing regions gradually converge toward these structures as income rises. See tables.

Food Demand

- Current patterns from FAOSTAT database (FAO, 1999b).
- Food demand determined by population and food consumption per capita. In OECD regions, consumption is the same in both scenarios, remaining close to base-year levels in most OECD regions. In the non-OECD regions, consumption rises with income, but more slowly than income.

- Meat consumption grows gradually as a fraction of caloric intake in developing regions and stabilises in industrialised countries (see tables). This drives livestock, grazing land and fodder requirements.
- Agricultural output changes due to substantial yield improvements and modest changes in land in agriculture and irrigation. Agricultural trade guided by consistency with historic patterns, constraints on agricultural expansion and, in *Policy Reform*, meeting environmental and resource targets.

Hunger

- Current levels from FAO (1999a) (developing regions); FAO (2000a) (transitional regions); Rose, and others. (1995) (U.S.); other regions estimated from available data.
- Hunger in the scenarios is determined by population, income and the distribution of income. The effects counteract one another: the number of hungry increases with population growth and as income distributions become less equitable, but decreases as incomes rise.
- In the *Policy Reform* scenario, the scenario goal of reducing hunger is met through more rapid income growth in developing countries in *Market Forces* and less skewed income distribution. The hunger calculations are performed at the national level and aggregated to regional totals.

Equity

- Current levels from Deininger and Squire (1996); Tabatabai (1996); UNU/WIDER (1999); U.S. Census Bureau (1997); World Bank (2000).
- In the *Market Forces* scenario, income distributions gradually converge toward U.S. levels, following the assumption of global convergence in the scenario. In some regions, this assumes a change from historic patterns as countries join the global economy and restructure economies and policies.
- In the *Policy Reform* scenario, income distributions (along with higher incomes in developing countries) are more equitable in order to meet hunger goals (see Hunger above).

Note: The 'equity' indicator reported in the tables and graphs is the ratio of the average income of the lowest-earning 20 per cent of the population to that of the highest-earning 20 per cent. The calculations are performed at the national level and aggregated to the regional level, weighting national values by population. As income distributions become more equal, the equity indicator increases.

Energy

- Current data from IEA (1999) (most regions); EIA (2000) (South Pacific and Western Indian Ocean). *Note: For two regions (South Pacific and Western Indian Ocean) detailed energy balances are not available.*
- Energy requirements are determined by economic growth and the efficiency of energy use.
- Energy requirements are computed by economic sector (i.e., industrial subsectors, transportation modes, services, agriculture). Therefore, requirements change both due to the increasing scale of the economy and to the changing mix of economic activity, e.g., more services, less agriculture, stabilization of heavy industry in industrialized countries, etc.

- Electrification increases in developing regions in both scenarios. In regions with substantial hydropower in 1995 (e.g., South America and Central, Eastern and Western Africa), expanding electrification drives a shift away from hydropower in the production mix, contributing significantly to increases in greenhouse gas emissions.
- Energy efficiency improves in the scenarios, following recent trends in *Market Forces* in industrialized countries, with gradual convergence toward these values in developing regions as incomes grow, and toward "best practices" in the *Policy Reform* in order to meet environmental targets.
- In several developing regions, the energy requirements in *Policy Reform* are comparable to *Market Forces* as a result of two competing effects: higher economic growth drives energy needs up while greater efficiency drives it down.
- The mix of final fuel requirements changes in the course of the scenarios due to electrification, reduction of the share of traditional biomass and changing fuel prices. Modern renewables penetrate only gradually in *Market Forces*, and more rapidly in *Policy Reform* in order to meet environmental targets, with natural gas playing a role as a "transitional fuel" – a fossil fuel with relatively low carbon emissions per unit energy produced. Nuclear electricity generation continues to play a role in the *Market Forces* scenario, but is gradually phased out in the *Policy Reform* scenario.

Water

- Current patterns from Pacific Institute (2000).
- Water use in the scenarios is driven by changes in activity (e.g., population, irrigation, economic output and power production) and water- use intensity (e.g., use per capita for the household sector, use per hectare of irrigated land, use per value added in industry, power plant water cooling requirements, etc.).
- Water use intensities decrease (i.e., efficiency improves) in the scenarios, following recent trends in *Market Forces* in industrialised countries, with gradual convergence toward these values in developing regions as incomes grow, and toward "best practices" in the *Policy Reform* in order to meet environmental targets.
- In several regions, the water requirements in *Policy Reform* are comparable to *Market Forces* as a result of competing effects: higher economic growth drives water needs up, greater efficiency drives it down and food trade changes in order to meet the water and land requirements of the scenario.
- Water stress (as reported in the tables) is computed on a national basis and aggregated to regional values. At the national level, the level of water stress depends on the "use-to-resource ratio" – water withdrawals divided by renewable freshwater resources. The fraction of population in water stress rises from zero to 0.95 as the use-to-resource ratio rises from 0.1 to 0.4, and to 1.0 as the ratio rises to 1.0. This is based on indicators in the literature (Raskin and others, 1997). In water-scarce areas, the potential for improving water-use efficiency limits the degree to which water stress can be reduced.

Carbon Emissions

- Current emissions computed from energy mix and emission coefficients. Emission coefficients are based on IPCC (1995).
- Scenario carbon emissions in energy sector determined by fuel use (see Energy above). In the *Policy Reform* scenario, the scenario goal of reducing emissions is met through more fuel switching (to natural gas and renewables) and greater efficiency improvements.

Note: Only carbon emissions from fossil fuels are reported. High Policy Reform emissions in Western, Central and Eastern Africa are due to a combination of factors: greater electrification, a shift away from hydropower in electric generation and lower household biomass use. Emissions per unit of economic output are lower in Policy Reform than in Market Forces.

Sulfur Emissions

- Current sulfur emissions determined by fuel use and sulfur emission coefficients, which depend both on emission control technology and sulfur content of fuels, especially coal. Emission coefficients based on Posch et al. (1996) and Kuylenstierna (1998).
- In *Market Forces*, sulfur emissions in developed regions moderate relative to historic growth levels as current control policies play out. In *Policy Reform*, more rigorous reductions occur due to the changing fuel mix (e.g., greater penetration of renewables) and stricter emissions controls. The reductions in emission factors in the *Policy Reform* scenario are roughly twice as great as in the *Market Forces* scenario.

Note: In some developing regions, sulfur emissions in the Market Forces *scenario are comparable to the* Policy Reform *scenario, but only where they are extremely low to begin with. This is generally because of more rapid economic growth in coal-using sectors. In Western, Central and Eastern Africa, high emissions are due to greater electrification combined with a shift away from hydropower in electric generation.*

Forest

- Source: FAOSTAT database (FAO, 1999b) with FAO (2000b). Figures shown in the graph are the total of natural and plantation forest.
- In many regions, forest area declines due to conversion to agricultural land and the built environment, and losses to forestry. Forest area is higher in *Policy Reform* than in *Market Forces* due to expansion of plantations and reforestation, and greater reliance on agricultural imports in some regions, in order to meet the scenario goal of ecosystem preservation.
- In major food- exporting regions (North America, European regions, Australia and New Zealand) forest areas are similar in the two scenarios due to two counteracting effects in *Policy Reform*. On the one hand, there is more forest preservation. On the other hand, there is more land in agriculture as exports increase to allow food-importing regions to meet their own forest- preservation goals.

Note: Small apparent changes in the graphs of forest areas for certain regions may mask large absolute changes (see the numerical tables that accompany the graphs).

Toxic Waste

- *Data source:* World Bank Industrial Pollution Projection System (Hettige et al., 1994).
- *Market Forces* incorporates “lower-bound” toxic emission factors from the above source (emissions per value added at the 3-digit ISIC level). Changes in emissions in *Market Forces* therefore reflect growth in industrial composition from highly polluting industries to less-polluting ones. Emission factors in *Policy Reform* scenario are reduced in all regions by 70% by 2032, to meet scenario goals.

References for Notes

Deininger, K. and L. Squire. (1996). A New Data Set Measuring Income Inequality, The *World Bank Economic Review* 10(3), pp. 565-591.

Energy Information Agency of the United States Department of Energy (EIA). (2000). International Energy. Data available from: http://www.eia.doe.gov/.

FAO (1999a). *State of Food and Agriculture 1999*. Rome.
FAO (1999b). *FAOSTAT 98 CD-ROM*. Rome.
FAO (2000a). *The State of Food Insecurity in the World 2000*. Rome.
FAO (2000b). *The Global Outlook for Future Wood Supply from Forest Plantations*. Rome. Global Forest Products Outlook Study Working Paper GFPOS/WP/03.

Hettige, H., P. Martin, M. Singh and D. Wheeler. (1994). *The Industrial Pollution Projection System*. Washington, D.C.: The World Bank.
International Energy Agency (IEA). 1999. *Energy Balances 1999*. Paris: OECD/IEA.
Intergovernmental Panel on Climate Change (IPCC). 1995. *IPCC Greenhouse Gas Inventory Reference Manual: IPCC Guidelines for National Greenhouse Gas Inventories*. Vol. 3. IPCC: Bracknell, UK.

Kuylenstierna, J. 1998. Personal communication.

Pacific Institute. 2000. *The World's Water: The Biennial Report on Freshwater Resources*. Data available from: http://www.worldwater.org/; INTERNET.

Posch, M., J.-P. Hettelingh, J. Alcamo and M. Krol. (1996). "Integrated Scenarios of Acidification and Climate Change in Asia and Europe," *Global Environmental Change* 6(4), pp. 375-394.

Raskin, P., P. Gleick, P. Kirshen, G. Pontius and K. Strzepek. (1997). *Water Futures: Assessment of Long-range Patterns and Problems*. Background Document for the SEI/United Nations Comprehensive Assessment of the Freshwater Resources of the World. Stockholm: Stockholm Environment Institute.

Rose, D., P.P. Basiotis and B.W. Klein. (1995). "Improving Federal Efforts to Assess Hunger and Food Insecurity," *Food Review* 18, Jan-Apr.

Tabatabai, H. (1996). *Statistics on Poverty and Income Distribution: An ILO Compendium of Data*. Geneva: International Labour Office.

United Nations Population Division (UN). (1999). *Annual Populations 1950-2050: The 1998 Revision*. New York: United Nations.

United Nations University/World Institute for Development Economics Research. (1999). *UNDP World Income Inequality Database*. Data available from: http://www.wider.unu.edu/wiid/wiid.htm; INTERNET.

United States Department of Commerce, Bureau of the Census (USBC). (1997). *Historical Income and Poverty Tables (Table H-4)*. Washington, D.C.: United States Census Bureau. Available from http://www.census.gov/hhes/income/histinc/index/html; INTERNET.

World Bank. (2000). *World Development Indicators 2000.* Washington, D.C.: World Bank.

World Resources Institute (WRI). (1998). *World Resources 1998-1999*. New York: Oxford University Press.