KPMG
cutting through complexity

Expect the Unexpected:

Building business value in a changing world

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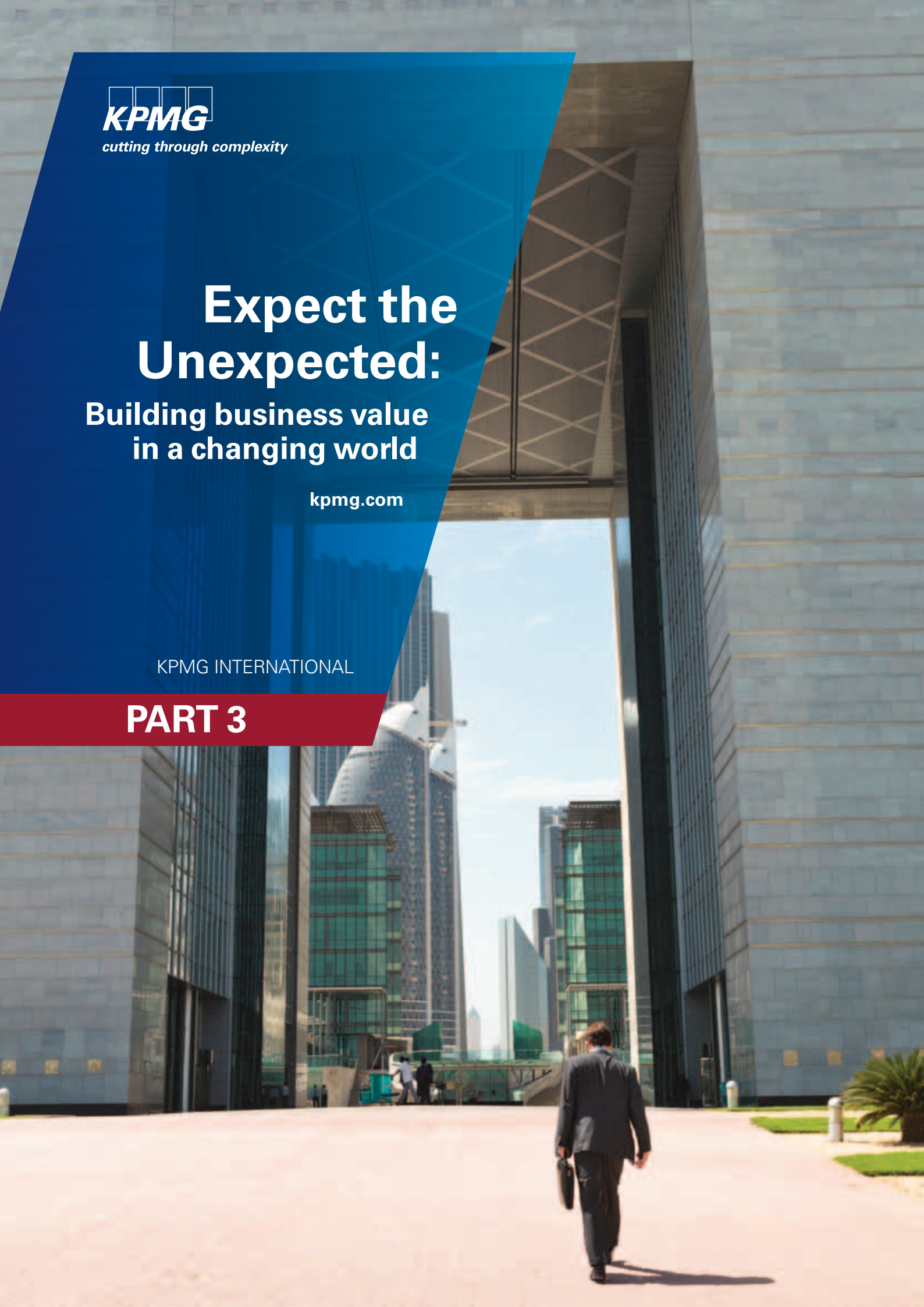
KPMG INTERNATIONAL

PART 3



In this report we offer a starting point for discussion. We present a system of ten sustainability megaforces that will impact each and every business over the next 20 years. We want to build awareness that these forces do not act alone in predictable ways. They are interconnected. They interact.

Foreword

Businesses today are operating in an ever more interconnected and globalized world. Supply chains stretch across continents and are vulnerable to disruption. Consumer demands and government policies are changing rapidly and will impact your bottom line if your business does not respond.

Against this background of complexity we face a new set of challenges. For 20 years or more we have recognized that the way we do business has serious impacts on the world around us. Now it is increasingly clear that the state of the world around us affects the way we do business.

This report shows that population growth, exploitation of natural resources, climate change and other factors are putting the world on a development trajectory that is not sustainable. In other words, if we fail to alter our patterns of production and consumption, things will begin to go badly wrong. How wrong and for whom, is also explored in the report.

Intergovernmental treaties are yet to solve the issues and, at a national level, the transition to sustainable growth remains a goal rather than an achievement. The concept of "green growth" has gained ground but we still lack a precise understanding of how we can achieve it along with higher standards of living within the limits of our planet.

Corporations are, of course, not passive bystanders in any of this. Our report shows that global megaforces are likely to bring significant threats and opportunities.

The resources on which businesses rely will become more difficult to access and more costly. There will be increasing strain on infrastructure and natural systems as patterns of economic growth and wealth change. Physical assets and supply chains will be affected by the unpredictable results of a warming world. And businesses will be confronted with an ever more complex web of legislation and fiscal instruments.

But this is not the whole story. Consumer and investor values are changing. And as they change more corporations are recognizing that there is profit and opportunity in a broader sense of responsibility beyond the next quarter's results. The bold, the visionary and the innovative recognize that what is good for people and the planet will also be good for the long term bottom line and shareholder value. Competitive advantage can be carved out of emerging risk.

At KPMG's network of firms we have always been at the forefront of developments that shape business behavior. We are working with organizations to help them understand the forces at work that will influence markets and impact profitability in the medium to long term.

This means moving on from old notions of corporate responsibility focused purely on protecting and enhancing reputation. It means being aware that your business stand to be affected as supplies of fresh water decrease and costs of energy rise and ecosystems decline. Knowing what those effects will be and how your business can manage them successfully means developing a sophisticated understanding of these factors and how they work.

In this report we offer a starting point for discussion. We present a system of ten sustainability megaforces that will impact each and every business over the next 20 years. We want to build awareness that these forces do not act alone in predictable ways. They are interconnected. They interact.

At KPMG, we encourage businesses to understand this system of forces; we help them assess the implications for their own organizations and to devise strategies for managing the risks and harnessing the opportunities. We can never know the future. But it is good business sense to be prepared for the possibilities: to expect the unexpected.

This report cannot provide all the answers, and does not set out to, but it does suggest approaches that we believe will help to build business value in a changing world. We hope it provides a useful springboard for new thinking, debate and above all business action to deliver a future that is both sustainable and profitable.

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KPMG International

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KPMG Climate Change & Sustainability

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Call to action for businesses and policy makers

Introduction

With potentially devastating impacts on the horizon – including a rapidly changing climate, natural resource scarcity, food shortages, and population growth – businesses and policymakers together must make strategic decisions now and promote changes in long-term thinking. Without action and planning for the complex future that lies ahead, risks will continue to multiply and opportunities will be lost.

Sustainability requires a push from both economic sides – supply and demand. The supply side must make more with less; the demand side must make less do more. For the supply and production side, increasing resource efficiency and minimizing the environmental footprint of processes and operation must become standard practice for business. For the demand side, minimizing the impact of growing urban populations, rising middle classes and their growing demand for goods and services, while addressing the ensuing pressure on dwindling natural resources, must become a top priority.

In simplest terms, businesses and governments around the world must fundamentally change the way the world produces and consumes. There is no silver bullet. Instead, a wide range of actions – the global sum of individual company and government efforts – will lead towards a more sustainable future and breathe life into the concepts and solutions offered by this report.

This chapter examines the key business implications of global trends, both the risks and opportunities, and considers three key types of actions:

- actions by businesses to manage risks and opportunities
- potential actions by governments to help businesses respond more effectively(what business requires in terms of policy interventions)
- actions by businesses and governments together through public-private cooperation and partnerships to deliver a sustainable future.

Actions by business

In an increasingly complex world of population growth, urbanization, scarcity and environmental change, success will depend on how well a company can analyze problems, identify effective ways to address them, and implement appropriate action. This approach can turn daunting complexity into solid opportunities for growth. Such opportunities range from developing and maintaining low-carbon, zero-waste cities and infrastructure to improving and managing biodiversity, ecosystems, lifestyles and livelihoods. Enabling these changes can also create opportunities for finance, information and communication technology and partnerships. With new opportunities to be explored, external priorities to assess, partners to engage and risks to navigate, businesses that plan now for coming decades are likely not only to withstand the changes, but also to prosper.

“Businesses will face a more volatile and unpredictable market for fossil fuels and other resources.”

Sustainability megaforces: core challenges for business

- Understanding and assessing risks
- Analyzing opportunities for efficiency, substitution and adaptation or adjustment
- Using integrated strategic planning and strategy development
- Managing risks and capitalizing on opportunities

The Future is Now: Companies are already experiencing impacts of sustainability megaforces

Multinational food companies are already facing price pressures that were unimaginable years ago. The IMF calculates that between 1974 and 2005 real food prices, adjusted for inflation, fell by nearly 75 percent as improved technologies lowered costs. Then, in 2007 the UN food prices index rose by 40 percent in a single year. The wheat price now can routinely rise or fall by 15 percent in two days. Over the 12 months to May 2011, corn prices rose 80 percent in the futures market, oats was up 70 percent, wheat 54 percent and soy beans 37 percent. This increased volatility illustrates major difficulties in pricing, which may only grow worse in coming years.[1] A recent survey of consumer market executives found that approximately 50 percent of respondents have already seen a rise in the cost of compliance with health, food and safety, health care and environmental and sustainability regulations in the past year.[2]

Key emerging business risks related to global sustainability megaforces

Sustainability megaforces threaten to bring increasingly complex risks and interrelated challenges that demand a new approach to business planning. Businesses are likely to face a more volatile and unpredictable market for fossil fuels and other resources. New levels of scarcity for essentials such as water, energy, forest products and minerals could result in increased and more volatile prices and reduced availability of inputs. Water-intensive industries – including apparel, automobile, food and beverage, biotech and pharmaceutical, chemical, forest products, electronics, mining, refining and electric utilities – will be vulnerable to water shortages, declines in water quality, and water price volatility. Further degradation of global biodiversity and ecosystem services could also affect many industries, including forest products, pulp and paper, agriculture, fisheries and tourism. Industries dependent on biodiversity for innovation, such as pharmaceuticals, would be impacted by continued primary forest loss. These risks could jeopardize the long-term profitability – or even the survival – of some of the most-impacted sectors.

Emerging business opportunities

Sustainability megaforces could also open the door to unprecedented opportunities for business. Companies can find ways to save resources and reduce business risks, while also cutting costs. By planning for future resource shortages, they can improve the material efficiency of production, develop alternate materials, or find new ways to use freshwater or energy more efficiently. Focusing on sustainability could also lead to access to new markets for greener products, improved brand credibility, price premiums for green products and new finance sources. Companies can also become providers of new resource-efficient technologies and products. Global efforts to combat climate change, for example, will create demand for low carbon technologies, such as industrial and commercial energy efficiency. According to KPMG's International Corporate Responsibility Reporting Survey 2011, almost half of the Global Fortune 250 (G250)

Making the most of green opportunities

Royal Philips Electronics has allocated EUR 2 billion for investments in Green Innovation by 2015 to accelerate sustainable business across its three sectors. As a result, Philips Green Products generated 38 percent of total 2010 sales, up from 31 percent in 2009. This was achieved through focusing on EcoDesign – a process aimed at developing products with a significantly lower environmental impact throughout their lifecycle.[3]

For Siemens, revenue from eco-friendly products and solutions showed strong growth over 2011. Its Environmental Portfolio – which comprises products and solutions that assist in the abatement of greenhouse gases, as well as environmental technologies for clean air and water – contributed around EUR 30 billion to the company total. Siemens aims at exceeding the EUR 40-billion revenue mark with green technologies by the end of fiscal 2014.[4]

1 KPMG (2011) Consumer currents – Issues driving consumer organizations: *The trouble with food.*

2 CFO Insights – A Global Survey of Consumer Markets Executives, KPMG International, 2011.

3 *Philips to invest EUR 2 billion in green innovation by 2015*, (February 18, 2011). http://www.newscenter.philips.com/main/standard/news/press/2011/20110217_sustainability_report.wpd

4 *Siemens ends fiscal 2011 with record operating results* (November 10, 2011) http://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2011/corporate_communication/2011-q4/axx20111105.htm

companies report gaining financial value from their sustainability programs, while a third of the 100 largest companies in each of the 34 countries studied (N100) report the same.[5]

Population growth, and a growing middle class will mean significant increase in the number of potential consumers and producers driving the market for consumer goods, global connectivity and access to technology, as well as providing human resources for the workforce. Further opportunity is related to a variety of new financing mechanisms being developed for the transition to a sustainable economy. These range from product subsidies and tax breaks for R&D to pay-as-you-save loans. Companies can identify, quantify and capture tax credits and incentives specifically tailored to alternative energy, energy efficiency and other areas related to sustainability. Furthermore, sustainability is rapidly becoming a key differentiator in enhancing brand credibility.

Turning risk into opportunity: ensuring effective management of implications of global sustainability megaforces

Effective management of sustainability risks and opportunities requires their integration into strategic planning (*Figure 49*):

- identifying sustainability risks and potential opportunities through Enterprise Risk Management tools;
- integrating sustainability into core business functions and tapping into employee engagement – both internally and across business partners;
- measuring environmental inputs and productivity across the entire company and reporting on progress;
- and, finally, setting ambitious targets and leading by example. Leading global firms already are setting the pace with tough, long-term goals that define a vision, balanced with interim deadlines.

“The key for companies is to leverage current risk management processes to tackle future sustainability risks and to invest more leadership capital in sustainability risk management.”

[5] KPMG (2011). *KPMG International Survey of Corporate Responsibility Reporting 2011*.

The Gulf oil spill: corporate responses and sustainability risk management

After the oil spill in the Gulf of Mexico in 2010, the oil and gas industry faced a host of challenges involving liability and insurance coverage, the optimal operating model, contractor relationships, existing risk management practices, and new regulations. Major oil operators therefore began to develop risk mitigation strategies that changed the traditional integrated model. BP has announced the creation of a new division, Safety & Operational Risk, to oversee and audit its global operations. Similarly, Shell in 2009 established a new Projects and Technology unit, which combines its major project delivery, technical services and technology capabilities, covering both upstream and downstream.[6]

Managing risks via Enterprise Risk Management

A sophisticated Enterprise Risk Management process will identify actions to mitigate risks as well as realizing opportunities. It can assist in identifying potential future events, assessing the related risks and defining responses to deal with the risks. These include accepting the risk, transferring it to other parties, treating it with controls, or terminating the activity related to the specific risk. Enterprise Risk Management already has a central role in strategic management and most companies have tools and talent at hand. However, full integration of the sustainability perspective is not yet common practice. The key for companies, therefore, is to leverage current risk management processes to tackle future sustainability risks and to invest more leadership capital in sustainability risk management.

Integrating sustainability into core business functions

To unlock the potential of a changing world, companies need to address the full range of organizational areas and functions. Strategic planning for sustainability, perhaps more than any other functional strategy, requires the involvement of the business management and strategic planners and subject matter expertise in the area of sustainability. Such planning should encompass a wide range of corporate functions and may include portfolio management, mergers and acquisitions, R&D and supply chain management and purchasing. It also includes departments such as communications, investor relations, government relations and public policy, human resources, risk and compliance, audit, financial reporting and tax. Tax, for example, could be a major sustainability tool for companies using significant amounts of natural resources and energy in production or transportation.

Measuring and reporting sustainability

Measuring and reporting on sustainability performance is crucial for managing sustainability risks and opportunities. This is usually done through corporate responsibility (CR) reporting, a rapidly growing imperative for businesses worldwide. Of the 250 largest global companies, 95 percent now report on their behavior on key societal issues – a 14 percent increase since 2008.[7] Companies increasingly recognize that sustainability reporting is about more than just being a good corporate citizen – it is also an important tool for driving innovation and promoting learning. Many companies in the above-mentioned survey reported discovering new opportunities for improvements by analyzing their CR reporting data and benchmarking their performance against industry peers.

Sustainability reporting, although largely still unregulated, will become increasingly important in the future. Recognizing this trend, some companies have recently undertaken "integrated" reporting, where sustainability related information is included in a full picture of the company's comprehensive business performance and reported as part of the corporate financial reporting process. Many companies are already publishing CR or sustainability information throughout their directors' report. The next step for integrated reporting should therefore be for companies to build a framework for their CR reporting processes, as well as stronger information systems and appropriate governance and control mechanisms – on par with those currently used in financial reporting.

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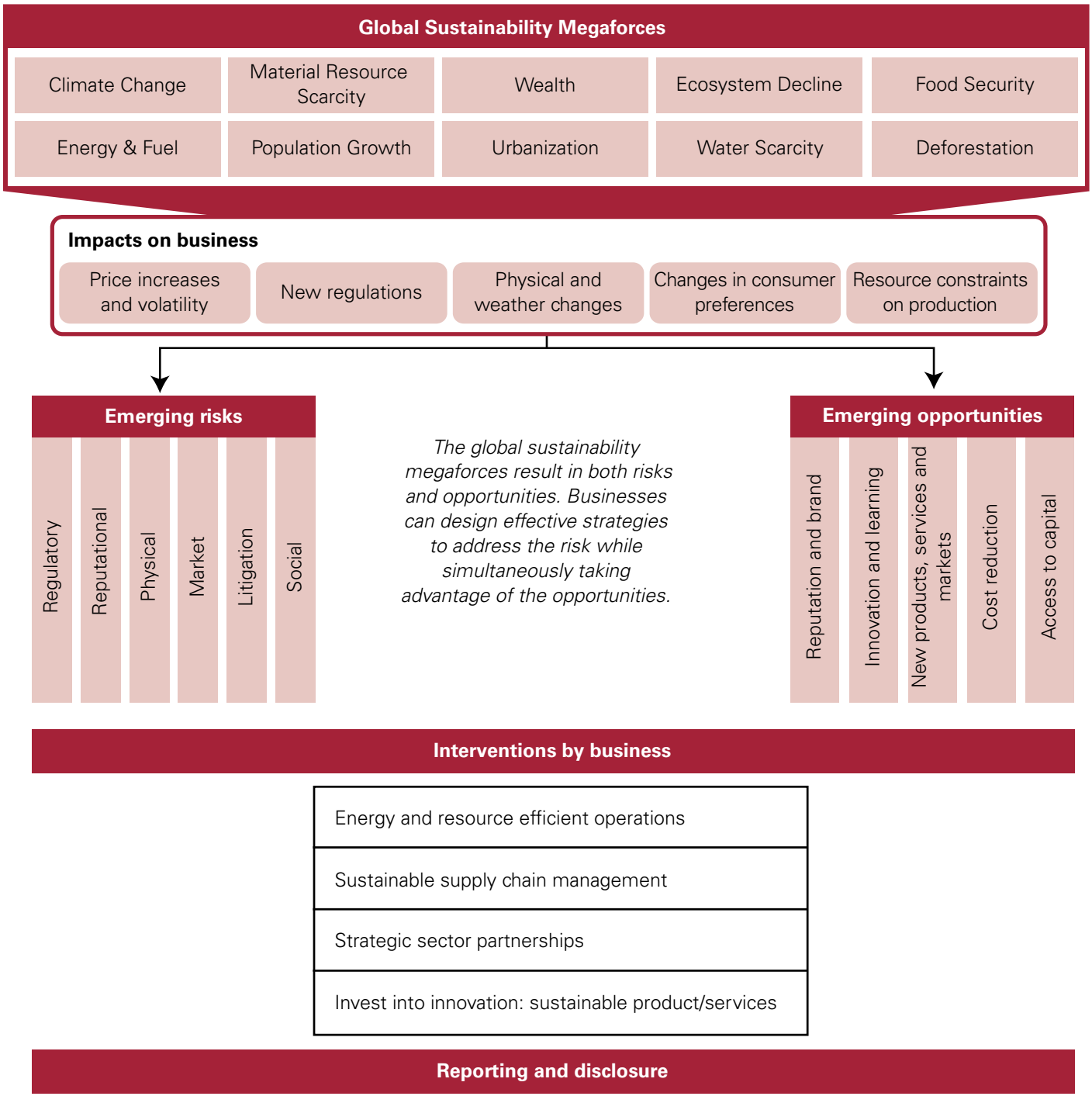
6 *After the Gulf of Mexico Oil Spill: Recent Developments in the Oil and Gas Industry,* KPMG Global Energy Institute, 2011.

7 *KPMG International Survey of Corporate Responsibility Reporting 2011.*

Figure 49: Global sustainability megaforces – Addressing the risks while realizing the opportunities



Source: KPMG analysis.

The Global Reporting Initiative's sustainability reporting

The Global Reporting Initiative's (GRI) Sustainability Reporting Guidelines have gained widespread adoption as the de facto global standard for CR reporting. Today, 80 percent of G250 and 69 percent of N100 companies are aligning to GRI standards.[8] The GRI, a network-based organization, draws participants from global business, civil society, labor, academic and professional institutions with the core goal of mainstreaming the disclosure on environmental, social and governance performance. The GRI is one of the initiators of the International Integrated Reporting Committee and firmly believes that integrated reporting should be the next step in corporate sustainability reporting.

"In the coming years, policymakers will be increasingly called upon to take the lead and adopt measures that promote sustainability while respecting consumer demand for goods and services as the primary driver of economic activity."

Recommendations: the essentials of business action towards sustainability

Global sustainability megaforces could mean a world of unprecedented constraints, complexity and risks for business. But business leaders can do much more than simply survive these risks. Indeed, with foresight and planning, they can thrive by turning these risks into new opportunities and undertaking pioneering actions to prepare for an uncertain future.

- **Understand and assess risks and analyze opportunities for efficiency, substitution and adaptation or adjustment:** First and foremost, businesses need to fully assess and understand future sustainability risks and define their responses to deal with them.
- **Use integrated strategic planning and strategy development:** CEOs should make sustainability central to their corporate strategy and incorporate it at all levels. Companies will also need to appreciate the benefits of measuring performance and reporting on sustainability. They should also seek collaboration between companies on sustainability issues, which will be critical to increase leverage and improve the cost-benefit ratio of action.
- **Manage risks and capitalize on opportunities:** Businesses need to turn strategic plans and strategies into ambitious targets and actions, such as energy and resource efficiency improvements, sustainable supply chain management, investment into innovation on sustainable products and services, and gaining access to new markets for greener products, services and technologies.
- **Build strategic partnerships:** Business leaders should seek opportunities for genuine dialogue with governments and demonstrate new and innovative approaches to public-private partnerships. Improved dialogue could focus on economic instruments and market barriers that could be reduced to make sustainable behavior easier.

[8] *KPMG International Survey of Corporate Responsibility Reporting 2011.*

Actions by governments

Government policymakers must play an active part, in partnership with businesses and other stakeholders, to address global sustainability trends and help direct longstanding development patterns toward a more sustainable future. As demonstrated in Part 2, leading businesses around the world have already begun to take supply-side action ahead of current policies and regulations, such as the "quick wins" of efficiency measures, in pursuit of both a sustainability measure and a sound business opportunity.

Sustainability measures on the demand side, on the other hand, would require more government support. In the coming years, policymakers will be increasingly called upon to take the lead and adopt measures that promote sustainability while respecting consumer demand for goods and services among the key drivers of economic activity. Government regulations and incentives, such as tax credits for insulation improvement to residential housing, as well as measures to help direct consumer demand towards sustainable choices, such as new product standards for energy efficiency, pricing mechanisms and taxes must be thoughtfully and thoroughly directed toward the goal of global sustainability.

This section considers the potential actions that government, in cooperation with business, can take to achieve sustainable growth. It is based on an analysis of policy implications from recent publications by business associations, as well as key messages from KPMG publications. It also demonstrates that businesses and government can – and indeed must – work together to provide bold leadership, drive innovation and move the world towards a sustainable future.

Sustainability megaforces: core challenges for government

- Ensuring predictability and stability in government policies
- Removing barriers to investment
- Creating enabling conditions for business
- Incorporating price externalities

The investment challenge: overcoming barriers to green growth

Sustainable growth will require massive investment from business. Climate change mitigation alone, according to the International Energy Agency, could require almost US$10.5 trillion (US$510 billion per year) over and above the business-as-usual scenario between 2010 and 2030.[9] Yet this sum provides only a 50 percent chance of limiting greenhouse gas concentration to less than 450 parts per million and global temperature rise to less than 2 degrees centigrade.[10] A large share of this investment needs to take place in developing countries[11] and the bulk of funding – over 80 percent – must come from the private sector.[12] To confront this and other sustainability challenges, barriers to innovation and investment must be lowered or removed through appropriate government policies.

> **"Barriers to innovation and investment could be lowered or removed through appropriate government policies."**

[9] International Energy Agency (2009). *World Energy Outlook 2009*. Paris.

[10] International Energy Agency (2009). *World Energy Outlook 2009*. Paris.

[11] International Energy Agency (2009). *World Energy Outlook 2009*. Paris.

[12] United Nations Framework Convention on Climate Change Secretariat (2007). *Investment and Financial Flows to Address Climate Change*. Bonn. Available from unfccc.int/files/cooperation.../financial.../background_paper.pdf.

“Financial incentives may also include market-based mechanisms that create additional income from the sale of emission allowances or other rights to the use of resource.”

Many green and low-carbon investments carry an unacceptable level of risk or offer an insufficient rate of return, particularly in developing countries, for a number of reasons. First, full environmental impacts and costs are often not priced in the market. Instead, current policies and market incentives allow businesses to run up significant social and environmental externalities, largely unaccounted for and unchecked. Limited availability and access to long-term finance for sustainability investments is another barrier, as banks often refuse long-term lending for less conventional and potentially risky technology, in addition to demanding high interest rates. Investors can also seek considerably higher returns, which are often incompatible with the payback periods of sustainability projects. Uncertainties around policy and fiscal regimes, and a lack of stable investment environment can also provide disincentives for green investment.

Call for government action

Transitioning to a sustainable economy will therefore require strategic government policies that encourage businesses to actively embrace sustainability. In addition to removing investment barriers, policymakers must establish enabling conditions in all areas: national-level regulations, policies, subsidies, incentives and legal frameworks, as well as international market, legal infrastructure, trade protocols and development aid measures. Governments, together with business, must make strategic decisions now and look to promote changes in behaviors and long-term thinking.

The complexity of addressing climate change provides a clear example of the strategic decisions needed now before the speed and severity of changes are fully known. Governments will need to take a close look at their existing policy and start thinking clearly about the long-term economic impact of energy choices ahead. If the goal is to avoid or minimize the negative impacts of global sustainability megaforces and in so doing leave a better world for future generations, it is critical to strive for a system that prioritizes effectiveness and long-term cost efficiency. Governments also need to think more aggressively about turning sustainability from a risk factor for business to an engine of economic growth.

Although climate change and other sustainability challenges seem formidable, an effective response can be achieved if governments – like business – apply a complex systems approach to policy making. Currently, most government interventions address trends in isolation without considering how distinct policy initiatives might interact, or even contradict, each other.

Therefore, a more comprehensive and coordinated systemic approach to managing resources that cuts across various nexuses will be essential for success. Government institutions with discrete responsibilities – such as water, agriculture, climate change, finance and urban development to name a few – need to work closely together to address sustainability. This allows for multiple co-benefits while minimizing required investment. For example, efforts to protect and sustainably manage forests are compatible with the goals of improving resilience to

climate change, addressing fresh water scarcity and protecting ecosystem services. Similarly, actions to mitigate climate change call for improving energy efficiency, which in turn reinforces responses to energy price volatility and reduced availability of energy resources.

Clear, well-planned and secure government policies are key to scaling-up private sector investment and facilitating the transition to green economy. Investors seek the security offered by clear policies with defined goals and consistent regulatory actions. They need coherent policy objectives accompanied by measurable targets and actions. Conflicting policy signals provide the opposite message and chill investor confidence in sustainability. An example is government policies that set the expansion of renewable energy as a primary policy goal while at the same time providing heavy subsidies for fossil fuel-based energy generation.

Incorporation of the full cost of externalities into the market price of resources is becoming increasingly important for scaling up investment in sustainable development. This is done through a range of economic and fiscal instruments, including environmental taxation (e.g. carbon tax), cap-and-trade systems and the removal of environmentally harmful subsidies. These instruments encourage emitters and resource users to find and implement the cheapest abatement options and to maximize efficiency in the use of resources, minimizing the overall cost to the economy. Environmental taxes and emission trading initiatives are already in place in several industrialized countries, while many developing countries are currently considering implementing regional, sectoral or national carbon emission trading initiatives. Application of these instruments will create both winners and losers among the businesses. Consideration of these diverse economic impacts and gradual rather than abrupt transition to the new policy instruments will be key for ensuring the effectiveness of sustainability policies.

Measures to enhance access to finance by improving the risk-return ratio can play a key role, both in terms of lessening the environmental footprint of production and facilitating investment into innovative greener products and services. Instruments for improving the reward parameters of sustainability projects range from putting a price on environmental externalities (e.g. carbon) to financial incentives aimed at increasing direct returns (e.g. feed-in-tariffs for renewable energy, tax credits for green investment). Financial incentives may also include market-based mechanisms that create additional income from the sale of emission allowances or other rights to the use of resource. However, there must be certainty around continuation of financial incentives by the government, as sudden changes (e.g. abrupt discontinuation of feed-in-tariffs) may bear significant adverse impacts for investors. Many countries provide financial incentives for energy-efficient equipment and price supports for renewable energy, to stimulate the diffusion of technologies. In the US, the Energy Policy Act of 2005 contains several financial incentives for various advanced technologies. These financial incentives have been estimated at US$11.4 billion over a 10-year period.[13]

> **“Standards and regulations can promote sustainable practices on the production and supply side, such as standards for pollution control or energy standards”**

[13] Intergovernmental Panel on Climate Change (IPCC). (2007) *Fourth Assessment Report: Climate Change* (AR4)

"Policymakers are urged to deliver the overarching policy goals that will be crucial for business to make a timely transition towards a sustainable society."

Policymakers can also help extend the period of lending or reduce the level of interest by, for example, providing blended public-private finance or guarantees. Government loan guarantees can allow private sector investors to borrow at a lower rate. Multilateral and bilateral financial institutions have long used such guarantees to mobilize private finance for infrastructure projects and restructuring programs.

Mixed equity funds are another means for lowering the risks for private equity investors. Such funds subordinate the public capital within the fund, giving private investors their returns first and protecting against the risk of project default or low financial performance. These mechanisms provide investors with the confidence to invest in less mature initiatives, where the financial model, technologies or skills bases might not yet be well established, but do not require governments to fund sustainability projects in full and up-front.

Taxation, if applied carefully and correctly, can provide an efficient tool for influencing behavior and promoting sustainability while raising revenue and providing a financial incentive to the marketplace. Approaches vary depending on jurisdiction. The US, for example, uses the "carrot" of tax incentives to promote the development of energy and sustainability projects. Some examples include programs for:

- alternative energy and energy efficiency;
- grants in lieu of tax credits;
- alternative fuel vehicles;
- energy efficient buildings deduction;
- energy efficient appliance credit;
- solar, geothermal and wind state incentives;
- green building related state incentive;
- sales tax exemptions;
- property tax exemptions and abatement;
- electricity related state tax incentives.[14]

Sweden applied the "stick" of carbon tax in 1991, which reduced greenhouse gas emissions during a period of overall economic growth while successfully assisting in raising revenue.

Standards and regulations can promote sustainable practices on the production and supply side, such as standards for pollution control or energy standards. On the demand side, they play a major role in directing markets towards more sustainable products in a number of sectors, such as home appliance standards for efficiency and fuel efficiency in automobiles. Furthermore, governments have a role in strengthening the metrics related to sustainability and productivity opportunities. Adoption of international reporting standards for business would significantly decrease complexity.

Capacity development and improving awareness efforts can be particularly important on the demand-side for influencing the preferences of consumers towards more sustainable lifestyles. Governments can play a major role in training local workforces and in building capacity for deployment of green technology, which in turn facilitates investors with a qualified local work force.

[14] KPMG (2011) – *Making Green Greener – Tax Incentives for Energy Sustainability*

Government incentives for R&D are critical for facilitating innovation and helping business scale-up investment in newer, more sustainable products, technologies and resource substitutes. Government has a wide range of measures available, including tax incentives, direct government procurement or direct governmental R&D funding.

Recommendations: the essentials of government action towards sustainability

The global sustainability megaforces of the coming decades are likely to bring shocks and surprises. As governments in all regions could be called upon to take more steps to limit or reverse negative environmental and social impacts, businesses will be confronted with an ever more complex web of sustainability-related fiscal instruments and legislation. Policymakers are urged to deliver the overarching policy goals that will be crucial for business to make a timely transition towards a sustainable society.

- Continuity and coherence in policy: Clear, well planned and secure government policies are crucial for scaling-up investment and facilitating the transition to a green economy. Strong collaboration across governmental bodies and ministries on sustainability issues will be key.
- Reducing complexity in policy: Reducing regulatory complexity and improving transparency is another key area for action, as businesses frequently cite regulatory complexity as one of the main sources of risk and uncertainty surrounding sustainability.
- Coordinated international collaboration: Multilateral coordination across countries and regions, particularly for carbon markets and any future climate treaty, is needed to reduce regulatory complexity.
- Creation of enabling "green" investment environment: Policymakers need to remove barriers to green investment and establish the essential enabling conditions in all areas: national-level regulations, policies, subsidies, incentives and legal frameworks, as well as international market, legal infrastructure, trade protocols and development aid measures. In creating an enabling environment, governments must seek to use a variety of policy tools – including taxation.
- Increased collaboration with private sector through Public-Private Partnerships (PPPs): If properly designed, PPPs can provide an effective architecture for promoting sustainability in a way that mobilizes private sector finance, rather than relying on public funding alone.

Business and government working together: Public-Private Partnerships as a tool for green growth

In the transition to green growth, the success – or failure – of government policies may hinge on the ability of policymakers to build effective partnerships with the key actors. This will require a full understanding of their partners' motivating factors, mutual interdependencies and long-term requirements, in addition to how they can best benefit through effective interaction. To achieve their strategies, governments need corporations to provide low-carbon and green technology, the skills to deploy and operate it, and the funds of financiers to invest in delivering it. Given that many national budgets remain stretched as a result of the global financial crisis, the conditions seem ripe for the wider introduction of PPP structures using private finance.

"Getting PPPs right will almost certainly be the key to unlocking affordable and sustainable infrastructure funding that ultimately will enable high-growth markets to maintain their current trajectory."

In many emerging markets, such as India and Brazil, PPP has been successfully used for economic infrastructure that generates cash flows directly from the users (such as toll roads, electricity generation, and water supply). The success of PPP structures in high-growth markets often comes down to fully understanding the ramifications of these structures on governments, sponsors and users. Developing successful PPP structures in emerging and high-growth markets requires both governments and sponsors to be realistic about the specific risk allocations for PPP projects, and to carefully assess the ability of projects to be freestanding economically. Getting this right will almost certainly be the key to unlocking affordable and sustainable infrastructure funding that ultimately could enable high-growth markets to maintain their current trajectory.[15]

Case Study: Mobilizing private sector investment for low-carbon technology through PPPs

International agreements under the United Nations Framework Convention on Climate Change (UNFCCC) now include a set of policies and actions, Nationally Appropriate Mitigation Actions (NAMAs), that developing countries can undertake as part of their commitment to reduce greenhouse gas emissions. The term NAMAs recognizes that different countries may undertake different actions and emission-reduction projects according to their specific national circumstances. It also emphasizes the need for financial assistance from developed countries to developing countries to help reduce their emissions. A key factor for ensuring the future success of NAMA projects therefore depends on the identification of an effective investment model that can successfully deploy low-carbon private capital at the scale required to secure a successful low-carbon transition for developing economies.

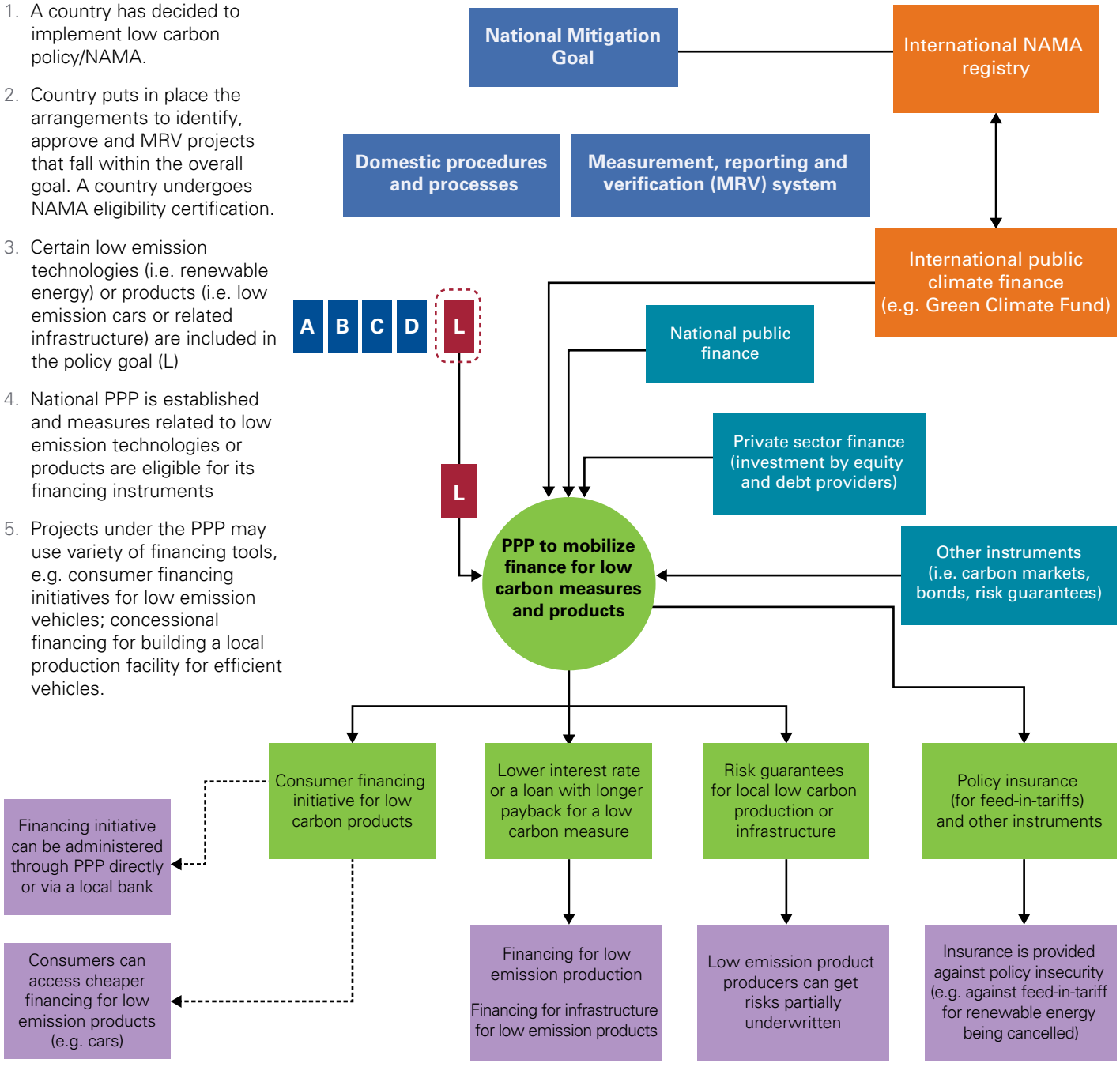
KPMG believes private sector investment through PPPs presents just such an effective model. Our proposed model employs a number of public finance instruments to remove barriers to private investment. Seed capital should come from the international financial pledges by developed nations through the Copenhagen Accord: US$30 billion in 2010-2012 and up to US$100 billion to be mobilized annually by 2020, i.e. through the Green Climate Fund or private sector facility. The model would give access to low-carbon finance in developing countries and leverage additional private finance by integrating the full toolbox of financial instruments to address the barriers related to the risk and reward profiles of projects (see *Figure 50*). Furthermore, it ensures the continuity of finance, since it would operate on a revolving basis both at the national and international level.

For example, the PPP at the national level could underwrite project risks or provide insurance against policy changes such as subsidies being removed. This type of insurance would improve a NAMA project's chances of attracting commercial finance. To benefit from such mechanisms, the country would need to have determined its overall policy goal, identified and prioritized mitigation measures, and undertaken financial and technological analysis of barriers and enablers to finance. Furthermore the essential domestic elements of the NAMA infrastructure need to be in place, in particular mechanisms and processes for measurement, reporting and verification of emissions and their reductions.

[15] KPMG (2011). *Insight – Urbanisation: The massive challenge facing cities and innovative ways it's being addressed.*

Figure 50: Options for mobilizing climate finance through PPPs

1. A country has decided to implement low carbon policy/NAMA.
2. Country puts in place the arrangements to identify, approve and MRV projects that fall within the overall goal. A country undergoes NAMA eligibility certification.
3. Certain low emission technologies (i.e. renewable energy) or products (i.e. low emission cars or related infrastructure) are included in the policy goal (L)
4. National PPP is established and measures related to low emission technologies or products are eligible for its financing instruments
5. Projects under the PPP may use variety of financing tools, e.g. consumer financing initiatives for low emission vehicles; concessional financing for building a local production facility for efficient vehicles.



Source: Embarking on the low carbon journey: National Mitigation Actions as green growth vehicles in developing nations, KPMG International 2011.

For example, scaling-up the use of low emission or electric vehicles, the above model could help address most of the challenges car manufacturers face in delivering such vehicles to the market at scale. Grant financing through the PPP could build the capacity of local suppliers and infrastructure providers and help reduce the barriers to the production and operation of low emission vehicles (e.g., develop a charging infrastructure for electric vehicles or improve quality of fuel). The affordability of low emission vehicles for consumers could be addressed through a financing initiative under the PPP, whereby customers would be eligible for lower interest rates or longer repayment periods on their loans. This would reduce the price differential between conventional and low emission vehicles.

Almost all investments in any economy's low-carbon transition will cost more than carbon-intensive alternatives as long as the environmental costs are not properly priced, and, as such, are likely to be policy dependent. If the central question is "how developing nations can use NAMAs to increase investment in green growth," the answer is clearly "be more innovative in the blending of public and private finance". More effective collaboration is required between banks, pension funds, the private sector and semi-public resources. Putting a price on carbon can change the investment equation dramatically. Although challenging, it is nonetheless possible to design NAMAs that put the private sector center stage and blend public and private finance intelligently to achieve green growth goals. KPMG believes in the possibility of designing an international architecture for supporting climate change mitigation in a way that mobilizes private sector finance, rather than relying on public funding alone.

Recommendations for PPPs

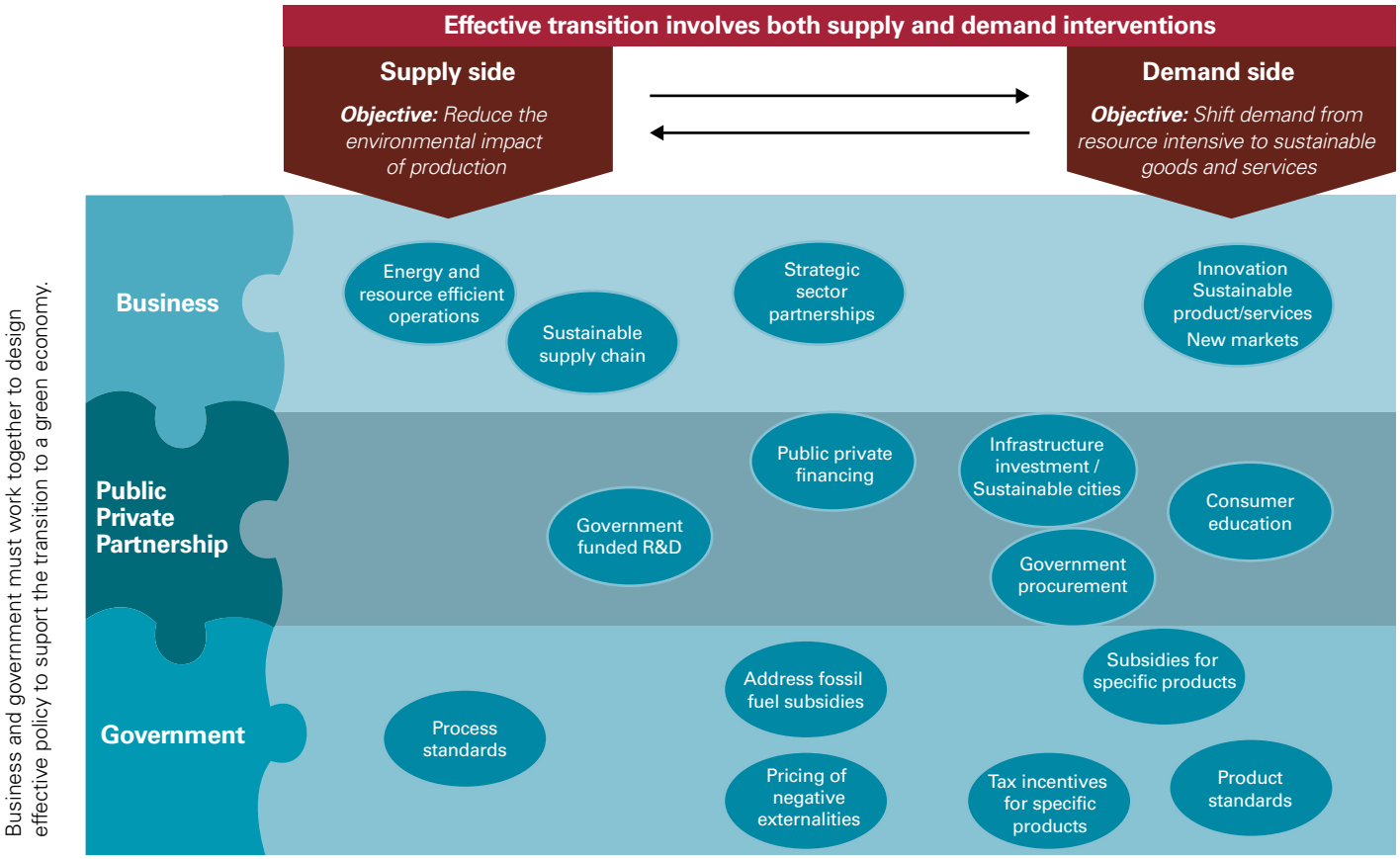
KPMG has engaged in many PPPs over the past 15 years. Based on this experience the key points for developing successful PPPs are:

1. Thorough planning and legal structuring to ensure that responsibilities are clearly established and risks are allocated and mitigated as far as possible;
2. Public contribution to up-front costs to build the confidence of investors. Funding options include concession agreements, equity or debt funding agreements;
3. Government taking an active role in monitoring and regulating the project;
4. Clear frameworks setting out how contracts will be reviewed over the time frame of the project (particularly important for projects with operational life of 10 years or more);
5. Transparency and competitiveness in procurement procedures.

Imperatives for achieving sustainable growth

The global sustainability megaforces that will reshape the planet in the next 20 years clearly demonstrate that the current resource-intensive structure of the economy is no longer viable. Current production techniques and the ever-growing quantities they demand are pushing many of the planet's resources to the brink. While the transition to a sustainable economy is technically possible, it requires widespread global support from businesses, governments and civil society. This transition requires solutions that address both how and which goods and services are produced (*Figure 51*). Clearly both the public and private sectors have a vital role to play and a coordinated approach holds the key to success.

Figure 51: Imperatives for concerted action on sustainability



Source: KPMG analysis.

Appendix 1: Methodology

Global Sustainability Megaforces

The global sustainability 'megaforces' identified as key drivers of future change in Part 1 of this report are: Climate Change; Energy & Fuel; Material Resource Scarcity; Water Scarcity; Population Growth; Urbanization; Wealth; Food Security; Ecosystem Decline; Deforestation.

The megaforces were identified through a review of over 30 external future trend projections a list of which can be found in Appendix 2.

Scenarios Interpretation

The scenarios interpretation in Part 1 of this report is based on a review of over 20 external future scenario research documents a list of which can be found in the bibliography included in Appendix 3.

Sector Definitions

The analysis in Part 2 of this report covers industry sectors defined according to the Industry Classification Benchmark (ICB) structure: a definitive system categorizing over 70,000 companies and 75,000 securities worldwide and maintained by FTSE International Limited. The ICB system recognizes four levels of industry aggregation: industry, supersector, sector, and subsector.

Most of the analysis was conducted at the sector level, but in a few cases data was analyzed at the industry level to capture an important industry fully, or at the subsector level in order to capture detail. This report covers:

Airlines (subsector): Companies providing primarily passenger air transport. Excludes airports.

Automobiles & Parts (sector): Makers of motorcycles and passenger vehicles, including cars, sport utility vehicles (SUVs) and light trucks. Manufacturers and distributors of new and replacement parts for motorcycles and automobiles, such as engines, carburettors and batteries. Manufacturers, distributors and retreaders of automobile, truck and motorcycle tires. Excludes makers of heavy trucks and makers of recreational vehicles (RVs and ATVs).

Beverages (sector): Manufacturers and shippers of cider or malt products such as beer, ale and stout. Producers, distillers, vintners, blenders and shippers of wine and spirits such as whisky, brandy, rum, gin or liqueurs. Manufacturers, bottlers and distributors of non-alcoholic beverages, such as soda, fruit juices, tea, coffee and bottled water.

Chemicals (sector): Producers and distributors of simple chemical products that are primarily used to formulate more complex chemicals or products, including plastics and rubber in their raw form, fibreglass and synthetic fibres. Producers and distributors of finished chemicals for industries or end users, including dyes, cellular polymers, coatings, special plastics and other chemicals for specialized applications. Includes makers of colourings, flavours and fragrances, fertilizers, pesticides, chemicals used to make drugs, paint in its pigment form and glass in its unfinished form. Excludes producers of paint and glass products used for construction.

Electricity (sector): Companies generating and distributing electricity through the burning of fossil fuels such as coal, petroleum and natural gas, and through nuclear energy. Companies generating and distributing electricity from a renewable source. Includes companies that produce solar, water, wind and geothermal electricity.

Food Producers (sector): Companies that grow crops or raise livestock, operate fisheries or own nontobacco plantations. Food producers, including meatpacking, snacks, fruits, vegetables, dairy products and frozen seafood. Includes producers of pet food and manufacturers of dietary supplements, vitamins and related items. Includes manufacturers of livestock feeds and seeds and other agricultural products. Excludes producers of fruit juices, tea, coffee, bottled water and other non-alcoholic beverages, which are classified under Beverages. Excludes manufacturers of fertilizers or pesticides, which are classified under Chemicals.

Industrial Metals & Mining (sector): Companies that mine or process bauxite or manufacture and distribute aluminium bars, rods and other products for use by other industries. Producers and traders of metals and primary metal products other than iron, aluminium and steel. Manufacturers and stockholders of primary iron and steel products such as pipes, wires, sheets and bars, encompassing all processes from smelting in blast furnaces to rolling mills and foundries. Includes companies that primarily mine iron ores. Excludes manufacturers of finished aluminium products, such as siding, which are categorized according to the type of end product. Excludes companies that make finished products, which are categorized according to the type of end product.

Mining (sector): Companies engaged in the exploration for or mining of coal. Companies engaged in the exploration for and production of diamonds and other gemstones. Companies engaged in the exploration, extraction or refining of minerals not defined elsewhere within the Mining sector. Prospectors for and extractors or refiners of gold-bearing ores. Companies engaged in the exploration for and production of platinum, silver and other precious metals not defined elsewhere.

Marine Transportation (subsector): Providers of on-water transportation for commercial markets, such as container shipping. Excludes ports and shipbuilders.

Oil & Gas (industry): Companies engaged in the exploration for and drilling, production, refining and supply of oil and gas products. Integrated oil and gas companies engaged in the exploration for and drilling, production, refining, distribution and retail sales of oil and gas products. Suppliers of equipment and services to oil fields and offshore platforms, such as drilling, exploration, seismic-information services and platform construction. Operators of pipelines carrying oil, gas or other forms of fuel. Excludes pipeline operators that derive the majority of their revenues from direct sales to end users, which are classified under Gas Distribution. Companies that develop or manufacture renewable energy equipment utilizing sources such as solar, wind, tidal, geothermal, hydro and waves. Companies that produce alternative fuels such as ethanol, methanol, hydrogen and bio-fuels that are mainly used to power vehicles, and companies that are involved in the production of vehicle fuel cells and/or the development of alternative fuelling infrastructure.

Telecommunications (industry), Telecommunications Equipment (sector) and Internet (subsector): Providers of fixed-line telephone services, including regional and long-distance. Includes companies that primarily provides telephone services through the internet. Providers of mobile telephone services, including cellular, satellite and paging services. Includes wireless tower companies that own, operate and lease mobile site towers to multiple wireless service providers. Makers and distributors of high-technology communication products, including satellites, mobile telephones, fibres optics, switching devices, local and wide-area networks, teleconferencing equipment and connectivity devices for computers, including hubs and routers. Companies providing Internet-related services, such as Internet access providers and search engines and providers of Web site design, Web hosting, domain-name registration and e-mail services.

Further information on the ICB structure can be found at www.icbenchmark.com

Quantitative Analysis: Value at stake and environmental intensity

The quantitative data in Part 2 of this report is generated by Trucost, an independent environmental research agency. The data use a pricing methodology that calculates the cost to global society of environmentally-sensitive corporate activities. These include inputs such as resource use and outputs such as greenhouse gas and pollutant emissions. The data set is based on the operations of over 800 companies between 2002 and 2010 (2010 being the most recent available data) and representing the 11 key business sectors. The selection of companies is representative, as an exact comparison of companies between the two census dates is not possible due to alterations in the corporate landscape between 2002 and 2010.

The Trucost data price the damage that is done to society and human capital by pollutants and natural resource use. This external costs-based system draws on a library of prices for over 700 different natural inputs and outputs. The prices

are based on cost principles derived from a review of environmental economics literature, and the library is overseen by an independent international advisory panel of leading academics. A total of 22 key environmental impacts were evaluated for this report, including: greenhouse gases (carbon dioxide, HFCs, nitrous oxide, methane, perfluorocarbons, sulphur hexafluoride), waterabstraction, pollutants including acid rain precursors, ozone depleting substances, and waste generation. The physical totals of these inputs and outputs incurred both directly and indirectly[1] were converted into financial values and aggregated to achieve a total environmental cost value. These costs which for the most part do not appear on corporate financial statements are known as external environmental costs.

In the quantitative analysis the external costs of these 22 environmental impacts have been compared with sector EBITDA. EBITDA data come from independent financial data providers, and are checked by Trucost analysts against company financial statements.

The conversion of environmental impacts into dollar sums of external environment cost is a relatively new practice. For this reason, the analyses and summary should be taken as indicative rather than absolute.

Qualitative: Risk and readiness

The perceived risk and readiness interpretation is based on KPMG's meta-review of over 60 external industry reports, which aggregates citations of sustainability risks and indicators of risk preparedness for all 11 sectors. Reports from sources including investment banks, business associations, insurance companies, consultancies, rating agencies and intergovernmental organizations were analysed in terms of risk types and sector preparedness. The risk categories used were physical risks; competitive risks, regulatory risks, reputational risks, litigation risks, and social risks. Expanded definitions of these categories of risk can be found in the Introduction to Part 2 of this report. The incidence and level of references to the six risks outlined were aggregated to provide an overall score of sectoral risk and readiness. In addition, the level of sector readiness has also been assessed using the results of the KPMG International Corporate Responsibility Reporting Survey 2011.

The qualitative findings of this review should be taken as indicative not absolute; risk exposure and readiness levels are perceived values, providing both a relative indicator across sectors, and a risk reading that is supplementary to the quantitative assessment.

[1] The external environmental cost data relate to both direct and indirect inputs and outputs – that is costs incurred by a surveyed company, plus costs incurred in the company's upstream supply chain. Trucost uses a global input-output model based on detailed government census and survey data on resource use and pollutant releases, industry data and statistics, and national economic accounts. The model can distinguish inputs and outputs at any level of the supply chain from the first-tier of suppliers through to total upstream supply chain requirements. The input-output methodology models the purchases a company makes and the resultant environmental impacts. This provides a means to differentiate between low impact supplied goods, such as renewable energy, and high impact supplied environmental goods, such as fossil fuel energy.

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Glossary: Terms & abbreviations

ADB: Asian Development Bank.

APERC: Asia Pacific Energy Research Center.

ATC: Air Traffic Control.

Basel III: A set of banking regulations agreed in response to the financial crises that occurred at the end of the first decade of the 2000s. The regulations greatly increase the amount of capital banks must hold against their losses.

BAU: Business as usual.

BGS: British Geological Society.

Biomass: Biological material from living or recently-living organisms (usually in the context of a capability of being thermally, chemically or bio-chemically converted to energy). Examples include wood, grasses and crops.

BLS: US Bureau for Labor Statistics

BRIC: Brazil, Russia, India & China.

Carbon Trading: A system for pricing carbon emissions and trading the rights to emit carbon. Examples include the EU Emissions Trading System and the UN's Clean Development Mechanism.

CBD: Convention on Biological Diversity

CCS: Carbon Capture and Storage.

CDM: Clean Development Mechanism – a 'flexibility mechanism' defined in the Kyoto Protocol (2007) that allows industrialized countries to invest in emissions reductions in developing economies and thus gain carbon credits.

CDP: Carbon Disclosure Project.

Cefic: The European Chemical Industry Council.

Ceres: A coalition of more than 120 investors and public interest groups working towards global sustainability solutions.

CLD: Causal Loop Diagramming, a method of depicting the interaction of trends.

CO_2: Carbon dioxide.

CR: Corporate responsibility.

Crack Spread: The cost difference between a barrel of crude oil and a barrel of the petroleum products made from it, eg. jet fuel.

Cubic Meter: 1 cubic meter = 264.17 US gallons.

DEFRA: UK Department for Environment, Food, and Rural Affairs.

EBITDA: Earnings before interest, tax, depreciation and amortization.

EEDI: Energy Efficiency Design Index – a minimum standard of maritime energy efficiency established by the International Maritime Organization.

EIA: US Energy Information Administration.

EIU: Economist Intelligence Unit.

EPA: US Environmental Protection Agency.

EPHC: Environment Protection & Heritage Council.

ETS: Emissions Trading System.

EVs: Electric vehicles, including battery powered vehicles, full and plug-in hybrids, and fuel cell vehicles.

External Environmental Costs: A calculation of the total non-balance sheet value of environmentally-sensitive inputs and outputs in corporate operations, using the Trucost input/output price library.

FAA: US Federal Aviation Administration.

FAO: Food and Agriculture Organization.

FFF: Forum for the Future.

FSC: Forest Stewardship Council.

FWA: Fixed Wireless Access.

G20: A forum for 19 countries representing the world's leading economies, plus a representative of the European Union, meeting annually.

G250: Global Fortune 250 ranking of companies.

G8: A forum for eight countries, Canada, France, Germany, Italy, Japan, UK, US, and Russia, meeting annually.

GAO: US Government Accountability Office.

GCF: Green Climate Fund.

GDP: Gross Domestic Product.

GeSI: Global e-Sustainability Initiative, an ICT industry membership organization.

GFN: Global Footprint Network, an international sustainability think-tank.

GHG: Greenhouse gas.

GM: Genetically modified.

GRI: Global Reporting Initiative. GRI's Sustainability Reporting Guidelines have gained widespread adoption as the *de facto* global standard for CR reporting.

$GtCO_2e$: Gigatonne of CO_2 equivalent.

IATA: The International Air Transport Association.

IBA: Indian Beverages Association.

ICT: Information & Communications Technology.

IEA: International Energy Agency.

IFPRI: International Food Policy Research Institute.

IFTF: Institute for the Future.

IMF: International Monetary Fund.

IMO: International Maritime Organization.

IOC: International oil company.

IPCC: Intergovernmental Panel on Climate Change.

ITU: International Telecommunication Union.

JLG: Joint Liaison Group of the Rio Conventions.

Living Planet Index: An indicator of the state of global biodiversity, developed by the WWF.

LNG: Liquefied natural gas.

MARINTEK: Norwegian Marine Technology Research Institute.

MDO: Marine diesel oil.

Metric Ton: 1 metric ton (or tone) = 1.1 US (short) tons.

Millennium Ecosystem Assessment: A United Nations-sponsored research project undertaken 2001-2004 designed to identify the implications of global ecosystem change.

MRV: Monitoring, reporting and verification.

MSA: Mean Species Abundance, a biodiversity indicator.

MWh: Megawatt hour.

N100: The largest 100 companies by country.

NAMA: Nationally Appropriate Mitigation Action.

NGN: Next Generation Network.

NGO: Non-Governmental Organization.

NOC: National oil company.

OECD: Organization for Economic Cooperation and Development.

PEFC: Program for the Endorsement of Forest Certification.

PES: Payments for Ecosystem Services, incentives for ecological management of agricultural resources.

PPP: Private Public Partnership.

RED: EU Renewable Energy Directive, a 2009 directive designed to ensure that the EU produces 20% of overall energy and 10% of transport energy from renewable sources by 2020.

REDD: Reducing Emissions from Deforestation and Degradation.

REM: Rare Earth Mineral.

SEI: Stockholm Environment Institute.

SERI :Sustainable Europe Research Institute.

SFI: Sustainable Forestry Initiative.

SIK: Swedish Institute for Food and Biotechnology.

SITM: Symbiosis Institute of Telecom Management.

Smart building: A building that embodies a group of embodied ICT systems that maximize energy efficiency.

Smart grid: An electric power grid that integrates ICT applications throughout the grid to enable efficiency and optimization solutions.

SOX: The Sarbanes–Oxley Act (also known as the Public Company Accounting Reform and Investor Protection Act), a 2002 US federal law.

TEEB: The Economics of Ecosystems and Biodiversity, a United Nations Environment Program research initiative designed to explore the economic benefits of biological diversity.

UCSUSA: US Union of Concerned Scientists.

UII: Urban Infrastructure Initiative.

UN DESA: United Nations, Department of Economic and Social Affairs.

UNCTAD: United Nations Conference on Trade and Development.

UNDP: United Nations Development Programme.

UNEP: United Nations Environment Programme.

UNFCCC: United Nations Framework Convention on Climate Change.

UNFPA: United Nations Population Fund.

UN-Habitat: The United Nations agency for human settlements.

USDA: US Department of Agriculture.

USGS: US Geological Survey.

VOIP: Voice Over Internet Protocol.

WBCSD: World Business Council for Sustainable Development.

WEF: World Economic Forum.

Wimax: Worldwide Interoperability for Microwave Access, a wide-area high-speed internet delivery technology.

WRG: Water Resources Group.

WRI: World Resources Institute.

WWF: The World Wildlife Fund (known outside the US and Canada as the World Wide Fund for Nature).

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External Sources: Figures 1, 2, 3, and Figure 18

External Sources: Figures 1, 2, 3, and Figure 18

Figure 1: Accelerating human footprint on natural systems and resources
(*Percent change statistics ranging from 1990 through 2011 on a global basis*)

1. *Air freight transport*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
2. *Gross domestic product*: World Bank, World Development Indicators 2005 (1990 World GDP); United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012) (2010 World GDP).
3. *Cement production*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
4. *Merchandise exports*: World Bank, World Development Indicators 2011.
5. *Nitrogen fertilizer use*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
6. *Plastics production*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
7. *International tourist arrivals*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
8. *Palm oil land area*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
9. *Air passenger transport*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
10. *Steel production*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
11. *Construction minerals use*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
12. *Soybean land area*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
13. *Electricity production*: World Bank, World Development Indicators 2011.
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15. *Coal consumption*: Energy Information Administration (EIA), International Energy Outlook 2011.

16. *Natural gas consumption*: Energy Information Administration (EIA), International Energy Outlook 2011.
17. *Livestock production*: World Bank, World Development Indicators 2011.
18. *Urban population*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
19. *Food production*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
20. *Energy consumption*: Energy Information Administration (EIA), International Energy Outlook 2011.
21. *Total materials extraction*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
22. *Global CO_2 emissions*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012) (1990 global CO_2 emissions); International Energy Agency (IEA), World Energy Outlook 2011 (2010 global CO_2 emissions).
23. *Fish and seafood consumption*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
24. *Petroleum consumption*: Energy Information Administration (EIA), International Energy Outlook 2011.
25. *Global ecological footprint*: World Wildlife Fund, Living Planet Report 2010.
26. *Per capita natural resource consumption*: Sustainable Europe Research Institute (SERI), Global Materials Flow Database (www.materialflows.net).
27. *World population*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
28. *Meat consumption*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
29. *Resource intensity*: Sustainable Europe Research Institute, Under Pressure (Nov. 2011).
30. *CO_2 emissions per unit GDP*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).

Figure 2: Human social and economic progress
(*Percent change statistics ranging from 1990 through 2011 on a global basis*)

1. *HIV prevalence, % pop aged 15-49*: World Bank, World Development Indicators 2011.
2. *Female parliamentarians*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
3. *Mean years of schooling*: United Nations Development Programme, Human Development Reports (various years).

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5. *Number of free countries*: Freedom House, *Freedom in the World 2012: The Arab Uprisings and their Global Repercussions*.
6. *Slum dwellers*: United Nations Development Programme, Human Development Reports (various years).
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8. *Access to improved sanitation*: World Bank, World Development Indicators 2011.
9. *Access to improved water service*: World Health Organization (WHO) Fact Sheet 290 (May 2011).
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11. *Primary education completion rate*: World Bank, World Development Indicators 2011.
12. *Adult literacy rate*: World Bank, World Development Indicators 2011.
13. *Girl-boy ratio, education enrollment*: World Bank, World Development Indicators 2011.
14. *Life expectancy at birth*: World Bank, World Development Indicators 2011.
15. *Male youth literacy rate*: World Bank, World Development Indicators 2011.
16. *Female labor force participation*: World Bank, World Development Indicators 2011.
17. *Population living <$US 2.00 per day*: World Bank, World Development Indicators 2011.
18. *Dependency ratio on working population*: World Bank, World Development Indicators 2011.
19. *Undernourishment prevalence*: World Bank, World Development Indicators 2011.
20. *Underweight children <5 years old in the developing world*: United Nations, Millennium Development Goals Report 2011.
21. *Total fertility rate*: World Bank, World Development Indicators 2011.
22. *Population living <$US 1.25 per day*: World Bank, World Development Indicators 2011.
23. *Population average annual growth rate*: World Bank, World Development Indicators 2011.
24. *Infant mortality rate*: World Bank, World Development Indicators 2011.
25. *Maternal mortality rate*: World Bank, World Development Indicators 2011.
26. *Under 5 child mortality rate*: World Bank, World Development Indicators 2011.

Figure 3: Persistent human deprivation
(*Percent change statistics ranging from 1990 through 2011 on a global basis*)

1. *People without access to adequate sanitation*: United Nations Environment Programme (UNEP), *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*, 2011.
2. *People living on less than $US 2.00 per day*: World Bank PovcalNet (online database of global poverty statistics).
3. *People severely restricted in civil and political freedoms*: Freedom House, *Freedom in the World 2010: Global Erosion of Freedom*.
4. *People intermittently lacking food security*: United Nations Food and Agriculture Organization (FAO).
5. *People without access to reliable electricity supplies*: United Nations Environment Programme (UNEP), *Keeping Track of Our Changing Environment, From Rio to Rio +20* (1992-2012).
6. *People living on less than US $1.25 per day*: World Bank PovcalNet (online database of global poverty statistics).
7. *People lacking access to professional health care systems*: World Health Organization (2008), The World Health Report 2008.
8. *People suffering from malnutrition/undernourishment*: United Nations Food and Agriculture Organization (FAO), FAO World Livestock 2011: Livestock in food security.
9. *People without literacy*: UNESCO Institute for Literacy Statistics (2011).
10. *People without access to safe drinking water*: United Nations, Millennium Development Goals Report 2011.
11. *People living in slums without secure shelter*: United Nations, Millennium Development Goals Report 2011.
12. *People without gainful employment*: International Labor Organization (ILO), Global Employment Trends 2011.

Figure 18: Summary of business-as-usual global projections
(*Variously from 2008/2010 to 2035*)

1. *Energy-related CO_2 emissions*: International Energy Agency (IEA), World Energy Outlook 2011.
2. *Mean temperature rise*: IPPC/UNEP/GRID-Arendal, Graph: *Projected Changes in Global Temperature (global average 1856-1999 and projection estimates to 2100)*.
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4. *Net electricity generation*: Energy Information Administration (EIA), International Energy Outlook 2011.
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13. *Urban land cover km²*: Seto K.C., et. al. (2011). *A Meta-Analysis of Global Urban Land Expansion*.
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- Sustainable supply chain enhancements
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