

Changing Pace

Public policy options to scale and accelerate



business action towards Vision 2050



wbcasd

Contents

1	Foreword
2	A public policy process for Vision 2050
4	Vision 2050 – the Pathway policy elements
11	People’s values
15	Human development
23	Economy
33	Agriculture
39	Forests
43	Energy and power
49	Buildings
55	Mobility
61	Materials
69	Acknowledgements



Foreword

Changing Pace

In 2010, WBCSD published Vision 2050. In this important thought-piece, a vision was laid down showing what a sustainable world could look like in 2050, as well as a pathway to get us there.

In this report, the period between 2010 and 2020 was called the Turbulent Teens. And even though time has only moved forward by 2 years, it is already clear that turbulence is more severe than anticipated. Just look at the continuing financial crisis, with the threatening economic recession; the widespread social unrest; or the toll that the many natural and man-made disasters continue to take.

As the world's population has now hit the 7 billion mark, and continues to grow, WBCSD believes that the need for decisions and action to move towards Vision 2050 are more pressing than ever. The role of business is to provide practical solutions to create this sustainable world. Solutions that can best be initiated, and, more importantly, scaled up if the right framework of public policies provides the right incentives.

In order to break out of the current short term focus and threatening deadlock, WBCSD has decided to issue two further pieces of work that are aimed to move Vision 2050 from an

aspirational concept, to a clear and implementable call to action. This document: Changing Pace, translates each of the nine elements of the pathway to the sustainable world of Vision 2050, by means of clear and concrete public policy recommendations. This document will be complemented by a collection of concrete and measurable commitments to actions by some of the largest companies on our planet.

These two initiatives form the core of the WBCSD input to the UN Conference on Sustainable Development - better known as Rio +20 - in June of 2012. At WBCSD, we propose to actively engage business in the design and implementation of the public policies required for creating a sustainable world, given that:

- Public financing alone will fall short of the necessary investment levels to create a global economy that successfully deals with the resource and carbon limitations of the future.
- A predictable, certain and long-term policy will encourage business to work with investors, to implement and scale up solutions, in line with the Vision 2050.
- As explained in each of the elements of the pathway in Vision 2050, the Green Race will need to evolve as we move through the different stage of exploring, testing, scaling up and learning from yet unfound solutions. This is best carried out in close co-operation between business and governments.

Changing Pace is neither a consensus piece nor a definitive answer. It is intended to be the starting point for a discussion around the best policies that can help get the realization of Vision 2050 underway without delay. As such, it is an invitation from WBCSD and its members to governments, policy makers, civil society, and business leaders to actively engage in the debate now.

Peter Bakker
President WBCSD

Chad Holliday
Chairman of WBCSD



Vision 2050

A public policy process for

The Vision 2050 project addressed three questions:

- What does a sustainable world look like?
- How can we realize it?
- What are the roles business can play in ensuring more rapid progress toward that world?

Vision 2050 is an optimistic, strong business perspective on what a sustainable world could look like. Designed as a constructive platform for dialogue about the future of the world, Vision 2050 outlines a world where every human can live well, without harming the ecosystems that support us now, and in the future. This presents the biggest economic opportunity ever. This is not, however, an opportunity that can be achieved under current mainstream business, consumption and policy conditions.

As desirable and coherent as it seems, Vision 2050 will neither happen spontaneously, nor by the good words and deeds of a group of global companies. Actually, most of today's progress is off or behind the Vision 2050 trajectory. Every year lost makes it harder to create the sustainable world.

Business cannot succeed in a world that fails, and it cannot avoid failure on its own. Its fundamental purpose is to provide continually improved goods and services for an increasing number of people, at prices they can afford, without unsustainable impacts, and in ways that create jobs and economic value. It is the role of governments to arbitrate between the needs of their citizens and societies, and the security and conservation of public goods; they must set the rules that define the priorities, the objectives of growth and

purchasing power, as well as determine how to get there. This role is ever more difficult: policy decisions are complex, from the vulnerability of local ecosystems and societies, to the swelling of megacities and the global circulation of capital, information, goods and greenhouse gases. At the same time, scientists and economists warn about the increasing risks of severe systemic failures. Such systemic failures also threaten our global economy.

As we near a major multilateral conference – Rio+20 – to review and revive progress on the path to sustainable development (a path that closely guided the formulation of our Vision 2050), we felt a responsibility to clarify the policy options that business recommends and endorses in order to accelerate progress at the necessary scale, and with the right momentum. This companion document to Vision 2050 is neither a program nor a positioning platform, but an offer to engage and contribute to complex and urgent policy solutions.

Taking population dynamics and ecological boundaries as given constraints, the WBCSD is convinced there is a path of decisions, precautions and innovations that will ensure economic growth and human development. Twenty years ago we called this path eco-efficiency. It inspired our members, many other companies, cities and the Organization for Economic Cooperation and Development (OECD) to embrace practices that start to decouple economic growth, human development and well-being from negative environmental and social impacts. We stressed that eco-efficiency *“is also about redefining the rules of the economic game in order to move from a situation of wasteful consumption and pollution, to one of conservation; and to one of privilege and protectionism to one of fair and equitable chances open to all”*.¹

In retrospect, the economic game has largely been redefined in favor of short-term wins and unfettered speculation, deferring externalities to future

¹ Changing Course, 1992



generations, and boosting economic growth with cheap credit for non-essential goods, to maintain enough employment and social stability. As a result, the global economy has taken a turn for the worse. In this context, eco-efficiency delivers much less than intended. Only countries that introduced supportive policies in the form of environmental taxes, subsidies, standards and labeling schemes have somewhat “decoupled” GDP growth from energy, water, mineral consumption and wastes, toxic and greenhouse gases production. But most efficiency gains are absorbed in further growth of local or export demand. Thus, at the global scale, this local and relative progress is overwhelmed by the growing flows and impacts of fossil fuels, materials, water and wastes throughout the entire world economy.

WBCSD believes that, in the right policy framework, education, empowerment, entrepreneurship and globalization can eliminate poverty and inequity and create sustainable livelihoods. For nearly a decade now, the promotion of **inclusive business** has been a major goal of our work: shaping core business activities into solutions that empower poor people to gain access to the formal economy and quality of life.

In the more recent drive for green growth in a **Green Economy**, we recognize continuity and coherence with our eco-efficiency and inclusive business focus that, in turn flowed from the 1992 Rio Earth Summit and its **Agenda 21**. Challenges are similar, only more urgent and difficult today due to the weak and or delayed action during the last two decades. By analyzing the green growth strategy that emerged from OECD Ministerial Council Meetings through the lens of our Vision 2050, we see good alignment between the business quest for competitiveness and progress on three vital fronts: poverty eradication, managing ecosystems sustainably, and better quality of life for all. This also holds for the United Nations Environment Program’s work on the Green Economy where we recognize, throughout the environmental challenges, the wider scope of inclusive, sustainable growth.

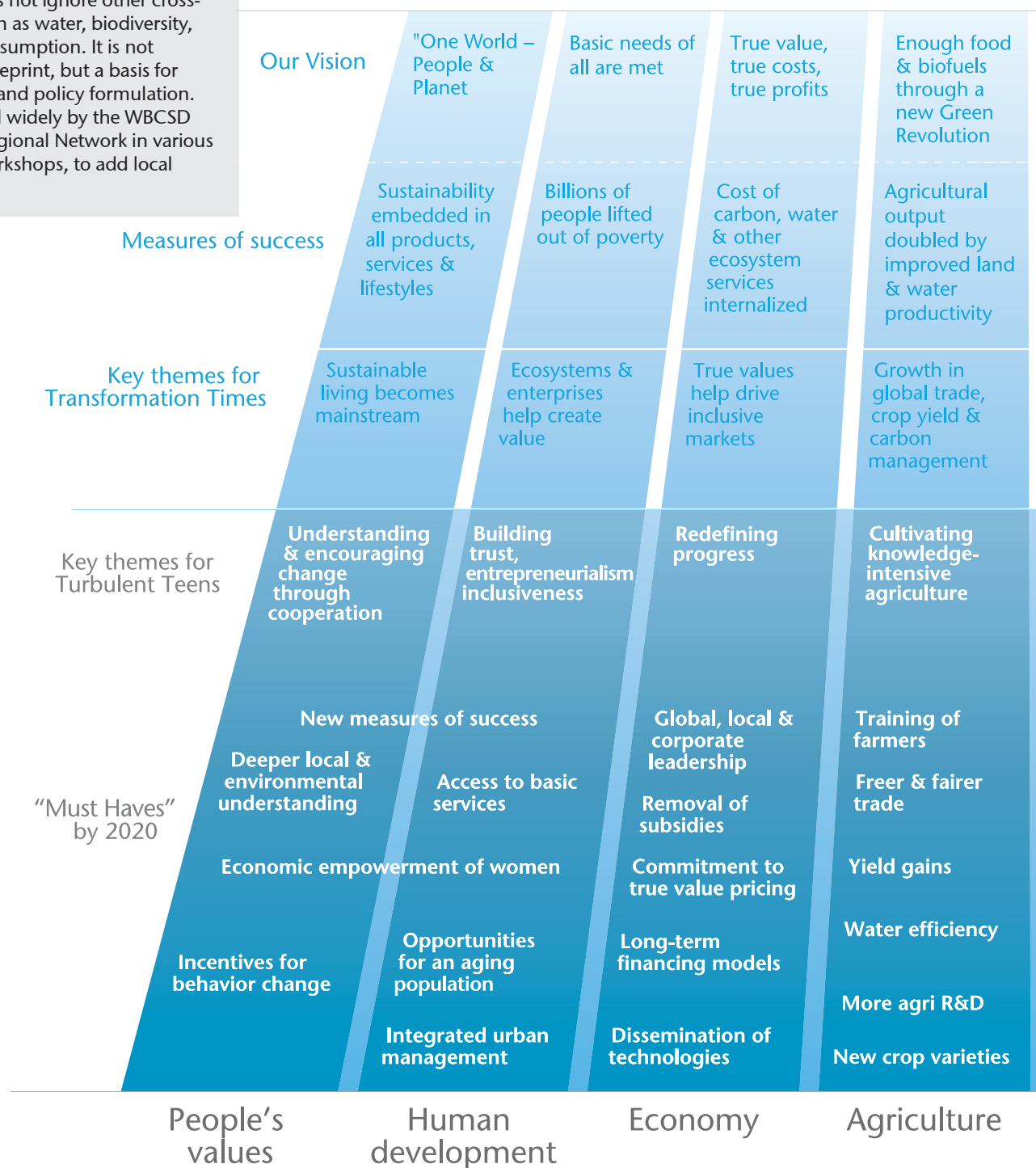
Far-sighted entrepreneurs and corporations everywhere are joining an unprecedented “**Green Race**” for climate-friendly, energy-, water- and resource-efficient technologies. In several countries, the fiscal and funding measures to stimulate economic recovery specifically aim to create a groundswell for this Green Race. However more is needed to sustain and amplify the movement. In particular, stimulus packages should be turned into stable public policies that value natural assets to reflect their growing scarcity, and reward Green Race innovations with cost advantages within the market. Innovations’ success is neither spontaneous nor secure, unless public policies create a strong and long-lasting coherence between the interests of all: government, business and consumers.

We acknowledge the difficulty to solve global issues by top-down agreements and global rules. Even though, in theory, this seems the logical way to proceed, sovereign states have not delegated to their multilateral institutions the power to arbitrate and force binding consensus. Decisions are too slow and are often uncertain, this hampering progress. But we can, nonetheless, build a mosaic of bottom-up initiatives that address local problems, with local actors who define their own stretched and binding goals. This pragmatic approach creates meaningful progress as well as competitive potential. It also builds experience and goodwill that can benefit multilateral frameworks. Because of their global ramifications, sustainability and poverty issues must ultimately be resolved through international exchanges of finance, technologies and human expertise, towards accepted common objectives.

The WBCSD developed **Vision 2050** in a thorough dialogue with its members, groups of experts and stakeholders. It was conceived according to a “back-casting” model: starting with a definition of the desirable 2050 future in operational terms and building a Pathway of actions and conditions that could lead us out of the present “Turbulent Teens” toward the objectives of the “Nine billion people living well, within the limits of the planet”. Vision 2050 stresses the business perspective on its role and opportunities. It highlights in particular, a set of actions and measures of progress along nine critical elements – see figure 1. In making this choice it does not ignore other cross-cutting areas such as water, biodiversity, pollutants or consumption. It is not intended as a blueprint, but a basis for further dialogue and policy formulation. As such, it is used widely by the WBCSD members and Regional Network in various stakeholders’ workshops, to add local perspectives.

Figure 1

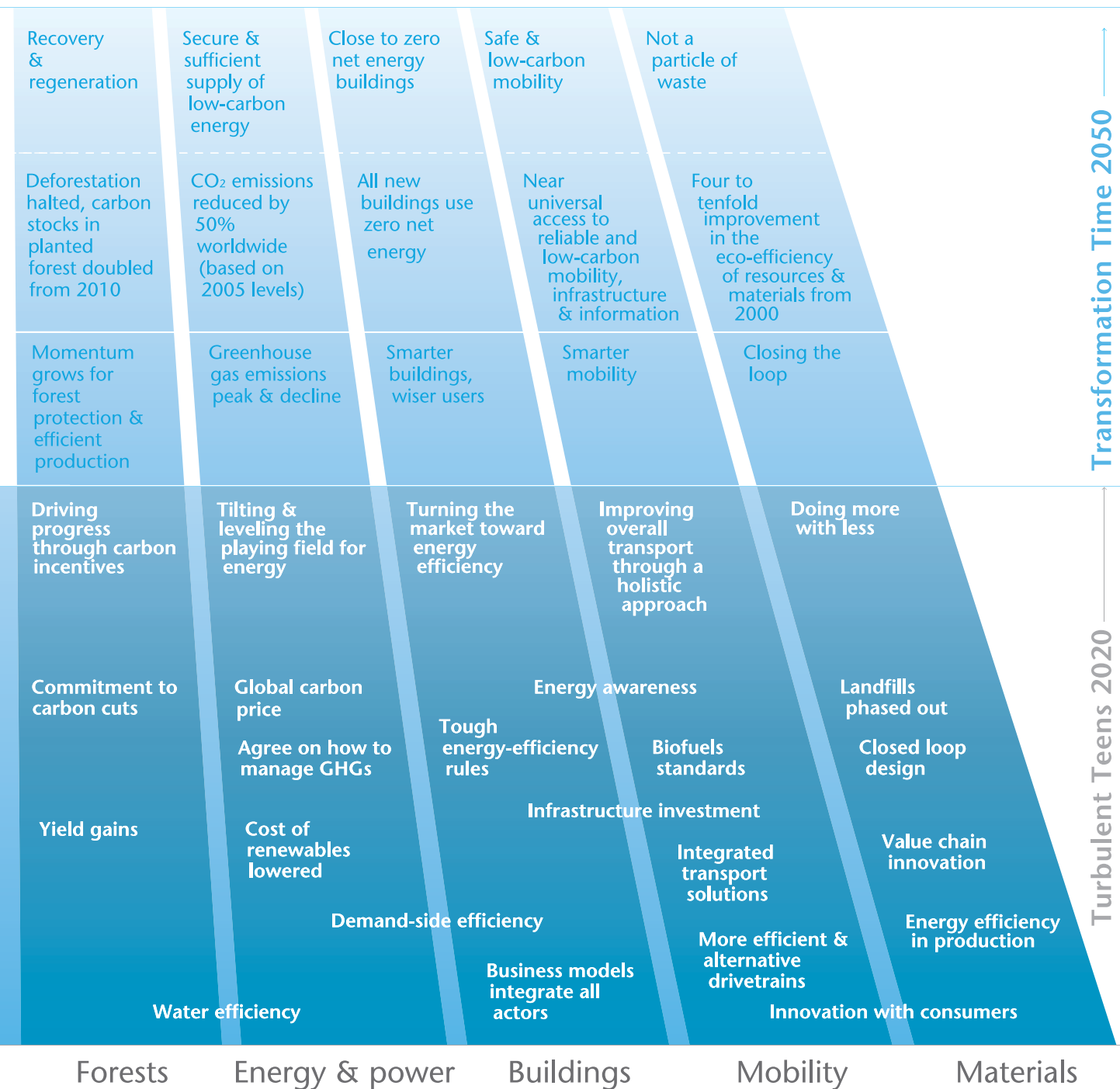
Vision 9 billion people living well,



From business as usual

2050

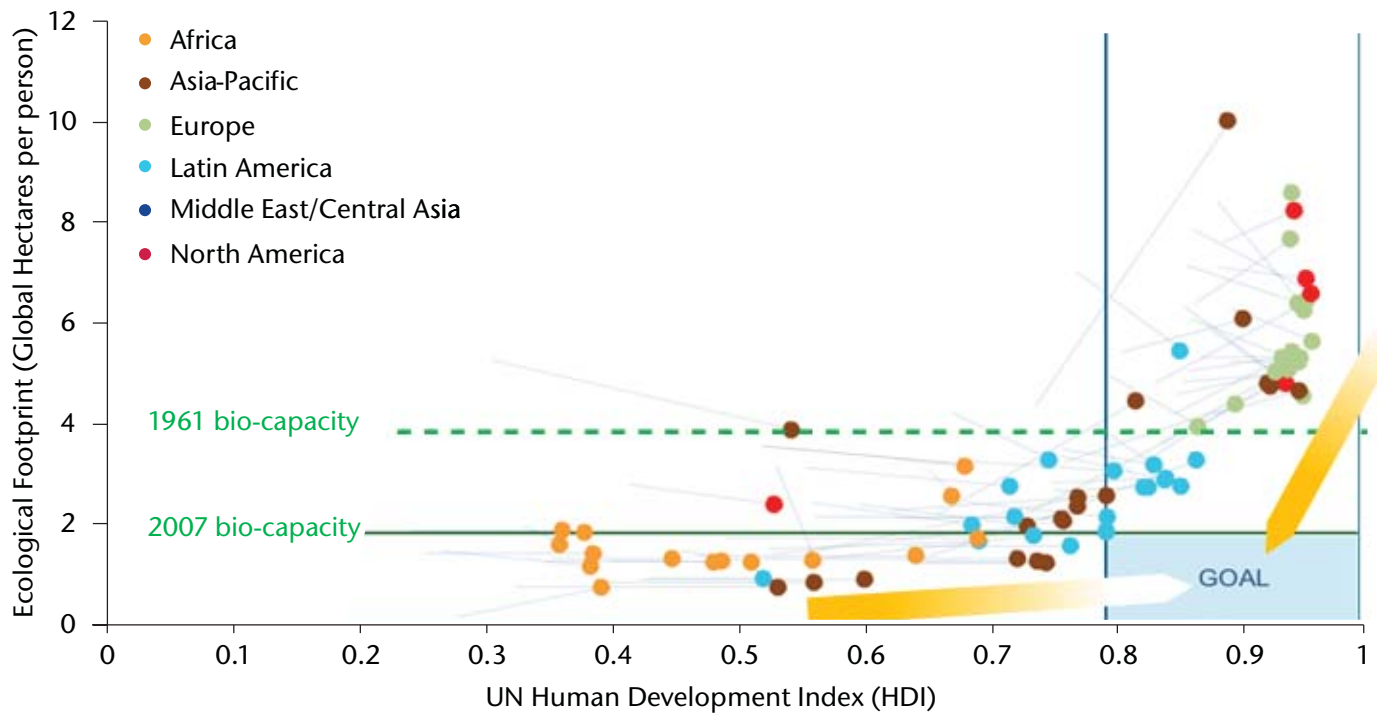
and within the limits of the planet



to a sustainable world in 2050

Sustainable Development: 1980 - 2007

Human Development Index and Ecological Footprint of Nations



In this document, we take stock of the 2011-2012 contexts for each main element of the pathway to test whether the assumptions are still accurate and cover all the important angles. We then identify specific government decisions and policies that we deem most helpful, from now on, in our common journey to 2050. They can apply at all levels, from cities and regions, to states and their unions.

When we consider these public policy options, we find a number of important connections and complementarities. They reflect the fundamental linkages between food, water, energy, materials, finance, quality of life, and human values. Although implementation will have to vary depending on the context, we can, nonetheless, propose overarching policy architecture with a process to secure the promises of Vision 2050.

In Vision 2050, we adopted a powerful chart that shows the relation between the two key indicators of sustainability; Human Development and Ecological Footprint (Figure 2). It illustrates the challenge of ensuring that our present progress trajectories focused on increasing human demand do not clash with the ecological capacity of our planet. Rich nations have achieved a high Human Development Index, but exceed the ecosystems carrying capacity. Many developing countries, on average, have not yet reached environmental boundaries, but fail to provide the desired human development. This is why the sustainable living² box remains empty. Yet this is where all nations must urgently converge, and be prepared to avert irreversible environmental degradation, severe social conflicts and breakdowns before 2050.

The proposed Green Growth Policy Accelerator Model (Figure 3) is therefore aimed at drawing every national economy into the sustainable living zone by or before 2050. It relies on the interaction of seven key categories of government decisions and actions. The seven categories are dynamically linked; they cover functions that are all necessary and complement each other to achieve progress.

² See WBCSD Vision 2050 – it proposes that sustainable living be defined by two indicators: a Human Development Index (UNDP) higher than 0.8 and an average bio-capacity requirement per person lower than the 2006 benchmark calculated by the Global Footprint Network. This bio-capacity calculates the biologically productive water and land area that is necessary to produce all the resources and absorb safely all the wastes produced by human activity. It is expressed in ha / capita. It shrinks as the population grows and as the world average biological activity is degraded by pollution and land use changes.



The Green Growth

Policy Accelerator

Figure 3

Policy accelerator

4 - Adapt budget

Collect and allocate financial resources to support the public goals through fiscal schemes, subsidy reforms and pricing carbon, scarce natural resources and negative externalities.

Policy accelerator

2 - Communicate and educate

Enhance human capital and strengthen the commitment and capacity to act. Create awareness amongst the public.

Policy control

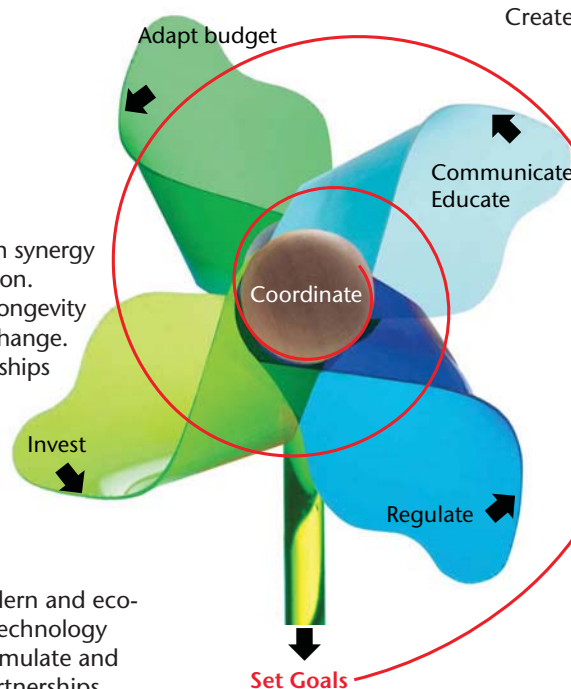
7 - Coordinate

Balance all policy elements in synergy toward excellence in execution. Ensure policy certainty and longevity for gradual but irreversible change. Foster public-private partnerships

Policy accelerator

5 - Invest

Provide funding for modern and eco-efficient infrastructure, technology developments and to stimulate and secure public-private partnerships with risk-sharing schemes. Implement green government procurement standards.



Policy control

6 - Monitor

Ensure transparency and accuracy of progress evaluation through adequate indicators and their measurement, verification and reporting.

Policy accelerator

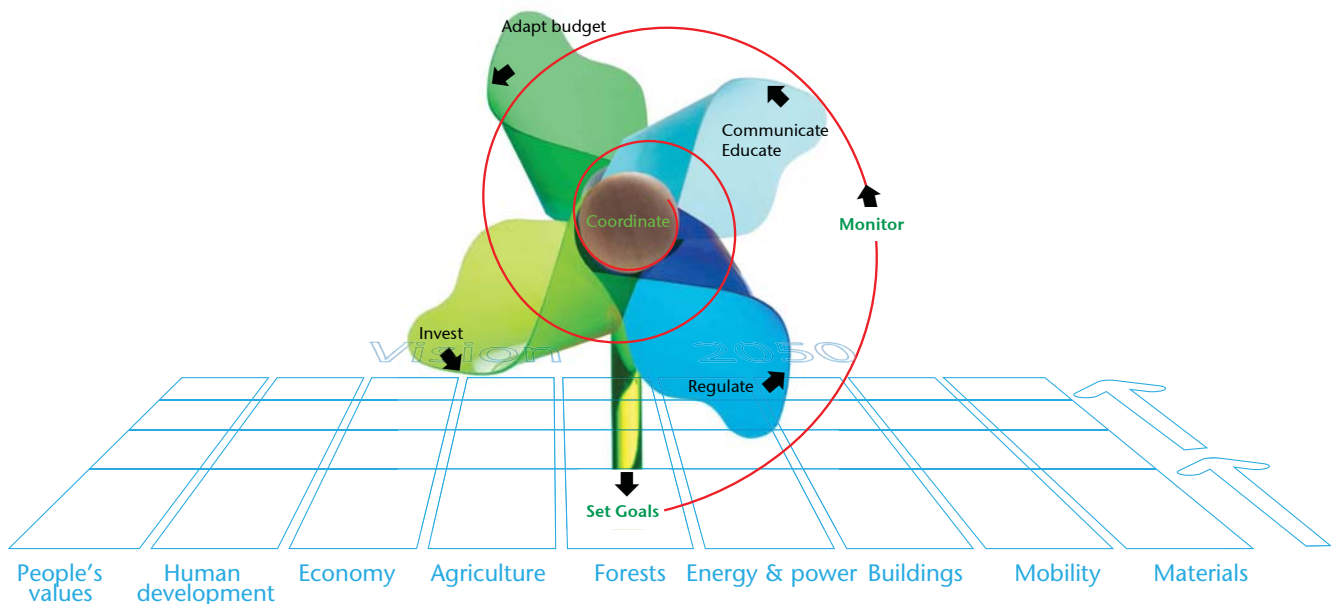
3 - Regulate

Set and enforce performance standards, norms, limits, rules and codes of conduct.

Policy purpose

1 - Set Goals

Specific goals for human development and environmental performance. Turn capacity building, innovations, investments, production and consumption in the right direction.



The Green Growth Policy Accelerator

Qualities:
Coherence + Certainty
+ Longevity

and household budgets. They are also the basis for a productive dialogue between producers and consumers to set the nature, levels and timing of public incentives as well as to support lowering the barriers necessary for progress.

Realizing inclusive sustainable growth is a complex challenge. Accelerated progress will not be achieved through the implementation of a single set of policy measures, but rather through the adoption of linked measures that build on and enhance each other, through the use of the four “progress accelerators.”³ The WBCSD has repeatedly advocated the need for a policy “framework” that enables companies to perform toward sustainable development. We try here to deconstruct this notion of framework into seven essential constituents: 1 guiding element, an acceleration process of 4 elements, and 2 elements of control.

Policy purpose

1 - Set goals

The policy purpose must be transparent and clear. The Millennium Development Goals are a good example of specific objectives with a review date. So are the Kyoto targets for Annex 1 countries. When it is difficult to agree on binding objectives, aspirational targets can be effective, as long as they are supported by a set of coherent progress accelerators and measurements. Vision 2050 proposes meaningful ambitions for each element of the pathway.

Only clear goals and stable policy programs can be integrated into business strategies, farmers’ planning,

Policy accelerators

2 - Communicate and educate

The transition to sustainable inclusive growth is a learning process with many layers. Nutrition, health, schooling and skill training must be universally available, with an emphasis on resource efficiency and ecosystems protection. Citizens must have the information to understand the issues, and be motivated to adhere to goals, and engage as consumers, as employees and entrepreneurs, and as role models for their families and communities. They also need clarity about progress, the risks of delayed action, and details on addressing the intermediate adaptation needs.

3 - Regulate

When solutions and best practices are well-defined, it makes sense to set them as minimum standards and decision processes for all actors who have an influence on reaching the goals. Recycling quotas, maximum emission levels, energy intensity norms for buildings, water and air quality standards, sustainable procurement rules, product labeling or non-financial reporting obligations, are examples of government actions that can drive all market participants towards change and compliance. Their set up cost is usually low for governments, but they work poorly without compliance, verification and appropriate financial measures to alleviate the initial compliance costs to business.

Change creates winners and losers, and costs money. Therefore transition periods with realistic timetables alleviate the pressure, lower the resistance to change, and allow for optimization. Formal public-private partnerships can help to share costs, risks and benefits toward agreed milestones.

³ The “accelerator” and its diagram are a reminder of the principle of particle accelerators in physics: particles are directed toward a target, they gain sufficient momentum in several loops through a succession of magnetic fields...

4 - Adapt budget

Not all sustainability objectives are served by simple solutions based on proven technologies and practices. It is better to leave it to the innovative capacity of business and the efficiency of markets to create and organize winning solutions. This process is not spontaneous, and clear objectives are insufficient to bring out change. Governments must make undesirable situations and their negative externalities sufficiently costly to trigger avoidance responses through innovation. Phased implementation approaches will prevent the most extreme avoidance response – outsourcing to lower-standard countries or closing the business. Local economies must continue to reduce unemployment. Therefore, revenues from environmental taxation, emissions fees, carbon pricing, waste disposal and other levies, and the savings gained from eliminating harmful subsidies, should be reassigned to reduce other taxes, in particular on employment. In other words, government approaches should include incentives for early action, and pressure on laggards.

The financial and economic crisis has seriously exposed most governments' budgets. The necessary debt reduction and fiscal consolidation can be served by rebalancing revenues from harmful activities to those enhancing green growth and welfare.

The reallocation of resources has become particularly important in the face of the growing inequality of income and social security in both poor and rich economies. Fiscal reforms that mobilize wealth from the top of the pyramid, and from polluting practices, toward investments that strengthen human capital and create sustainable infrastructure, are consistent with the pathway to Vision 2050.

5 - Invest

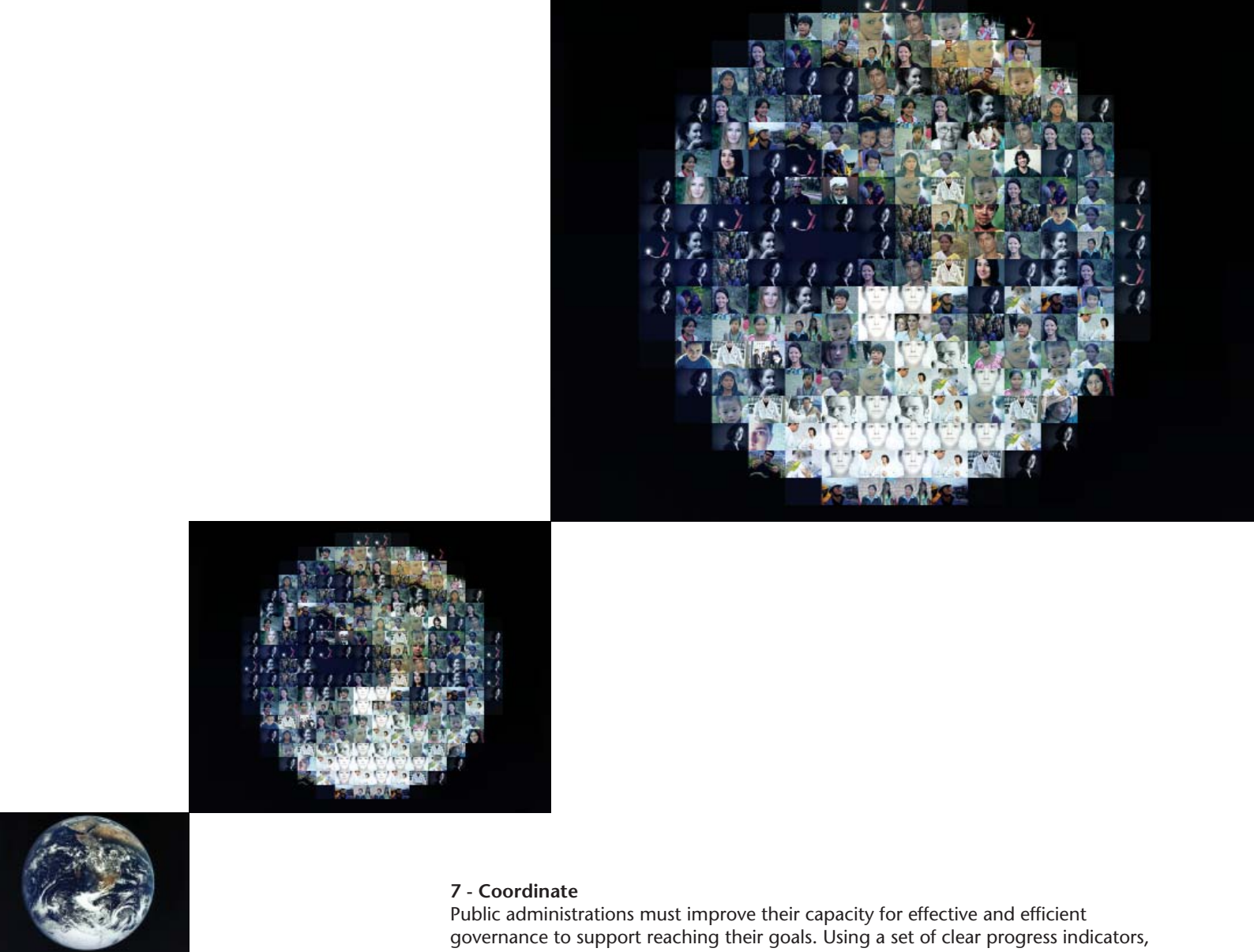
Despite the fact that technologies and experience are broadly available, large investments are needed in developing economies to create efficient logistics, commerce, water and energy infrastructure. Water and energy efficiency, zero-carbon energy systems, and circular material cycles, require research and development that companies alone will not be able to initiate and fund from their profits. Public funding and risk insurance can encourage and mobilize private capital; it can also help to eliminate obsolete and harmful assets. Many economies can integrate such investments in their economic recovery efforts and stimulate green growth, not just for a few years but for the coming decades, to have a transformative impact on their future prosperity. Early adoption and green procurement by governments are critical to build markets that sustain innovations toward maturity.

Policy control

6 - Monitor

The current demographic momentum in a resource- and pollution-constrained ecosystem does not leave much time and margin for error. Reliable measurement of progress is crucial. However, GDP alone is not sufficient, and can give the wrong signals of progress. Other indicators must be adopted, measured and verified at the micro- and macroeconomic level, to inform citizens and assist politicians in corrective action.

³ The “accelerator” and its diagram are a reminder of the principle of particle accelerators in physics: particles are directed toward a target, they gain sufficient momentum in several loops through a succession of magnetic fields...



7 - Coordinate

Public administrations must improve their capacity for effective and efficient governance to support reaching their goals. Using a set of clear progress indicators, governments must balance the other four policy accelerators – education, regulation, budgeting and investment in ways that are coherent, predictable and persistent. These qualities are vital to smart policy management, as they help give companies confidence to align strategies, R&D, and investments and encourage consumer choices. They also inspire emulation amongst cities and nations. This does not mean all policies must be set at once, and for ever. There must be room for dialogue and corrective action. It is a learning process for continuous improvement, particularly as adaptation starts to set in.

The WBCSD has repeatedly called on governments to create an enabling policy framework to support companies dedicated to moving faster toward sustainable development. In the following chapters we try to identify what we expect to work better. We are coming out of a period when the prevailing thinking was that less government intervention is best for business. This mindset is still shared by many. But the experiment with a deregulated world, where no one seems in charge, has only brought a mixed bag of progress, social tensions and financial weaknesses. As we strain the limits of natural resources, pollution and social inequity, we need to invent and try a better approach.

We are serious about the pathway to Vision 2050. We can make it happen if business and governments pull in the same direction.

People's values

The 2050 Vision

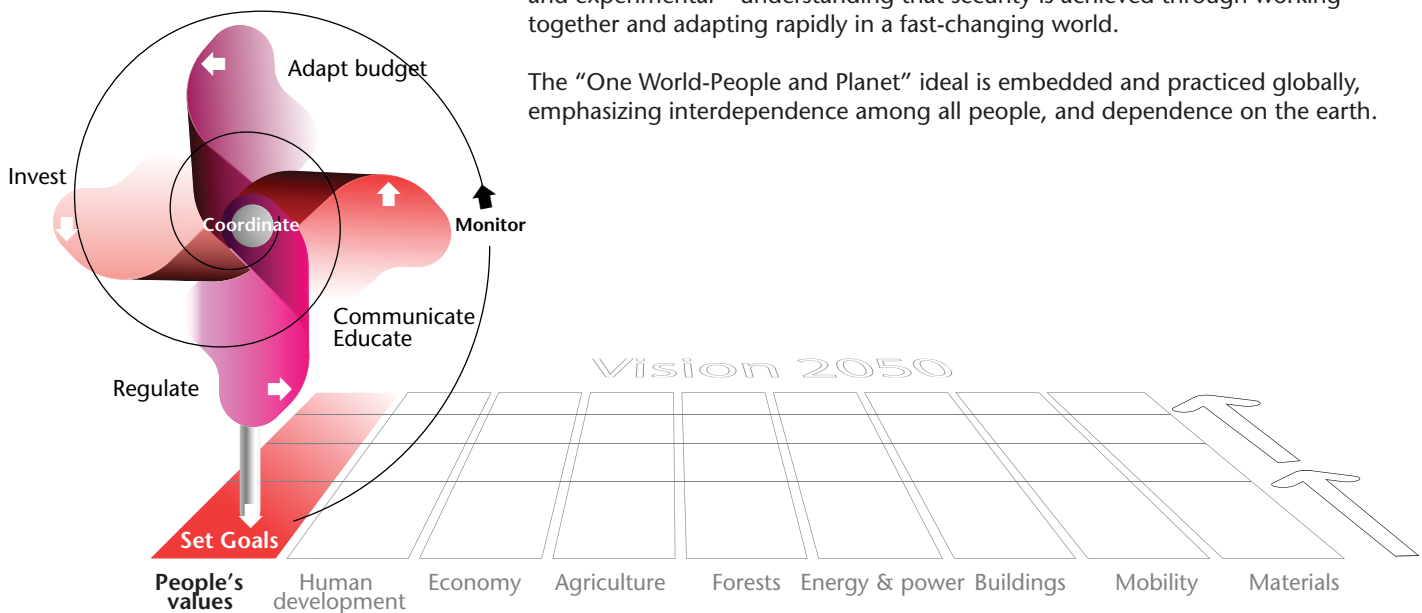
New ways of living have taken root all over the world, inspired by a change in the way success is defined and measured, as well as innovative forms of education and connectivity.

New ways of living have taken root all over the world, inspired by:

- A change in the way success is defined and measured.
- Innovative forms of education and connectivity.

People, companies and governments are forward-looking, problem-solving, resilient and experimental – understanding that security is achieved through working together and adapting rapidly in a fast-changing world.

The “One World-People and Planet” ideal is embedded and practiced globally, emphasizing interdependence among all people, and dependence on the earth.



Set goals

- Draw durable lifestyle goals based on scientific and ethical assessments.

Communicate & Educate

- Organize continuous public awareness campaigns and educational programs that link individual behavior and responsibility to the benefits of green growth, social cohesion and global interdependency.
- Ensure consumers have access to comprehensive product performance profiles.
- Encourage and facilitate stakeholder accreditation and participation in the preparation and implementation of major policy decisions.

Regulate

- Make labeling with target resources performance data compulsory for all assets and goods with a significant overall impact or clear sustainability issues in a phase of their life-cycle.

Adapt budget

- Increase price levels, via taxes and levies, to influence a shift of consumption toward the offering with the best environmental and social profile.
- Provide tax credits and green funds to stimulate change and savings, as well as retirement of obsolete assets.
- Be a role model for “green” purchasing and low impact public services.
- Reduce distributional problems to support low income households.

Invest

- Contribute to the infrastructure of metering and data collection that empowers all actors with performance awareness and distance to targets.

Monitor

- Deploy metering of significant energy, water and material flows at consumer, producer and aggregated levels.

Coordinate

- Sustainable living will grow mainstream if it brings a positive lifestyle experience, and secures profitability and employment through supply chains. The efficiency of the transition depends on how rules, incentives, awareness and cooperation campaigns are adjusted for optimum synergy.



People's values

Current context

The **One World** vision is the ultimate stage of a conceptual evolution that started decades ago. This evolution produced several paradigm shifts that combine how we comprehend our world, and, as a result, how we try to deal with it.

Throughout the 70s and 80s, a technical understanding of impacts such as acidification, eutrophication or stratospheric ozone loss prompted command and control approaches at the local and multilateral level, in the form of substance bans and compliance controls.

In its 1987 report - **Our Common Future** - the World Commission on Environment and Development proclaimed the interdependency of human development and environmental progress, captured in the notion of sustainable development, and nurtured the elaboration of the 1992 Rio Summit's **Agenda 21**. It encouraged a system and life-cycle understanding of waste, carbon dioxide, and other emissions, and of overconsumption of water, fuels and other non-renewable resources. Environmental progress could be achieved, despite society's development and economic growth, through strategies of system redesign for eco-efficiency. Economic growth could decouple from its negative

environmental impacts, thanks to business foresight, voluntary initiatives and covenants. Innovation and new behaviors would spread through well-functioning and free markets, with only light government interference.

This new worldview was summed up in the "three pillars: ecology-society-economy" scheme. Because of its complexity, it demands performance indicators that monitor behavior change and progress by businesses and other actors. Thus, Corporate Social Responsibility and public-private partnerships became the preferred modes of business action, shaped in dialogues with stakeholders and monitored through schemes like the Global Reporting Initiative, the Carbon Disclosure Project, the Dow Jones Sustainability and other governance and accountability indexes.

This ladder of expanding worldviews is embedded in the core of the One World vision. One World weaves together quality of life, equity and enhancement of our human and natural capitals. It relies on interdependent, purposeful, innovative individuals to achieve these ideals through the efficiency of markets. Sustainable development, instead of being an "end-of-pipe" or "add-on", becomes an integral part of the core business strategy.

The One World vision is making its way into consumer values. A number of surveys⁴ show that concerns about social and environmental issues are on most people's minds, in all countries. They express a willingness to take action, and select products and suppliers based on their alignment with corporate responsibility principles. They also want products and services that perform and give good value, while being rated as more sustainable. Nonetheless, only about 1 in 5 people go all the way to adjust lifestyle, behavior and purchasing decisions. Most feel they cannot evaluate the sustainability merits on their own, or they lack the purchasing power to afford a premium for environmental quality. Support from governments to provide practical rules and

⁴ WBCSD, Sustainable Consumption – Facts and Trends, November 2008, Geneva.



education is essential to turn this willingness into trust in environmental claims and action.

While numerous think tanks and international summits have articulated the ideas around sustainability and green growth, our political systems have difficulty coping with such a holistic, high-level and constantly-evolving notion. They are set to maintain a harmonious society where every individual is able to satisfy its own needs and desires, without harming the human rights of others. Rooted in the 19th century, this principle is based on an abundance of resources and confidence in education, science and technology to break through limits of scarcity. It relies on commerce and contracts to create and distribute wealth, and thus ensure social peace.

Citizens delegate their power through the election of representatives who are expected to satisfy the interests of their electors through action, legislation and compliance. This vote is both a sanction of the performance of outgoing representatives, and a support of the action plans of candidate representatives. This political system is naturally committed to rather personal, local and immediate interests and concerns. Endangered species and unborn generations do not vote. Even though inaction at the present time may increase the probability of remote, irreversible future damage, it is practically impossible to allocate, today, the level of resources that would prevent an uncertain crisis, tomorrow. This requires a sufficient number of concerned citizens to elect representatives committed to such danger prevention and mitigation plans. The climate negotiations show, so far, that national delegates need to operate within the mandate of their domestic legislators, and stick to local and near-present strategies, rather than accept binding global, long-term emission ceilings based on predictive science.

Despite a rapid evolution of the concepts and ideals of sustainable development, progress on the ground, for real people and their environment, remains slow and difficult.

A business perspective on policy options

In this context, the WBCSD believes that progress toward Vision 2050 requires a dual approach:

- One that accelerates awareness and takes citizens and policy makers through the sustainability learning curve to build a common understanding, and create a robust desire for green growth, including shared goals and progress metrics.
- A combination of policy measures that provide short-term benefits to households, cities, and regions, while converging into the global longterm benefits of a greener economy.

Responsible citizens through education

The emotional awareness of environmental and social issues is already impacting a large part of the population in developed economies, and spreading fast in developing nations⁵.

What is still largely missing is a positive outlook and acceptance of the idea that green growth provides a better life for all. Green growth is about satisfying needs in an intelligent and measured manner. It does not mean consuming less, but

⁵ WBCSD, Sustainable Consumption – Facts and trends; November 2008

differently. It means seeking well-being, without over-consuming, and the side-effects of pollution, resources depletion and waste that undermine the well-being of others, in a different place (or our own), later. Changes in individual and common behavior can improve the complex web of ecological services and resources, provide more opportunities for the poor, and contribute to a stable economy and prosperous society.

This requires more research and pilot experiments, particularly in the urban setting, and on the *quality* of growth. Experience should feed continuous public awareness campaigns and prepare acceptance of policy programs that aspire to realize the transition toward green growth.

The role of stakeholders

The concepts of sustainable development, eco-efficiency and eco-innovation, sustainability reporting, corporate social responsibility, ecosystems services, clean development mechanisms, and many more, have matured in the interplay of science, campaigning organizations and business. They have merged with other social principles like human and labor rights, anti-corruption and transparency. This was often adversarial but becomes more and more collaborative.

Schemes like the Global Reporting Initiatives, the Marine Stewardship Council, ISO 26000 guidelines on Corporate Social Responsibility are designed and maintained by such collaborations.

A One World Vision, an aspirational green growth transition must also be science-based. The initiatives and planning for implementation and the policy measures must benefit from the experience of motivated citizen groups. Thus, NGOs, small and large, have leveraged their campaigns by joining corporate advisory groups and councils of various natures.

Further, corporations and governments have found in NGOs reliable channels to gather citizen opinions on long-term and ethical challenges. The WBCSD and its members have invited stakeholder feedback on most of their projects and contributed, as well, to many important government-led dialogues. We recommend that governments continue to intensify these channels of policy innovation by accrediting major groups to official advisory bodies focused on the implementation of green growth.

Greening citizen behavior

The conclusions of several WBCSD reports related to mobility, energy efficiency in buildings, water and sustainable consumption are confirmed by a recent OECD study⁶ of household consumption patterns and behavior mirrors. It reinforces our own recommendations to promote green citizen behavior:

- Provide consumption information with energy, water metering and billing information that highlights potential financial savings and shows the gap to ideal targets. Public utilities can take the lead before public authorities enforce sectorial standards. Business in general has gained expertise in lean consumption and recycling practices that can be shared and deployed with consumers.
- Increase prices to achieve consumption, emissions and waste objectives. Reduce distributional problems through supportive measures that enable low-income households to modify or replace their wasteful equipment. Link price increases to potential savings measures supported through green funds or tax credits.
- Develop product labels that link scoring with potential savings. This is particularly important in the new energy labeling for existing buildings. The technical assessment that scores a building includes the basis of the score and therefore the improvement opportunities with highest potential, be it insulation, low-carbon heating system, or other changes available to the purchaser. More generally, labels based on a transparent science-based scoring system can also be turned into a tool to set targets for reducing the performance gaps, monitor progress and to base incentives or restrictions on desirable or undesirable performance categories. Labeling can be expensive. To remain cost-efficient, it is important to focus on product categories with significant impacts or obvious critical aspects in their life-cycle like food supply chains, buildings, transportation, household appliances, clothing, cleaning and wood-based disposables.
- Devise supply-side measures that meet domestic needs: every domestic usage can be serviced with a spectrum of commercial offers, some highly eco-efficient and others not at all. In general, most offers are somewhere in the middle (public transport > car sharing > middle-range car > urban 4WD truck, etc.). Taxation, product norms or usage fees can, in due time, with appropriate warning and transition periods, eliminate the worst offers. At the same time, fiscal incentives encourage consumers to become early adopters of the top efficiency offers and thus move the average toward the best performance.
- Establish demand-side measures: public authorities can often influence choice through green purchasing rules that penetrate supply chains and set examples. They can also rethink the way public services are designed and delivered in order to ensure speed and efficiency at the right cost.

While these demand-side measures are coherent with a systematic shift toward green growth they continue to be held back by those who are concerned by government intervention in the market, the cost of labeling and the burden of other measures. Competitiveness and employment must be protected but not the short-sighted benefits from business-as-usual and unsustainable practices.

Informed, eco-efficient households will not lose quality of life but very few will take spontaneous measures without initial pressure and incentives. They will also not accept lower functional performance in exchange of environmental claims. However, a proven balance of benefits is soon likely to create the public support for politicians and governments to devise a wider, deeper set of green growth policies.

⁶ OECD (2011), *Greening Household Behaviour: the Role of Public Policy*, OECD Publishing.
<http://dx.doi.org/10.1787/9789264096875-en>

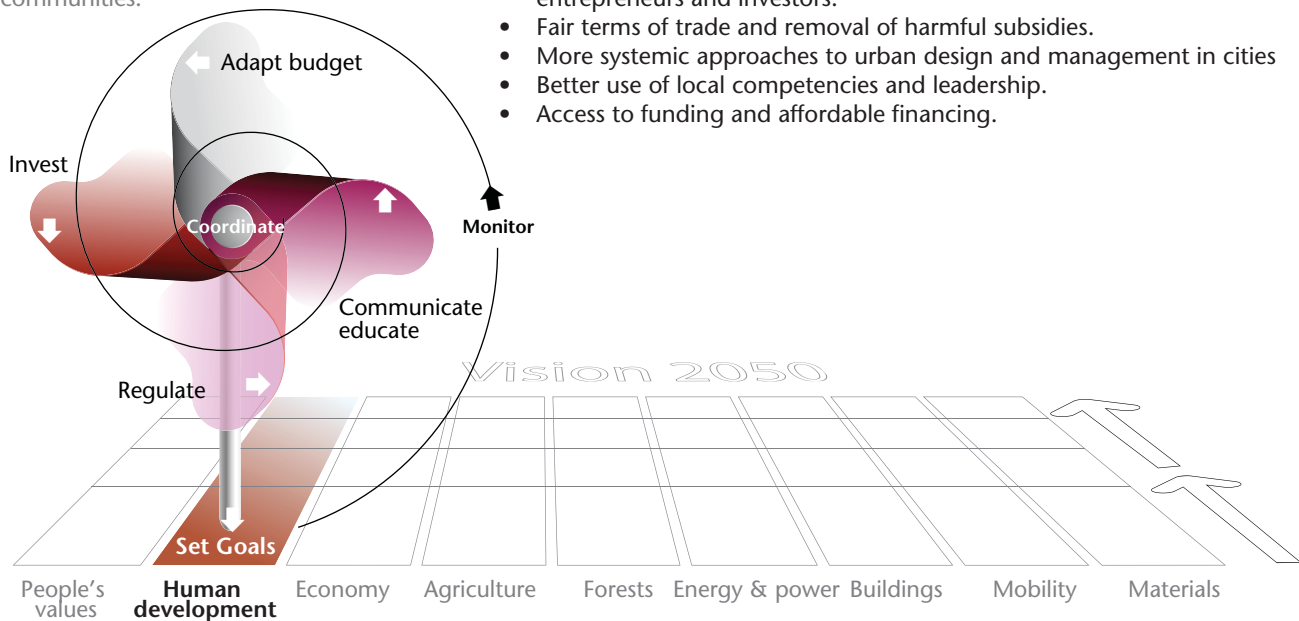
Human Development

The 2050 Vision

The global population has begun to stabilize at around 9 billion with more than 6 billion living in cities. All can meet their basic needs, including dignified lives and meaningful roles in their communities.

This has been achieved by:

- Education and the economic empowerment of women.
- A consensus between government, business and society around the promotion of greener growth, and a combination of bottom-up, top-down approaches to human development objectives.
- Improved legal systems and intellectual property protection to encourage entrepreneurs and investors.
- Fair terms of trade and removal of harmful subsidies.
- More systemic approaches to urban design and management in cities
- Better use of local competencies and leadership.
- Access to funding and affordable financing.



Set goals

- Continue to set national and global goals for green growth and access to livelihood essentials, as well as reduction in disparities related to gender, origin and income (extension of MDGs).

Communicate & Educate

- Provide capacity building for the development of SMEs and self-employment in the areas of water, energy, sanitation, health, food, telecommunications
- Foster an inclusive, deliberative process to give all citizens equal access to environmental and economic information; demonstrate responsiveness to needs

Regulate

- Develop functioning institutions to ensure compliance with laws, tax collection, transparent judiciary process.
- Protect physical and intellectual property.
- Guarantee payment discipline for products and service.
- Root out corruption.
- Protect the rights of children and women.

Adapt budget

- Ensure tax collection and allocation of funds to education, social security and functioning public services.
- Avoid squandering of natural resources like water, arable land and natural forests, through progressive pricing schemes.

Invest

- Improve and develop core infrastructures for energy and water distribution, for logistics of supply-chains, for sanitation and health services, for telecommunications.
- Identify and implement technologies that present the lowest environmental impact and highest human development benefits.
- Attract climate finance, and other environmental funding facilities.

Monitor

- Create a robust set of indicators and verification schemes to underpin access to international development and environmental finance

Coordinate

- Create transparent management of the complexity of the fund flows in relation to goals and progress milestones. Accountability is vital, to create confidence, and attract international public and private development finance



Human development

Current context

Development means the building of societies in which people are able to enjoy security, sufficient food, good health, decent housing, clean water and modern power supplies. It depends on people having the opportunity to earn a good living, and knowing they have some security in hard times.

It brings with it the ability to travel further than your feet can take you; through the physical mobility that transportation brings, the social mobility that education enables, and the unprecedented opening up of connections that communications technologies make possible. Poverty is the opposite: people living without sustainable livelihoods, without electricity, clean water and enough food, without transportation, caught up in wars and conflict, excluded and victimized for being poor. It includes the immense human suffering caused by material shortages, vulnerability to disease, inadequate education, a degraded environment, and lack of protection by the rule of law. The overwhelming need to concentrate on survival holds people back from achieving their potential.

A few decades ago, the development challenge was seen as the imperative of enabling 5 billion people living in poorer countries to reach the living standards of the 1 billion living in developed or

industrialized nations. Today, the situation is understood to be more complex. There is rapid growth in major emerging economies, while others remain in absolute poverty, and in stagnant economies. The greatest development gap is widening between the “bottom billion” and those living in economies that are growing, creating jobs, and becoming more prosperous. Yet, underdevelopment exists everywhere. Despite great gains in emerging economies like China and Brazil, only a few can claim they have managed to “make poverty history.” Cities are booming, the global middle class is growing, but poverty and hunger persist in both urban and rural areas.

The great change to the development challenge is the recognition that old models of economic development cannot be sustained. Over the past 200 years, economic development depended on a shift from the use of traditional renewable resources – energy and materials that can be grown or harnessed from the sun’s energy – to non-renewable resources, dug out from deep fossil stocks. In 1900, 41% of the materials used in the US were renewable, but by 1995, this had fallen to only 6%. The global population is expected to grow by almost 50% before leveling off at just over 9 billion in 2050. But economic development has already endangered ecosystem services, on which prosperity and survival depend, through massive interference with the natural cycles of freshwater, carbon and nitrogen.

The impacts of deteriorating ecosystems, such as climate volatility, freshwater shortages, and depleted fisheries, fall most heavily on the poor, who rely more directly on ecosystems to survive. For example, in Africa, the vast majority of farmers depend on rain-fed agriculture. Climate change could halve non-irrigated farm yields in many African countries by 2020. Floods, and then water shortages, will affect billions who depend on predictable flows of water from the glaciers of the Himalayas and Andes. All nations must adapt to climate change, since it is already too late to avoid consequences, but people living in the least developed countries will be forced to do so, with fewer public



and private resources. They will need support, education, training and access to communications technologies, credit, new crop varieties, affordable pest control and healthcare, to protect them from new, or harder to treat, drug-resistant diseases. For them, development must go hand in hand with *adaptation*.

Development challenges are business challenges. Business is held back by the same factors that keep individuals and communities in poverty: poor education and healthcare, environmental deterioration, and the absence of adequate infrastructure or an effective rule of law. Companies can play a crucial role in solving these challenges, and with the right policy frameworks, develop new technologies and business models to meet human needs, drive up efficiency, create jobs and enable broader access to solutions.

The development gap has several characteristics. Some are absolute like the rationale underpinning the Millennium Development Goals. Some are territorial: opposing the opportunities of regions, and urban and rural populations. Some are relative, and compare difficulties and advantages of people living close to each other, yet at different ends of the social ladder.

The 2000 UN Millennium Development Goals represent the pledge of 189 nations to resolve 8 urgent development priorities, expressed by 21 specific targets for minimum achievement by 2015, and 60 indicators to monitor progress. By 2010, progress against the 1990 baseline was patchy but encouraging. The review⁷ heightened the awareness of challenges and success factors, and fed the dialogues between governments, civil society organizations and business for more pressure on action.

The Millennium Development Goals express a global political consensus on specific poverty reduction objectives, a turning point in economic development policy. The World Bank and International Monetary Fund (IMF) make now Poverty Reduction Strategy Papers a precondition to support poor countries.

Never before in history have so many people been lifted out of poverty in such a short period. Yet poverty elimination remains a daunting challenge. There are other dimensions of development beyond the current MDG indicators that also require attention and action: proper housing space, access to electricity and cooking fuels and transportation. There is a strong combination of hardships; most of those lacking safe water and sanitation also lack clean cooking energy and electricity and are undernourished. The United Nations Development Program has estimated that the number of people deprived of 2 to 6 of its 10 indicators of poverty reached 1.75 billion⁸. Of those, 51% are in South Asia, 28% in Sub-Saharan Africa and 15% in East Asia and the Pacific. In general, the rural poor outnumber the urban poor who have easier access to health, schooling, and basic necessities as well as benefits from poverty reduction programs run by governments, business or charities. Yet the number of people in urban slums without access to safe piped water and proper sanitation is increasing.

Comprehensive and detailed statistics per countries and regions are not yet available on a regular, comparable basis. However the Research Institute of the Credit Suisse⁹ bank produced an analysis of wealth distribution. Including the 21 countries that already compile usable Household Balance Sheets, this study estimates the evolution of the net wealth – financial and non- financial assets minus liabilities – of adults (age over 20 years) in 216 countries between 2000 and 2010.

⁸ UNDP – Human Development report 2010; Palgrave Macmillan, New York

⁹ Credit Suisse Research Institute – Global Wealth Data Book, October 2010

¹⁰ Credit Suisse Research Institute – Global Wealth Data Book, October 2010

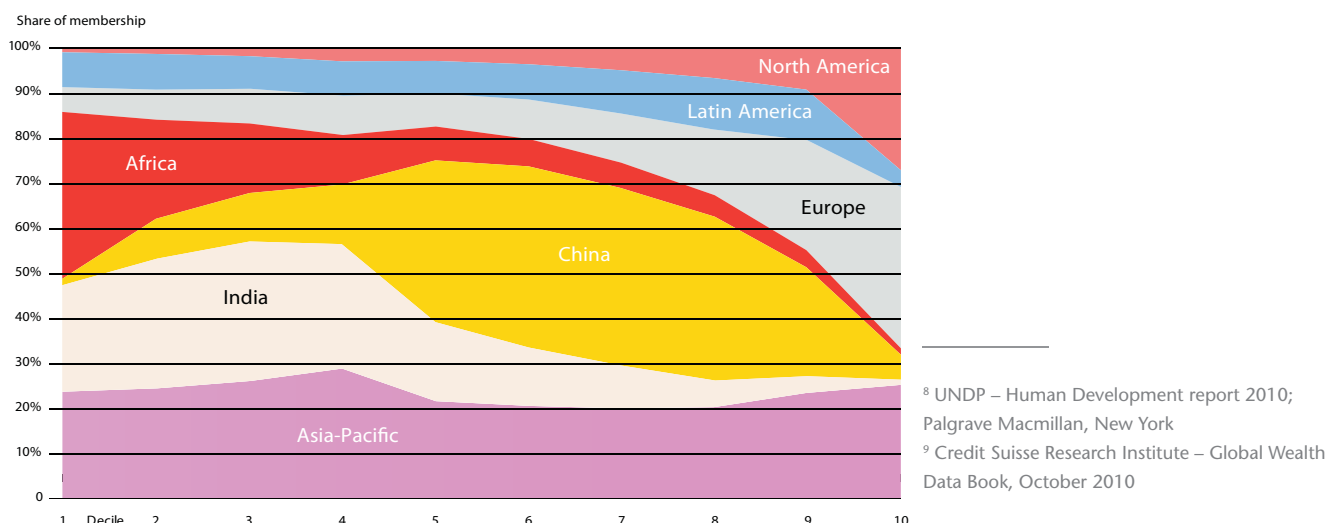
The Millennium Development Goals

The 8 Goals	Progress by 2010
Eradicate extreme poverty and hunger	The proportion of people living with less than USD 1.25/day fell from 1.4 billion in 2005 to 900 million, ahead of plan. Despite population growth, the 2015 halving target should be met. Progress toward full employment stalled as a result of the economic recession. Even with a job, 1 in 5 workers and their families live under the poverty line. Food security has also hit resistance around the 1 billion undernourished people.
Achieve universal primary education	Steady progress has driven enrolment up to 89%, but will miss the goal of universality. Zones of conflict, cultural bias against girls are tough barriers to universal primary schooling
Promote gender equality and empower women	School enrolment of girls reached 96% of parity with boys by 2009. Paid non-agricultural work moved from 35 to 40% of work force, but parity remains far away. Representation in national parliaments progressed, but remains below 20% in most regions.
Reduce child mortality	Child mortality under five years dropped from 12.4 million in 1990 to 8.1 in 2009. The 2/3rd reduction target looks feasible, with some regions almost there
Improve maternal health	Deaths caused by pregnancy dropped by 34% from 1990 to 2008, yet far off the 2015 target. Access to skilled maternal healthcare workers, and adequate support for family planning and more contraception for the vulnerable age group of 15-19 years are crucial.
Combat HIV/AIDS, malaria and other diseases	New cases of HIV/AIDS are declining; treatments reduce mortality and infection rates, but the target of universal access to treatment will not be met. Prevention is low in many countries, particularly among women. MDG targets for malaria and tuberculosis are in sight thanks to the international funding of affordable prevention and treatment.
Ensure environmental sustainability	The Montreal Protocol succeeds in reversing the loss of the atmospheric ozone shield. Access to clean drinking water will exceed the 89% target. Only 1 in 10 people, mostly rural, remains without piped or improved sources of drinking water. But still 2.6 billion people lack clean toilets and improved sanitation, too far off the MDG target. The number of slum dwellers continues to increase beyond 828 million.
Develop a global partnership for development	In 2010, the net Official Development Assistance was the highest ever – USD 129 billion – but did not even reach half of the amounts (0.7% of rich GDP) pledged by developed countries in various past multilateral development summits. The remaining duties on imports from developing countries to developed countries continue to drop slowly except for textiles. Since 2009, the recession depressed export revenues and the ability to service foreign debt.

Thus, 4 442 million adults share the world's net worth of USD 195 trillion in 2010¹⁰. Figure 4 divides the total adult population in 10 equal groups, from the poorest 10% on the left, to the richest 10% on the right of the graphic. Each group is also divided vertically into its geographical membership. Thus, the richest and super-richest reside mainly in North America, Europe, Japan and the highly industrialized small South Asian states; the poorest in Africa, India and Indonesia. There is also a rapidly growing middle class around the 8th and 9th top deciles in China, and several other emerging economies. Although those countries mostly claim special development status in international negotiations, the consumption style of their millions of affluent households weighs ever more in the balance of natural resources and negative impacts.

¹⁰ Credit Suisse Research Institute – Global Wealth Data Book, October 2010

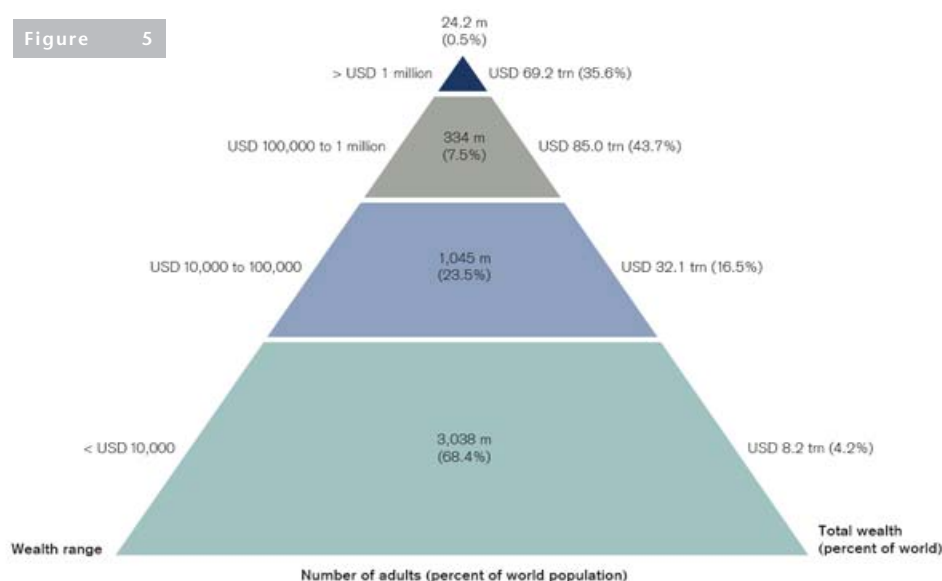
Figure 4



Source: Original estimates: See text for explanation of methods

Another perspective on the inequality dimension, grouping people into just four orders of wealth magnitude, reveals the steep inequality between the 334 million rich and 24 million richest and the 3 billion at the bottom of the wealth pyramid ¹¹.

Figure 5



Source: Credit Suisse Global Wealth Databook, Shamrocks/Davies/LLuberas

Economic growth alone is not sufficient to release the poor from the trap of multiple market failures. Wealth distribution matters as demonstrated in several studies summarized in the latest UN World Economic and Social Survey 2010¹². Initial distribution and the ongoing distribution of income growth, are important. For example, a relatively egalitarian situation helped poverty reduction in South Korea and Taiwan during the 1960s and 70s and, more recently, on a wider scale in China.

Sustainability and equitable progress are closely linked. The UNDP 2011 Human Development Report¹³ shows the dual direct correlation between growing human development and growing environmental degradation, and between environment degradation and the vulnerability of the poorest people. It also shows that, except in Latin America and Sub-Saharan Africa, equity has deteriorated in most countries, despite an increase in average income, health and education indicators. Thus our current model of development amplifies the hardship of the poorest, and the environmental risks for all. Equity and distributive policies are needed to achieve sustainability.

¹¹ Credit Suisse Research Institute – Global Wealth Data Book, October 2010

¹² UN DESA, Retooling Global Development, World Economic and Social Survey 2010; Department of Economic and Social Affairs, United Nations, New York

¹³ UNDP – Human Development report 2011 – Sustainability and Equity: A Better Future for All; Palgrave Macmillan

In perfect markets, the ability to benefit from economic growth should be open to all, at incremental costs. However a large category of poor, stay poor even in growing economies, because they cannot hold title to land, open savings accounts, access credit and get insurance; the hurdles of transaction costs are too high for small disposable incomes. Stuck in transient, low-paid, unregulated and informal labor markets, they cannot build skills for formal jobs¹⁴. They need their children to chase cash, and curtail their schooling. This situation is particularly critical in countries with a large proportion of poor, as it holds back the whole economy from the benefits of global growth. An underclass represents a huge loss of human and economic potential. Land ownership reforms, with policy support to boost agricultural productivity and farmers' income has helped several South Asian countries to create a backbone of rural income while developing export-oriented industries back integrated into regional suppliers using significant local content and supporting local employment. Social programs can help to redistribute wealth by fostering health and education that build human capital in line with the economic needs and opportunities in the formal economy.

Progress in recent decades has shown that success in human development relies not on a general theory but on country-specific strategies. Based on local resource endowments, these strategies must ensure a strong coherence between:

- 1 Investments in human capital, agricultural, industrial and infrastructure priorities
- 2 An effective combination of substituting imports with local goods and stimulating exports to increase competitiveness in global trade
- 3 Fiscal and exchange-rate policies to stimulate green growth
- 4 Education and labor rules with universal social security schemes to draw people into the formal sector
- 5 The increased capacity of government agencies to ensure a comprehensive and ethical enforcement of the rule of law

As investor and tax payer, employer, innovator, producer and marketer, business is completely engaged in such successful development strategies.

A business perspective on policy options

Business is good at increasing economic wealth. At its best, it creates jobs and household incomes, provides affordable products and services for better living, protects natural capital, secures value for its shareholders and creditors, and pays taxes which are redistributed into, ideally, institutional capacity, education and infrastructures for the benefit of the collectivity. It also seeds social initiatives in the communities and regions where it operates.

The WBCSD is committed to advancing thinking on the business role in development. For a decade now, it has promoted inclusive business opportunities to alleviate poverty and stimulate development in emerging economies. These are commercially-viable business ventures that provide affordable goods and services to meet basic needs and create new employment and income opportunities for the poor. The Council has also examined specific business solutions to development challenges, such as those related to mobility or providing access to energy, water and sanitation.

The WBCSD aims to realize the objectives of Vision 2050 by inspiring business to create sustainable and inclusive growth in developing countries. But progress would remain sporadic and slow in the absence of the following public policies:

At the domestic level

- **Good governance** is fundamental for stimulating private sector investment. Policies must to focus investment particularly into core infrastructures for development, such as transportation and distribution centers, energy systems, water and sanitation and telecommunications. This means setting and maintaining sound macroeconomic policies, coordinating national, regional and municipal planning and investment, and ensuring that new projects benefit all, in particular the poorest.

¹⁴ Central Banks Symposium – Balancing-growth with Equity, the view from development – paper by Esther Duflo, Jackson Hole August 2011

- Establishing **effective and efficient institutions** is crucial, to enforce the rule of law, collect taxes and root out corruption, which affect the poorest the most. They will also generate stability and predictability to foster private sector investment and development.
- Providing capacity building, financing and access to credit to support the **development of local supply chains and SMEs** is vital. SMEs account for the lion's share of employment in developing countries, and play a particularly important role in creating sustainable livelihoods for the poor. They also play a key role in delivering basic services to low-income populations, often as part of the supply chains of larger enterprises.
- Granting and protecting physical and intellectual **property rights** is an important development factor. On the one hand, adequate Land Use Acts that define physical property rights provide a way out of informality for the poor, and can be used as co-lateral to access credit and improve their livelihoods. On the other hand, the protection of intellectual property rights is crucial, to enable the private sector to invest in the invention, development and deployment of the technologies needed to move toward a more inclusive, energy- and resource-efficient economy.
- Introduce adequate water **pricing** and consumer payment discipline to correct the misperception that water is a free and there is no cost involved in providing and maintaining the distribution infrastructure.
- **Public private partnerships** (PPPs) are particularly important in providing access to basic infrastructure services and goods for low-income communities. Meeting the electricity, water, health and sanitation needs of the poorest will not happen – much less become a business opportunity – without strong PPPs that help lower investments risks, and secure returns on investment.
- A functioning and reliable **tax system** to ensure that the state gets the necessary resources to invest in core infrastructure, public education, health and universal social security benefits, fostering a formal labor market and reduce inequality.
- Encourage and enforce **gender equality**, not only in respect of the Millennium Development Goals but, as demonstrated in the 2012 World Development Report¹⁵, because women's education and economic opportunities generate broad productivity gains, transfer economic potential to children and lead over time, to better policy choices and a more inclusive development path.

At the international level

- A **fair and competitive global trading system** should be established. In particular, harmful subsidies and trade barriers need to be removed. They hinder the ability of developing countries to capitalize on their resources and labor advantages to create wealth and reduce inequality.
- The free flow of goods, services and ideas underpins economic development. It will enhance developing countries' opportunities to leapfrog to more energy- and resource-efficient growth paths.
- **Technology transfer** is most effectively achieved by business-to-business cooperation, but it should be supported by governments.
- **Official Development Aid** to improve the quality of local governance, and stimulate private sector development in recipient countries needs to be prioritized.
- **International climate finance and ecosystems stewardship** should be leveraged to enhance the resilience of vulnerable, low-income populations in developing countries, and to accelerate a transition to low-carbon economies. The role of the World Bank, and other multilateral development banks and funds, need to be supported with adequate funding.

¹⁵ World Bank – World development Report 2012: Gender Equality and Development

Economy

The 2050 Vision

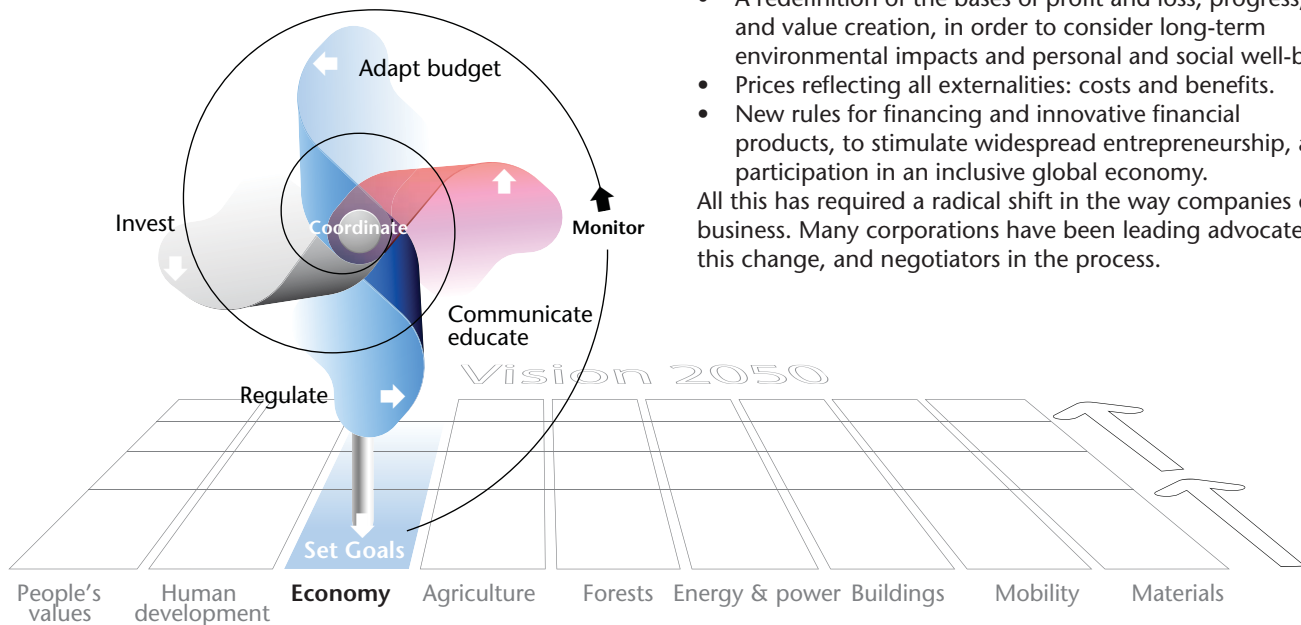
Economic growth is decoupled from environmental and material consumption and re-coupled to meeting needs. The economy creates sufficient jobs, while improving labor productivity.

Economic growth is decoupled from environmental and material consumption and serves real human needs. The economy creates sufficient jobs, while improving labor productivity.

This is enabled by:

- A redefinition of the bases of profit and loss, progress, and value creation, in order to consider long-term environmental impacts and personal and social well-being.
- Prices reflecting all externalities: costs and benefits.
- New rules for financing and innovative financial products, to stimulate widespread entrepreneurship, and participation in an inclusive global economy.

All this has required a radical shift in the way companies do business. Many corporations have been leading advocates of this change, and negotiators in the process.



Set goals

- Goals for greenhouse gases emissions, energy efficiency, water sufficiency, human development indicators, forestry, farming and industry outputs are necessary to switch the economy toward green growth.

Communicate & Educate

- Foster public understanding and dialogue with reliable information on green growth issues and national strategy.
- Inform policy makers, citizens and business of their contribution to progress at all levels of the economy.
- Adapt management education to focus on the challenges of green growth and enhance the capacity to innovate and lead change.

Regulate

- Mobilize private savings toward green investments.
- Increase bank reserves obligations.
- Set guidelines and insurance schemes to increase pension funds resilience and engagement in green investments.
- Foster corporate governance structures that operate as accountable owners, with transparent, long- term strategies, and comprehensive performance reporting.

Adapt budget

- Price externalities through taxes & levies to eliminate their impacts & indirect costs to society.
- Remove subsidies that encourage over-consumption and resources degradation.
- Provide incentives for employment, particularly in the new sectors that create green growth.
- Fund or tax-credit early adoption of green practices by consumers.
- Create tax differentials between speculative & ownership trading of equities & financial assets.

Invest

- Increase public support for research & capacity to discover & nurture green technologies.
- Create market demand to accelerate scale-up of maturing technologies, particularly in the form of public procurement.
- Accelerate retirement of obsolete technology assets.
- Contribute capital, credit or insurance to private green investments.

Monitor

- Complete GDP with relevant indicators of green growth.

Coordinate

- A gradual approach of rules, incentives and penalties is essential to enable most actors to adjust and align to achieve the goals.



Economy

Current context

Vision 2050, a collaborative effort that started in 2008, projects its optimism beyond the tide of major setbacks that continue to rock and weaken the global economy at the onset of the “Turbulent Teens.”

Meanwhile, debt has become a major vulnerability of the richest economies. In the past ten years, global debt exceeded GDP growth, and doubled to US 158 trillion, 266% of GDP in 2010¹⁶. Governments’ debt grows fastest in Japan, the US, and Western Europe, as they create liquidity and borrow at higher interest rates, in order to refinance past debts, maintain the material purchasing power of their population as well as their imports of more expensive fossil fuels and minerals. Their manufacturing sectors’ added-value recedes because of domestic productivity improvements and shifts to imports from low-cost producers like China, India and other emerging economies whose financial reserves, as a consequence, are increasing.

This indebtedness has reached proportions that handicap investments and spending in public services, savings for retirement of an aging population, and repayment of mature liabilities. It has started to challenge the confidence of the few international lenders with

significant reserves. It also challenges the credibility of developed economies as reliable sources of funding in international negotiations on global issues such as climate change and poverty reduction. On the other hand, it heightens the expectations on private financing and direct investments as principal key levy for development and environmental progress.

Demographics will not help the ability of developed countries to climb back from their valley of debt. By 2020, half of their population will be near 50 or over, demanding more healthcare services, and providing fewer savings, while their life expectancy continues to stretch. A decade later, it will be the turn of China, South Asia, Latin America and parts of the Muslim world¹⁷. The consequences for future economic priorities, dynamics of growth and employment, migratory flows, national security and international relations will be profound. They have hardly been studied yet.

The current record surge of public debt is mainly due to the attempts to cope with the consequences, at the end of 2008, of the global domino crash of housing subprime and mortgage derivatives. At least the previous “dot.com” boom, after its brutal death in 2000, left a large set of investors and entrepreneurs who continue to innovate and expand a valuable Information and Communications Technology sector. But this latest bubble, instead of a technology legacy, only leaves a huge stock of energy-wasteful housing assets in extended suburbs, and more vehicles and appliances. It also leaves hard lessons about the consequences of cheap consumption loans in a deregulated financial system.

Steering the economy toward green growth, the only reasonable and sustainable way forward, will be difficult without resolving a number of systemic flaws in the current economic rules, the allocation of capital, and the behavior of financial markets.

Financial markets and banks mobilize people’s and companies’ savings. They guarantee their deposits

¹⁶ McKinsey Global Institute, Mapping Global Capital Markets 2011, August 2011

¹⁷ Neil Howe and Richard Jackson – Global Aging and the Crisis of the 2020s, Center for Strategic and International Studies, Washington DC, USA



while they allocate this capital to other people and companies with bankable investment projects. They best serve the economy by ensuring low transaction costs and good risk assessments and management. From the 80s onward, deregulation has allowed significant deviations from that basic utility¹⁸. Often praised as financial innovations, their overlapping effects led however to the worst financial crisis and still undermine the recovery toward sustainable development. When banks are let to package mortgages into tradable securities, a key link for informed risk management brakes down between the lender and the home owner, the car buyer or credit card holder. Packaging these securities into more complex derivatives and structured financial products introduces ever more dilution and biased information between the original debtor, the designers of these products and those holding and selling them at the end of the chain for commissions and profits. With no transparent liquid market, the seals of quality for bundles of risky debt are only in the hands of an oligopoly of rating agencies.

New types of financial services have gained a license to operate without the prudent constraints of debt leverage. Commercial banks are also free to hold and sell assets. A generalized system of one-sided bonuses stimulates employees to multiply transactions for a fee, take highly-leveraged risks with little to lose on the down-side. Shareholders can neglect oversight as they barely risk their own equity with the potential for high-profit leverage.

Hence, from the bust of the dot.com boom to the summer of 2008, the financial sector managed to draw trillions of cheap US federal money and foreign capital into opaque layers of securities piled above the same foundation of abundant consumer loans. As a consequence it raised the benchmarks of corporate shareholder value (40% of the whole corporate sector's profits in 2007) and executive compensation.

During all that time, other business sectors, in the "real economy", had therefore little choice but yield to the colossal pressure from financial markets to match these new profit benchmarks, to increase their capital productivity and debt leverage, to buy back their shares, to reduce costs by layering, capping fixed salaries and outsourcing to low-wages suppliers. Failing several earnings forecasts quickly turns off analysts and brokers and sends share prices into zones that raise the prospects of takeovers, mergers or demergers. As a result of pressures on salaries and employment, median household income in OECD countries kept lagging about half a point every year behind GDP per capita growth. Income inequality and poverty have therefore increased during the last 15 years¹⁹. With a significant and rising fraction of people with income difficulties (24% in OECD), the current economic rules shape a more divided and unstable society and provoke rising outbursts of public resentment.

In a background paper for the OECD May 2011 Forum on Tackling Inequality²⁰ there is general evidence that the last 2 decades of economic growth have benefited the rich more than the poor: the Gini coefficients²¹ based on disposable household income distributions have increased because in most countries the top decile income increased faster than at the bottom of the income ladder.

The rise of international trade and the technological shifts in industry favor high-skilled workers and managers: their wages increase faster and they receive performance-based bonuses. The opportunities for productivity gains and the pressure from financial markets promote layering, lean management and off-shoring; lower-skilled workers lose working hours or move to public unemployment

¹⁸ Nouriel Roubini, Stephen Mihm – Crisis Economics, Penguin Books, 2010, 2011

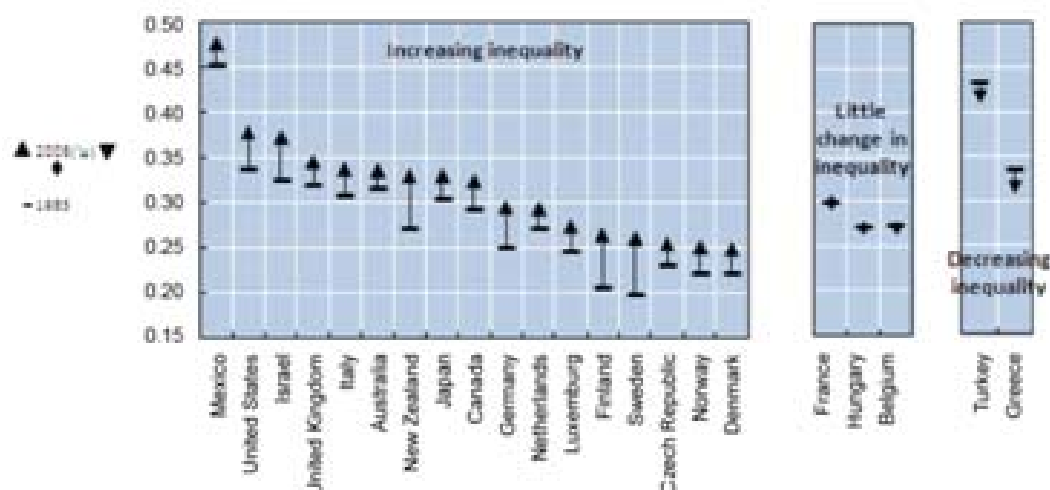
¹⁹ OECD – Society at a Glance 2011 – OECD Social Indicators

²⁰ OECD Forum on Tackling Inequality, Paris, May 2, 2011 www.oecd.org/els/social/inequality

²¹ Developed by statistician Corrado Gini, this coefficient measures the deviation from a perfectly equal income distribution. At 0.00 Gini value everyone in the country would have the same income, at 1.00 only one person would grab it all.

Figure 1. Income inequality increased in most OECD countries

Gini coefficients of income inequality, mid-1980s and late 2000s



benefits until labor demand picks up again but often at lower wages or shorter work-time. Capital income adds mainly to those with enough disposable means and credit to hold equities and properties. Tax rates and social benefits at least soften the impact of market-driven inequality. However in the last 10 years, unemployment benefits and income tax reforms have weakened their redistributive impact. But, on average across the OECD, income inequality would be about 20% higher without redistribution schemes.

This is not just a rich country problem. The UNDP Human Development Report 2011²² concludes that income inequity has increased in all major developing economies except in some countries of sub-Saharan Africa and Latin America (Brazil). Even though the Human Development Index increased on average and poverty receded, the disparity between the top and bottom quintile of the population is widening. Middle-class style consumption at the top is exacerbating environmental impacts on the bottom. Social tensions and conflicts are mounting.

Of the famous “three pillars” of sustainability, the economic is currently set against the social and environmental. It needs a challenging realignment.

Aside from a slowly growing cluster of Socially Responsible Investment funds, the Dow Jones Sustainability Index, the Principles for Responsible Investment and a fringe of farsighted business leaders and investors, the reality of financial markets leaves little room for more than incremental environmental improvements and energy cost reductions. A good example of this approach is the Waste-Reduction-Always-Pays-Program²³. But, once the low-hanging fruits of waste, materials, and water and energy efficiency are reaped to contribute to shareholder value targets, the next layer of improvement possibilities, does not meet the minimum rate of return that management sets to satisfy the financial market’s expectations. As a result of the overwhelming preference for speculative deals in real estate, commodities, high-growth and high-margins consumer goods and financial derivatives, relatively little is left for investments in low-risk eco-efficiency, water conservation, non-carbon energy sources, low-impact agriculture and mobility, and affordable living necessities for the poor. The low-hanging fruits demonstrate that indeed decoupling economic growth from environmental and social impact is no utopia. But, so far, most public and private economic decisions compete in the get-rich-fast realm.

A number of studies since the Stern Review, the International Panel on Climate Change (IPCC) Third Assessment and UNEP’s The Economics of Ecosystems and Biodiversity have attempted to estimate the growing cost of climate risk, biodiversity loss and environmental degradation. They all point to the failure of our financial market rules to recognize the economic impact and size of those externalities. They stress the limiting focus of our main economic progress indicator – the Gross Domestic Product per capita – that provides a distorted view of our real prosperity and its trends.

In these times of great indebtedness, economic insecurity and frustration, and corporate competitive pressures, how could we manage such weighty corrections?

²² UNDP – Human Development report 2011 – Sustainability and Equity: A Better Future for All; Palgrave Macmillan

²³ Coined by Dow Chemical in 80’ and embraced by many industrial corporations

In these times of great indebtedness, economic insecurity and frustration, and corporate competitive pressures, how could we manage such weighty corrections?

A business perspective on policy options

The WBCSD believes that the time has come to fix the system. The twin challenges of economic growth and managing the natural capital that sustains our prosperity cannot wait. It is precisely by redesigning the rules for well-functioning markets, and redefining the performance of companies, that green growth will lift the economy from its grim current condition.

It is not a question of going back to a former era of financial regulation. Financial innovation is not a sin. It is an essential factor of success but, with the pursuit of particular interests, it also needs to be consistent with securing common environmental and social goods. Deregulated approaches have shown their limits and their darker sides. A better policy framework and governance are necessary to ensure the mechanisms of capital and markets work for green growth.

UNEP's Green Economy team of experts modeled a scenario of green investment, equivalent to 2% of GDP per year, from 2011 to 2050. It has specific sectorial targets coherent with estimates made by other institutions such as the International Energy Agency and HSBC²⁴. In 7 years, this green growth scenario takes over an optimistic business-as-usual economic stimulus package; from there onward it generates significantly more wealth and jobs with less energy, water and ecosystems degradation. It also reduces the risks of man-made natural disasters. A model with so many assumptions cannot be the perfect forecast for the next 40 years, but it confirms the intuition and beliefs of many business leaders committed to the Vision 2050 pathway. They could charge ahead even more effectively and confidently when governments secure a combination of necessary policy reforms and incentives:

- Enhancing the indicators to measure prosperity and steer progress.
- Correct the payoffs and externalities that reflect the true value of the natural capital that supports the human economy.
- Target investments and incentives for innovation, infrastructures and institutional capacity.
- Enforce risk transparency and accountability for all financial services and products.
- Catalyze the emergence of green funds and portfolios for secure private investments.
- Commit to clear, reliable and time-bound transition strategies that allow potential losers to readjust and avoid hardship

Innovation, investment, production and consumption, as well as policy decisions and compliance, happen locally. They differ across countries and regions according to the state of development, natural resources and institutional capacity. The WBCSD believes that local initiatives and national action plans are essential to the green growth dynamics, and cannot wait for the whole world to move in unison. But goods, knowledge, technologies and capital are also mobile globally. Beyond the necessary transitions and learning curves, local initiatives need to feed and enrich collective action to create convergence and scale. Harmonization of local frameworks is necessary, sooner or later, to make the world economy more efficient and fair, and leave free-riders no place to hide.

A better way to measure prosperity

The case of the limitations of the output-based GDP and GDP/capita to monitor economic sustainability and people's well-being has been made on numerous occasions, not the least by the Commission on the Measurement of Economic Performance and Social Progress in its September 2009 report²⁵. Besides monitoring progress, indicators are important to focus policy measures on clear performance outcomes with quantified targets.

We believe GDP must continue to be on the dashboard to pilot the economy toward sustainability, but with a set of additional indicators to capture the status, dynamics and quality of green growth, as it relates not only to productive capital but also to other essential components: natural and human capital. The work of the World Bank on the wealth of nations²⁶ is particularly insightful. The framework

²⁵ <http://www.stiglitz-sen-fitoussi.fr/en/index.htm>

²⁶ World Bank – Where is the Wealth of Nations? Measuring capital for the 21st century - 2006

proposed by the OECD on headline indicators,²⁷ and the revision for February 2012 of the System of Environmental-Economic Accounts (SEEA)²⁸ will help to agree on the elements of a dashboard that is adaptable to specific national situations, comparable across economies and rooted into the performance indicators of business sectors – such as those developed by the Global Reporting Initiative, the Carbon Disclosure Project, the Integrated Reporting Pilot Program and other business-stakeholders initiatives.

With the perspective of Vision 2050 we can single out a cluster of essential headline economic indicators. Some still need a robust statistical definition and collection system that should result from the SEEA. Some will be a composite of several additional indicators.

Economic growth	A composite of GDP, natural and human capital variation
Employment	By structure of sectors and green growth activities
Poverty	Fraction of population still under the poverty line and progress on the Millennium Development goals
CO₂ productivity	Production and demand (real disposable income) based
Energy productivity	By structure of energy sources
Fresh water abstraction	As related to available renewable resources
Food productivity	Progress of agriculture's sufficiency to feed the population
Nitrogen/phosphorus productivity	As surplus or deficit related to agricultural output
Green growth investments	Composite of R&D and financial flows into green growth projects and policies
Ecosystems' biodiversity	Progress toward targets set by the Convention on Biological Diversity

Make externalities accountable

Pricing influences behavior and helps companies to make better decisions. The WBCSD therefore endorses true value pricing of natural assets, pollution and emissions impacts, and supports the removal of subsidies as well as tax shifts that encourage the sustainable production and consumption patterns needed to achieve green growth. Those public budget reforms and economic instruments must be decided quickly, yet developed by a broad consensus.

There are a number of proven mechanisms to price pollution, to place a value on natural resources to reflect their degree of scarcity, and to phase out subsidies that support overconsumption of scarce resources and production beyond normal demand. The WBCSD's Vision 2050 is based on "accounting for the real world"; accounting standards and prices reflect all externalities, positive and negative. Indeed, markets are not self-correcting to that end. Policy intervention is necessary.

The business community does not speak with one voice on this issue of absorbing the costs of externalities and the loss of subsidies. National governments, too, are prone to overlook domestic market failures that translate into competitive advantages in international trade or attractiveness for foreign investments. As a result, the promises of Agenda 21 and the Doha Development Agenda have not materialized and the multilateral negotiations on all global development challenges continue with difficulties and few outcomes.

Clearly the various instruments of fees, taxes, tradable emission permits introduce pressure to change. But the financial impact on the companies' bottom line can be avoided or reduced by undertaking that very change. Allowing for reasonable transition periods with early warning enables companies to adjust their operations and budget priorities. Capacity building programs for small enterprises and farmers also provide support during these transitions. Moreover governments can make judicious use of the revenues to reduce other barriers to competitiveness like labor taxes and incentives for green production and consumption. By thoughtful dialogue and design, such economic payoff reforms can benefit all. Those unwilling to change and innovate should not be allowed to slow down the process.

Foster innovation, infrastructures and institutional capacity

A green economy needs technology development and deployment that companies or sectors cannot finance alone. There is a pre-competitive substrate of science, education, infrastructure and scale-up projects which requires government funding

²⁷ OECD – Towards Green Growth; Monitoring Progress - 2011

²⁸ <http://unstats.un.org/unsd/envaccounting/seearev/>

and incentives. We highlight several specific areas in the other chapters of this publication.

Beyond a certain stage of maturity, new technologies and entrepreneurs depend more on market demand than on supply-side incentives. It is customer adoption and feedback that boost innovation and continuous improvement. It is market success that creates employment and the economic, environmental and social benefits of new products and services.

Finally, the incentives should leverage private contributions so that, at scale, government funding can phase out, in order to ensure the self-sustainability of suppliers and the efficient use of public finances.

The WBCSD therefore recommends a balance of:

- Supply-side public investments in research, education, infrastructures and institutional capacity.

Complemented by:

- Strong incentives and tax credits for public and private procurement, retirement and write-down of obsolete assets.
- Investments in extensive sensing and metering of energy consumption and key natural resources stocks.

Education for entrepreneurs and managers needs to enhance their ability to integrate the imperatives of human development, ethics and sustainable prosperity. This requires a comprehensive transformation in research and in the teaching at business schools and universities. The public licenses to deliver management education should foster this transformation and collaboration, to put social and environmental issues at the core of innovation, leadership and management programs.

Enforce risk transparency and accountability

Vision 2050 is about the long term: it spans the full active life of an employee, an executive or a policy maker. It demands decisions that are at odds with the current noise and turbulence of financial market pressures. In fact those who seriously believe in changing pace for the Vision 2050 pathway need to muster the self-confidence to filter and ignore most of the feverish signals sent by financial markets.

“Long term” means, at least, several years. Green technologies venture capital or equity funds anticipate positive returns in time spans of 8 to 10 years. A McKinsey study²⁹ estimates that 70 to 90% of a traded company’s value resides in cash flows expected in three or more years out. But roughly 70% of all US equities are traded at “hyper speed.” Such owners who hold shares only a few seconds are not interested in company fundamentals, but gamble on market dynamics, crowd behavior, and making money with highly leveraged money. Thus the stock of global financial assets rose from 1.2 times GDP, in pre-deregulation 1980, to 4.4 GDP in deregulated 2007. That year, the total stock market capitalization exceeded the global GDP by USD 9 trillion and reached almost 5 times the global gross domestic savings³⁰. These are obvious indications on how far stock markets have pulled away from the real economy made of households’ income, corporate profits and savings deposits.

Corporations mainly deal with banks for their investments. Stock markets are only occasional providers of fresh capital. Turning money into speculative bubbles, they have moved away from their social purpose of enabling shareholders to exchange stock. They steer many executives into financial tactics from quarter to quarter, demotivate work forces, and infuriate the public about capitalism.

A number of WBCSD members have already decided to counter this short-termism by the following measures:

Compensation and rewards for sustainability³¹: it is people who make decisions and their behavior is shaped by the prevailing codes and structures of incentives. Hence this means aligning executives and employee compensation to specific sustainability commitments with measurements and performance reviews. It also means providing support in time, and resources for improvements and for resolution of dilemmas between the conflicting business objectives that occur in real life.

There are a number of techniques to move part of the rewards from the short-term wins to longer multi-year track records: extending the vesting period of stock

²⁹ Dominic Barton, McKinsey – Capitalism for The Long Term – Harvard Business review; March 2011

³⁰ McKinsey Global Institute, Mapping Global Capital Markets 2011, August 2011 correlated with World Bank data

³¹ WBCSD – People matter reward – January 2011

options (even to retirement age), escrow accounts for bonuses to account for setbacks in the form of a malus before payouts every 3 or 5 years.

Ownership mindset: A major problem of financial markets is the “agent-principal” gap. Executives who know best about the company and its progress are alienated from shareholders by several layers of share brokers and managers of large diverse portfolios; most of them betting thousands of equities in fast- speed trading, on the basis of second- hand information, or mathematical models.

There are at least three complementary solutions to reduce the gap and tyranny of short-termism. Allowing boards to govern like owners, by selecting board members with experience in the sector, and demanding significantly more time devoted to formal and informal meetings, is one solution. Reducing the dispersion of the ownership structure by promoting the company to potential long-term owners with a track record in corporate social responsibility and green growth is another. And third, some WBCSD members have moved away from the rituals of quarterly forecasts and yearly outlooks. They survived, and have created more attention on the drivers of their long term success.

Transparency and accountability: Company equity and financial performance information already meets the highest standards that should be a model for all other financial products. There is still room for progress in the readability, materiality and comparability of corporate CSR performance. The WBCSD has participated in shaping the Global Reporting Initiative, and follows closely the work of the International Integrated Reporting Committee. These business and stakeholders collaborations provide the basis for assessing and tracking green growth and real wealth creation by the business sector.

These steps are also reasonable proposals for reform that could help the whole financial sector to achieve more accountability, transparency and commitment to wealth creation, at much lower risk.

Shares and corporate bonds represent about 25% of all financial assets, and very little of the derivatives famously named by Warren Buffet “weapons of financial mass destruction” (implying a major minefield on the pathway to green growth). Bringing the latter financial products into accountability and transparency will require some of the measures outlined above; particularly more disclosure and realistic risk-coverage. The WBCSD does not have the capacity and legitimacy to provide advice in that complex, yet urgent, area. Only public policy, in dialogue with forward- looking financial experts and institutions, can shape and enforce comprehensive reforms.

Financing Green Growth

Based on UNEP’s model for a Green Economy, about 10% of the world’s yearly capital formation should be reallocated to green growth projects. This amounts to about three times the total 2008 – 2010 green component of economy recovery packages, mainly driven by China, the USA and Europe³². Fiscal reform should do its part to mobilize and channel wealth from discontinued subsidies and new environmental levies into productive public investments. However, only part of the necessary investments can be made by highly indebted governments. The larger part must come from the private sector. Public policies and investments can act as catalysts to mobilize private investments, through the application of various instruments:

- Transfers of revenues, from environmental taxes and phased-out subsidies, to new fiscal incentives for green investments.
- Greening export credits for climate, water, and other clean technology foreign investments.
- Creation of pools of capital from green saving accounts with stable interests and tax incentives on deposits.
- Providing guidelines and insurance for state and private pension and life-insurance funds to relocate a proportion of their assets into green investments.
- Providing risk-sharing instruments, such as insurance, to stimulate investments into important green growth areas, despite risks that are not under the control of the investors.

³² HSBC, Global Research– A climate for Recovery – HSBC Bank plc 2009

Financing green growth requires turning previous financial innovation on its head: it is not about creating layers of tradable derivatives on the same primary loans,

but mobilizing and stretching liquidities into multiple investments with stable cash flows, that may provide initial lower returns, but sufficient upside potential, when markets are cleared of negative externalities.

The WBCSD is ready and willing to contribute to the public-private dialogues necessary to design better systems of green financing.

Commit to clear, reliable and time-bound transition strategies to allow potential losers to readjust and avoid hardship.

All the proposals above entail a purposeful government intervention in the economy. They run against prevailing beliefs, at least during the last three decades, that the economy becomes more efficient with less government intervention. There is indeed evidence that innovation, business creation and competitiveness suffer under bureaucratic constraint. But there is also broad evidence that current free-market policies are not at all the way to produce a more stable economy and embrace green growth.

Voluntary business initiatives and public-private partnerships are good incubators for innovative technologies and practices. They will only achieve the necessary scale and momentum with the support of public policies that remove obstacles such as volatile institutions, funding shortages, competition through perverse subsidies, negative externalities, and obsolete legacy assets. Progress needs new standards, compliance and stable institutional capacity. This is the role of government.

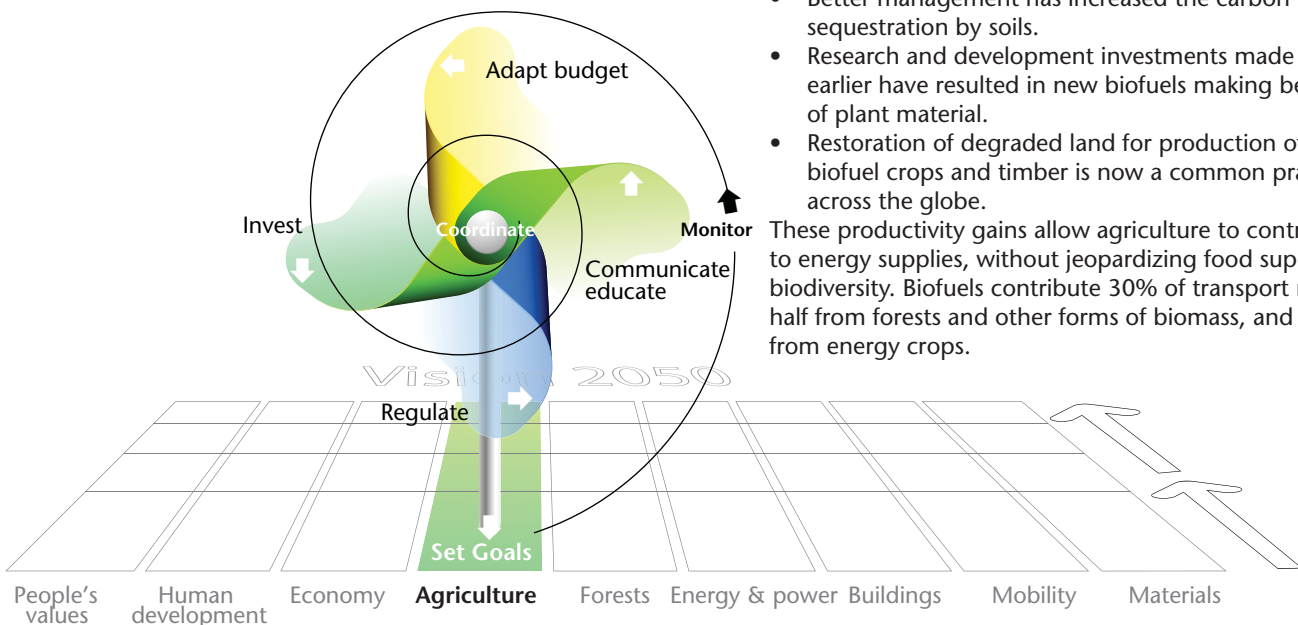
Change, particularly rapid change, creates pressure and hardship on potential losers at all levels, from countries, to corporations and households. Therefore, public policies must be designed with advance signals and reliable time-bound transition strategies that provide incentives and support, to anticipate and adjust to the new objectives and rules.

These transition strategies are best designed with the key stakeholders concerned in government-led roundtables, or advisory councils.

Agriculture

The 2050 Vision

A 21st century version of the Green Revolution has helped agriculture to meet the larger 2050 population's nutrition and energy needs.



- Improved agricultural practices, water efficiency, new crop varieties and new technologies, have allowed a doubling of agricultural output, without the traditional associated increases in the amount of land or water used.
- Bigger yields have released land area under agricultural production for forestry, infrastructure and buildings.
- Better management has increased the carbon sequestration by soils.
- Research and development investments made decades earlier have resulted in new biofuels making better use of plant material.
- Restoration of degraded land for production of food, biofuel crops and timber is now a common practice across the globe.

These productivity gains allow agriculture to contribute to energy supplies, without jeopardizing food supplies of biodiversity. Biofuels contribute 30% of transport needs, half from forests and other forms of biomass, and half from energy crops.

Set goals

- For food sufficiency, water, soil and biodiversity protection, farmers' quality of life, and rural communities' prosperity.

Communicate & Educate

- Provide farmers with affordable information and education on resource conservation and new forms of productive agriculture, such as Integrated Food, Feed, Energy systems.
- Reinforce consumer education on healthy nutrition, and how to select agricultural products with the lowest negative impact on natural resources and communities of origin.

Regulate

- Reduce and eliminate tariff and non- tariff trade barriers to the movement of agricultural products and crop protection materials.
- Implement the International Regime on Access and Benefit Sharing of genetic resources and traditional knowledge.
- Develop simple, harmonized and science-based product information and identification norms.

Adapt budget

- Reform the mechanisms of subsidies to decouple resource usage from production, in favor of incentives to adopt conservation practices.
- Introduce incentives for carbon and natural environmental services management.

Invest

- Support agricultural research adapted to local conditions, to ensure food sufficiency.
- Accelerate the development of Integrated Food, Feed and Energy Systems.
- Extend efficient infrastructures to move and market products with minimum losses from farm to point of consumption.

Monitor

- Extend measurement and sensing techniques for critical entrants: water, nitrogen, phosphorus, arable land.

Coordinate

- Ensure that farmers, particularly small-holders, retailers, and consumers receive their fair share of the incentives to change (and costs of negative impacts).



Agriculture

Current context

Agriculture occupies as much as one third of the world's labor force. The added value of its traded crops and livestock represent about 3 % of the world's GDP since 2005. Both demand and supply have followed demographic growth. However, agricultural markets are characterized by volatility, and the extremes have worsened: a sudden rise of food prices in 2007-2008, followed by the economic recession of 2009, and, in 2010, new price peaks due to weather-related shortages in major producing regions, are a reflection of this. As a consequence, around 1 billion people cannot afford sufficient food. Not enough progress is made on the Millennium Development Goal to half that number by 2015, although, in relative terms, one in three inhabitants of developing regions used to be undernourished 40 years ago, as compared to one in six now³³.

The unmet basic need of food security continues to threaten social peace in many countries, and to trigger frequent panic buying and hoarding, that even amplify tensions on the international agricultural markets. With higher fuel costs for cultivation and transportation, and the increasing linkage of biofuel crops to energy, food prices are projected to fluctuate above the levels

of the last decade³⁴. Yet, low returns, and the capture of value by large retailers and food processors in developed markets, combined with the lack of timely market information and transparency, hinder the necessary investments to expand production to a level that could overcome the food poverty gap. Moreover, they discourage the vocation of a new generation of farmers.

Fish represents 16% of all animal protein sources, and its production is more and more dependent on aquaculture to keep up with population growth, as well as a slightly higher proportion of fish in human diets. Of all marine fish stocks, about 32 % are overexploited and nearing depletion, 53% are captured at the limits of sustainable reproduction, and only 15% remain as moderately fished; the lowest level ever. Capture fishing, therefore, has been stagnant for the last decade, and fish farms have become a growth sector with a high need for better quality waste and disease management,³⁵ to become sustainable.

Improving the nutrition of a billion poor people, and feeding the population which will have grown by more than 2 billion people, is possible over the next 4 decades. The FAO estimates that 2.8 billion ha, twice the arable area currently cultivated, are still available for rain-fed production of permanent crops. But a large proportion must also be preserved to expand forests, or support infrastructure. There is also enough fresh water globally to provide irrigation for another 200 million hectares. However, neither arable land nor fresh water are uniformly available. Some regions like South Asia, Near East and North Africa, are already short of both. More international trade, and better yields, are then critical factors in providing food for all.

Even at this time there is enough food produced to feed everyone. Waste in the food chain is staggering. Of 4600 kcal of edible crops produced, only 2000 kcal are consumed daily, per person³⁶. Major losses are incurred at both ends of the chain. In the developing

³³ FAO – State of Agriculture 2010-2011

³⁴ Marco Favas Neves – Food chains and the reasons behind rising food prices – May 2011 – Practical Action Publishing (online)

³⁵ FAO – State of Fisheries 2010

³⁶ UNEP – The Environmental Food Crisis, 2009



world, 35 to 45% of the food produced is lost in harvesting and distribution, due to inadequate storage and poor logistics to markets. In the developed world, food is the single largest component of municipal waste from homes, restaurants and supermarkets: about one third of the food purchased is never consumed, but costs the community additional waste management capacity. Transforming edible crops into animal food for milk and meat is also diverting a conversion ration to sustain the livestock equivalent to 1200 kcal/day/person from total food production. Adequate supply chain management, and sufficiency purchasing behaviors for healthier diets, could avoid a general food crisis, and provide reserves for local emergencies.

Farming mobilizes significant material flows. 88% of vegetable dry matter is carbon and oxygen sequestered through photosynthesis from inexhaustible atmospheric stocks. 6% is hydrogen extracted from rainfall and renewable or fossil fresh water reserves. The 6% balance is composed of nitrogen, potassium, calcium, magnesium, phosphorus, sulfur, iron and a host of other mineral trace-elements³⁷. They are all naturally extracted from the reserves of humus and bedrock (nitrogen from air), by a delicate ecosystem of microorganisms. Farmers have learned to recycle organic matter into their fields, and supplement the natural reserves using manure and commercial fertilizers. But the growing transfer of crops and biomass from farmland to distant urban markets, along with industrial processes, continuously deplete the natural reserves of fresh water and important nutrients. Some, phosphorus in particular, have only a few high- grade mining sources in the world. Intense plowing and irrigation, and the forcing of cattle and cultures on inadequate soils, also degrade the natural fertility and productivity of many territories, and seriously pollute rivers and water tables with surplus nutrient discharges.

According to the FAO, agriculture accounts for 70% of global fresh water abstraction, and causes considerable overexploitation of groundwater reserves and electricity capacity to feed overhead irrigation systems. The Planetary Boundaries study by the Stockholm Resilience Centre³⁸ shows that commercial fertilization transforms more atmospheric nitrogen into reactive forms than all natural earth processes. This nitrogen pollution erodes the resilience of many ecosystems, and adds nitrous oxide to the cohort of potent greenhouse gases. Reactive phosphorus flows also threaten rivers and some coastal areas by depleting the available oxygen available to aquatic life. The Planetary Boundaries study highlights the importance of reducing nitrogen and keep phosphorus flows below safe thresholds in order to avert large scale, irreversible damage.

Only forms of conservation agriculture³⁹ that adapt to the natural potential of soils, and preserve their cycles of nutrients by minimum soil disturbance, permanent soil cover and adapted crop rotations, can restore and maintain the sources of fertility. In particular, Integrated Food, Feed and Energy Systems⁴⁰ hold the promise to supply nutrition, animal feed, fuels, materials and even chemicals, from the same sustainable biomass culture. Smallholder farmers converted to multi-crop agro-forestry practices can also demonstrate significant biodiversity and carbon benefits. For instance, a large-scale pilot project in Mozambique⁴¹, brings evidence that regions with vast arable land reserves, such as sub-Saharan Africa, could leapfrog straight into a bio-based economy, to accelerate food sufficiency and access to clean cooking and transport fuels. All regions of the world with the potential to increase sustainable farming of biomass could move toward bio-based economies, to transfer their reliance on crude oil to a distributed rural resource base for food, feed, materials, bio-fuels and polymers.

³⁷ Claude & Lydia Bourguignon – Soil, earth and fields – Sang de la terre, Paris – chap 4, Agrology and Fertilization

³⁸ Johan Rockström and al. Planetary Boundaries: Exploring the Safe Operating Space for Humanity – Stockholm Resilience Centre

³⁹ As defined by the Food and Agriculture Organisation at <http://www.fao.org/ag/ca/>

⁴⁰ FAO – Making Integrated Food-Energy Systems Work for People and Climate – Rome 2010

⁴¹ www.cleanstarmozambique.com

Europe, North American and high- income consumers in other countries show an increasing concern about how and where their foods are produced, and an emotional aversion for certain processes such as battery animals, genetic modification and pesticides. Some are even willing to pay a small premium for their preferences . This implies a trend for reliable traceability and labeling that will affect major food chains.

According to the World Health Organization, about 1.5 billion people are overweight, of which 500 million are obese. Overweight and obesity have more than doubled since 1980, and spread to developing countries, and cause more deaths than malnutrition. They result from a growing intake of foods high in fat, sugar or salt, combined with a sedentary urban lifestyle. They are fully preventable by healthy low- calorie diets. This calls for responsible choice editing and marketing by the food processing industry.

A business perspective on policy options.

Business cannot thrive in societies undermined by hunger and food crises, and the erosion of the natural capital of healthy and productive soils. The sustainable management of food chains and agricultural ecosystems presents numerous opportunities for innovation and value creation. Despite the large investment needs, risks are lower than in other business areas. Facts are clear and trends predictable⁴⁴.

The pathway to Vision 2050 is framed by the following challenges ,^{45 46}:

- The continuing of productivity trends of the past 4 decades at an average yearly rate of at least 1 to 2% per year.
At the same time, significantly reduce the environmental impact of inputs and wastes, water consumption, energy and carbon intensity of cultivation, nitrogen fertilization and transportation. Moreover, productivity gains must now be higher, to eliminate food poverty and emergencies. They must also be resilient against the predicted production losses from climate change.
- Empower millions of smallholder subsistence farmers with the knowledge, credit and tools to generate commercial surpluses. GDP growth from agriculture is twice as effective in alleviating poverty in rural areas as growth from other sectors.
- Mobilize about US\$ 90 billion additional yearly investments, from a mix of public and private sources, in primary agriculture development and the specific services and infrastructures necessary to bring products to markets.
- Foster consumer trust in food safety and quality. Ensure that the environmental and health benefits of new technologies, such as transgenic crops and industrial livestock farming, massively outweigh their independently assessed risks.
- Motivate farmers to quickly adopt yield and environmentally enhancing techniques, proven at a meaningful experimental scale, such as no-tillage conservation cropping. Ensure equal access to progress for smallholder and subsistence farmers.

Agricultural and food policies that affect billions in multiple geographies, cultures, stages of development and political systems, can only succeed if adapted and accepted locally. This complexity should not excuse slow or conflicting actions.

The WBCSD believes that all policies should adhere to two fundamental and inseparable principles. One is the integration of human development and food security for all, because value created in agriculture is the most effective solution to poverty. The other is a reliable understanding and stewardship of the total ecosystems that make meals, fibers and biofuels from soil, water, air and sunshine. A population increasingly urban, and emotionally detached from its natural support systems, should not ignore the importance of the farmers who ensure its well-being.

Then, more specifically, concerted action must focus on the following priorities:

- A rapid transition to trade rules that eliminate the asymmetry between developing and developed country farmers, and better distribute returns to the producing end of the supply chain.
- A combination of public financial support measures that favor poor farmers and innovation, and environmental protection in all regions.

⁴⁴ WBCSD – Agricultural Ecosystems; Facts and trends, 2009

⁴⁵ FAO – How to Feed the World 2050 – High-Level Expert Forum

⁴⁶ Croplife International website – www.croplife.org

- Land and crop stewardship, transparency and certification, responsible marketing, to enable consumers to make safe and healthy food choices.

Fair terms of trade

The WBCSD supports the Doha Development Agenda's goal to reduce tariff and non-tariff trade barriers, and continue to facilitate the exchange of goods, services and intellectual property. The failure of WTO members to reach agreement so far, while serving the interests of some nations and sectors, remains an obstacle to poverty alleviation, as well as the dissemination of innovation, progress and environmental protection. This is particularly true for the farming sector, where market barriers vary greatly across countries, and impair access of OECD and regional markets for many developing economies. At the same time, export subsidies in developed economies defeat the potential competitive advantages of developing economies' exporters, and discourage the production of domestic food surpluses. It is therefore urgent to eliminate such distortions, within short and predictable time scales, in order produce the necessary incentives to reach the Vision 2050 production growth objectives.

It is equally important to eliminate tariffs on crop protection materials. They raise the cost of farmers' access to the tools they need to deal with adverse effects caused by weeds, diseases and pests. On the contrary, with better market access and sales momentum, as well as preserved intellectual property rules, the crop science industry will be able to better develop technologies and products tailored for local crops, soils, climate variability, and budgets.

The improvement of crops and crop protection substances may use genetic resources and traditional knowledge. Adhesion to the new International Regime on Access and Benefit Sharing should ensure that business and farmers have sustainable access to genetic resources, at prices which provide incentives to secure and protect those resources in the long term.

Smart subsidies

Most developed countries provide incentives to supplement farmers' incomes, to protect them against production losses, and improve the competitiveness of the domestic agricultural sector. But this also has perverse consequences when it limits the ability of developing countries' producers to access markets on fair pricing terms, and therefore limits their investment and modernization capacity.

Even within domestic markets, subsidized farmers tend to lose out to the purchasing power of food processors and large retailers who capture more value, while consumers get the least of the intended cost benefits, if any at all. In the end, most farmers still have difficulties in mastering the resources (time, knowledge, finance) to adopt the high yield-low impact forms of agriculture available from science and industry.

On the other hand, the poorest developing countries provide little support to their agriculture, and thus remain dependent on imports to feed their population.

Business believes that public financial support can be valuable in developed economies if it is decoupled from production volume, and targeted to accelerate transitions towards water conservation, soil improvement, precision crop protection techniques, waste reduction, and maintaining set-aside land in production-ready conditions as insurance against food shortages. Such incentives can also initiate important auxiliary revenue sources, such as the management of carbon storage and natural environmental services. Climate-smart agriculture, as defined by the World Bank⁴⁷, provides farming revenue with a combination of proven practices of mulching, crop rotation, agroforestry and integrated crop-livestock management, enhanced by innovations in access to weather forecasts, risk insurance, carbon sequestration and water management finance.

Water is a critical input, and its use must be better measured in order to deploy pertinent conservation and efficiency measures, such as allocation, pollution limits and withdrawal pricing. They will trigger the introduction of such proven practices as drip and micro irrigation systems, drought resistant species, or non-flood seeding. They will also release water to other competing uses – drinking, sanitation, energy production, and aquatic biodiversity conservation.

⁴⁷ World Bank – Policy Brief: Opportunities and Challenges for Climate-Smart Agriculture in Africa – Dec 2011

Research and development, and dissemination of new technologies, are amongst the most productive investments in low income or food stressed economies. Benefits, however, take time to manifest. Farmers need more public support, in the form of education, open information and services for the access to improved seeds, fertilization, crop and livestock protection techniques. They need infrastructures, in order to move and market their harvests. To invest, farmers also must have a low-risk investment climate, with appropriate credit and insurance products.

Subsidies should never become factors that maintain a status quo by encouraging wasteful forms of irrigation, fuel and fertilizers consumption. They need to be targeted at performance and change, and bridge market failures until other policy decisions eliminate them, instead of becoming themselves market failures, as well as barriers to innovation.

Making sustainable farming initiatives the norm for consumer choice

Innovative farmers and businesses do not succeed in the long run because they are subsidized on the supply-side, but because they are satisfying the consumers' needs and preferences. The WBCSD therefore recommends more public support in the area of consumer choices.

Only a fraction of consumers are aware that their foods and beverages, as well as their natural clothing fibers, have the highest environmental footprint per dollar spent, compared to all other consumption commodities and services. Few also make a decisive link between energy- dense, fatty, sugary or salty processed foods, and the rising risks and public costs of chronic diseases. In other quarters, there is much distrust about the recent developments of plant sciences and biotechnologies that underpin the next version of a farming revolution.

Leading brands⁴⁸ have taken initiatives to ensure and verify the safety and sustainability of their products and supply-chains, and inform their consumers by many channels. Such initiatives form a good base from which to evolve compliance norms and information labeling schemes, with a sound scientific basis, transparent assessments, and government authority. Such requirements should seek harmonization and simplicity, in order to avoid burdening farmers, and confusing consumers with a multiplicity of schemes.

It is also necessary to alert consumers to the quality of life, and economic advantages, of healthy food choices, with the lowest environmental and social impact, all the way to the production location. This needs more transparency from the producers and retailers, and less discounts for buying more food that can be eaten.

Products that meet or exceed those norms should also be promoted in relation to their positive performance, in order to benefit from preferential public procurement. Products that fail those norms should be publically identified, and exposed to fines in due time, to offset the externalities that they cause in production and/or consumption. Business has an interest to contribute experience and innovative approaches to a sustainable stewardship of farming products, from fields to households.

⁴⁸ Unilever Sustainable Agriculture Code and other far reaching initiatives

Forests

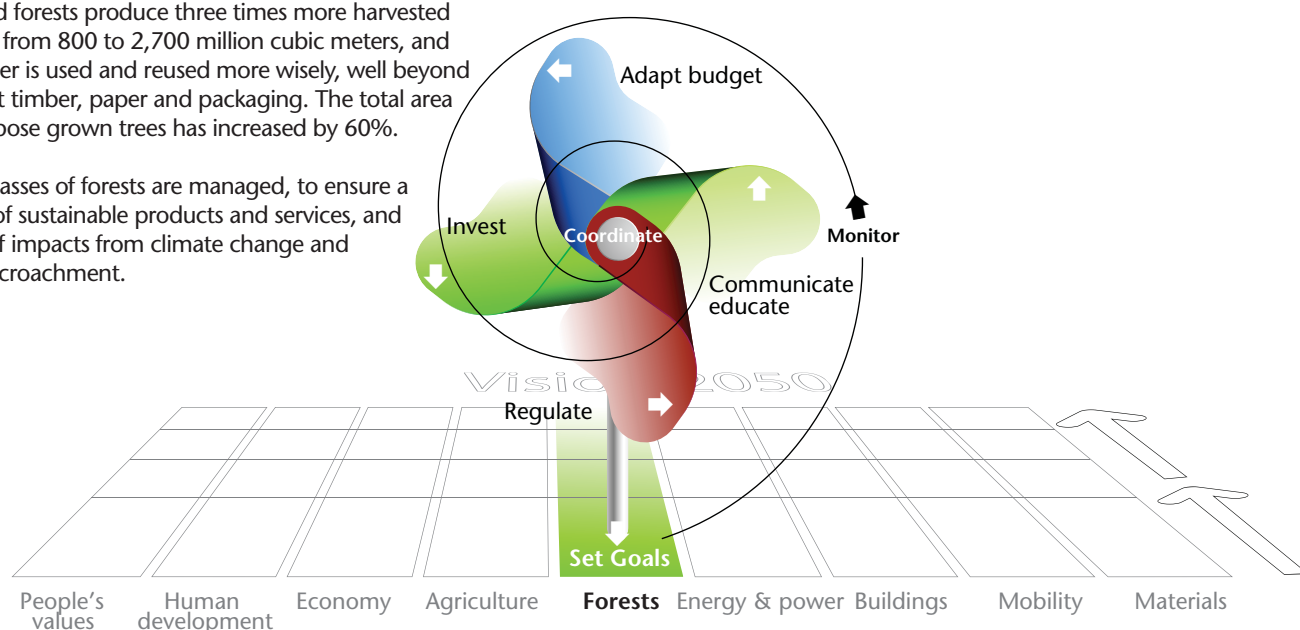
The 2050 Vision

The forests of 2050 have regained much of their capacity to protect against climate change and biodiversity loss, and to meet the resource needs of society.

- Forests cover more than 30% of the world land area.
- The total stock of carbon sequestered in forests is 10% higher or more than 2010 levels.
- Deforestation has significantly reduced.
- Primary forest coverage is intact, and has expanded somewhat. It is no longer used for new farmland; limited wood and biomass harvests do not affect the integrity of this ecosystem, and its provision of essential ecosystem services are valued and incentivized.
- Modified natural forests are harvested at lower levels of intensity, in favor of payments for the supply of ecosystem services including carbon sequestration and fresh water.
- Planted forests produce three times more harvested wood, from 800 to 2,700 million cubic meters, and this fiber is used and reused more wisely, well beyond current timber, paper and packaging. The total area of purpose grown trees has increased by 60%.

All three classes of forests are managed, to ensure a provision of sustainable products and services, and to stave off impacts from climate change and human encroachment.

The forests of 2050 cover more than 30% of the world's land area. They have regained 10% over 2010 of their capacity to fix carbon, protect against climate change and biodiversity loss, and to meet the resource needs of society.



Set goals

- Sustainably manage forests by setting national conservation programs for primary and natural forests and planting programs to grow carbon stocks, expand future sources of industrial wood fiber, and ensure provision of critical ecosystem services.

Communicate & Educate

- Develop the understanding and education of the forestry ecosystem services and capital.
- Develop expertise in sustainable forestry practices and forestry-based carbon management.

Regulate

- Generalize forestry management systems and certification schemes to enhance the economic value of wood products, carbon sequestration, and biodiversity conservation.
- Improve and enforce spatial planning, ownership registration and designation of protected areas.

Adapt budget

- Phase out subsidies that favor encroachment of agriculture into forests.
- Create a market for performance-based carbon storage in forests under REDD Plus.
- Redirect procurement to expand the demand for sustainable wood-fiber based products, including future bio-plastic, packaging, textile, pharma, chemical and energy markets.

Invest

- Without delay, provide adequate funding for the development of REDD Plus.

Monitor

- Strengthen the coverage and consistency of Forest Resources Assessments for reliable state and trend data.

Coordinate

- International cooperation is of foremost importance to share knowledge in sustainable forestry and compliance practices, and move funding to developing countries with a large reforestation and carbon storage potential.



Forests

Current context

During the past two decades, reforestation has gained somewhat against continued deforestation, but the cumulated net loss of forests in 2010 still reached 135 million hectares over 1990⁵⁰ levels. It continues at a loss of about 5 million hectares per year. Primary forests shrunk by 40 million hectares in the last 10 years; about half of the total net loss during the period. Forests modified for productive functions lost 50 million hectares. Purpose grown trees for future harvests, and soil and water protection, created 50 million hectares of new forests. Natural expansion of existing forests, and the spread of forests over abandoned agricultural land, also helped reduce the continued impact of forest clearing for infrastructure and new agricultural land. At least 1.6 million hectares are now covered by a management plan that covers 10 or more years; this trend is on the increase. However current economics and policies still favor deforestation over afforestation and conservation.

The formal forestry sector contributes about 1% to world GDP, with 467 billion dollars gross added value, and it employs 13.7 million people. Where accounted for, non-wood forest products such as subsistence foods

and local fuel wood, amount to 19 billion dollars, but the world total is believed to be much higher. Yet the current total economic added value from the forestry sector falls short of what would be needed for conserving primary and natural forests, and securing net carbon storage, as defined in Vision 2050.

Forests are a critical regulator of the terrestrial carbon cycle. Currently, their above ground biomass stores an estimated 289 gigatons of carbon. Taking into account the root system, dead wood, litter and soil, the world forests retain 652 gigatons of carbon, a time-steady average of 161.8 tons per hectare. Therefore deforestation and exposed forest land transfer carbon back to the atmosphere, and contribute to about 20% of all anthropogenic carbon dioxide and methane emissions that force climate change.

Beyond carbon storage, forests also provide essential environmental services in protecting soils, water quality, reservoirs and circulation, biodiversity, micro-climates and human communities. Some large timber companies have started to explore the valuation and transaction of such ecosystem services. At this time, however, neither environmental and protective services, nor carbon sequestration, can be reliably and consistently included in national and corporate accounting. Public and private forest owners therefore lack a set of significant indicators to help manage the capital and income streams of their forests.

A business perspective on policy options

In this context, the pathway toward Vision 2050 is framed by the following recommendations and rough estimates:

- Undertake massive planting and reforestation programs for industry and energy needs, and

⁵⁰ Global Forest Resources Assessment 2010, FAO, Rome



raise the global forest carbon stock by 37 gigatons of carbon; this equates to more than 200 million hectares of new forest land at maturity, versus current deforestation trends. It brings the world's total forest cover significantly above 1990 levels.

- Spare 4 million hectares of primary forest from destruction each year; compensate land owners for the opportunity costs of not harvesting them for commercial round-wood and/or turning the land to other uses.
- Conserve a yearly 5 million hectares of modified natural forests, by shifting harvests to planted forests where yields and quality are significantly enhanced through improved selection and better forestry practices.

Reducing the risks brought by climate change creates a demand for carbon abatement that cannot be fully met unless we can avoid deforestation and make a significant investment in reforestation. Depending on extent and location, deforestation and reforestation costs have been estimated⁵¹ to range from 2 to 20 US dollars/ton of CO₂ avoided; a reasonable investment for such a large-scale carbon capture and storage solution. Trees have fixed carbon since the beginning of nature. However, there are hurdles to expanding planted forests; primarily land availability and ownership. Moreover, carbon allowances depend on reliable measurement systems, tenure, and assurance of carbon stocks, as well as local capacity to ensure dealing and compliance with carbon management plans.

Under optimal harvesting and processing conditions, wood products continue to store carbon, and substitute carbon-intensive construction, household and packaging materials throughout their life-cycle. Even when converted into fuels, wood and forest biomass and wastes only re-circulate atmospheric CO₂; they eliminate most of the equivalent release from fossil fuels.

The right policies can drive progress, and bring economic growth, for public and private forest owners.

Policies should adhere to the principles of a rational mitigation hierarchy which firstly: prevents any negative impacts on forestry capital or its destruction, secondly: reduces interventions such as road construction, and thirdly: repairs adverse effects, or provides appropriate compensations and offsets, to achieve the goal of no-net-loss of forest space. Carbon is somewhat easier to measure and verify than other biodiversity assets, all of which, however, should be managed under the same mitigation hierarchy. Carbon sequestration follows the money invested to set up carbon sinks and create new forest space. Under this mitigation hierarchy, the WBCSD recommends rapid decisions in 3 areas:

- A rapid completion, implementation and continuous improvement of the REDD+ process.
- A serious reform of subsidies.
- A massive shift to sustainable public and private procurement of wood and wood-based products.

⁵¹ Johan Eliash – Climate Change: Financing Global Forests – www.occ.gov.uk

Reducing Emissions from Deforestation and forest Degradation Plus

In the long run, everyone will benefit from a gain in forest coverage and carbon storage but, in the short term, profits are made in clearing forests for other uses. Therefore, it is urgent to monetize the avoidance of deforestation, and thereby encourage conservation and sustainable forestry practices.

Such a scheme must be designed in ways that provide assurance to the international demand for carbon abatement at an affordable transaction cost, and benefit local forestry livelihoods. Communities depending on forestry should be able to combine reforestation with agroforestry farming revenues.

A phased approach, that allows rapid implementation of parallel country-specific methods, supported by an international funding mechanism, should provide the necessary experience in setting reference levels, measurement and verification, and the efficient processing of carbon transactions. The WBCSD is committed to participate and share competencies in order to develop REDD+ into a robust, performance-based carbon storage market that ensures accountability and fungibility in other trades of carbon permits, and creates economic value and development in participating countries.

Reform subsidies

While it is obvious that many forms of incentives encourage agricultural production of meat, biofuels and soya at the expense of forest stewardship, there is a need to have comprehensive information about these financial flows. This understanding will help to steer investments and markets towards conservation, reforestation and high-yield sustainable forestry practices. It will also help to foster agricultural land utilization and productivity, without invasion of land that is more valuable to grow trees.

Subsidy reform is a systemic undertaking with carefully designed transition plans. These must help the current beneficiaries to re-adjust in time to disappearing support. They must encourage new beneficiaries to gain confidence, and make necessary investments, while also understanding the future phase-out conditions of this support.

The WBCSD views subsidies as transient economic instruments to improve market conditions. They become inefficient, and finally harmful, to continuous innovation once new market conditions have matured.

Performance-based prices for avoided deforestation in a REDD+ mechanism are likely to be more economically efficient, alongside the elimination of subsidies for increasing cattle pastures and soya fields, and their related transport and irrigation infrastructures.

Sustainable procurement of wood and paper-based products

At the other end of the forestry value chain, it is equally important to ensure that purchases of raw materials moves swiftly toward procurement from certified sustainable practices that reward the provision of critical ecosystem services, and incorporate the value of storing carbon. Moving towards sustainable procurement, and supporting market development of fiber based bio-products from sustainably managed forests, will help slow forest clearing and degradation as well.

The WBCSD and the World Resources Institute have provided a comprehensive guide and set of tools⁵² to expand demand for wood and wood-based products from purpose grown trees, harvested and processed sustainably. These resources should assist policy makers in clarifying the requirements of Green Public Procurement, as well as help guide all other wood and paper-based retailers and professional users.

With knowledge and resources, it is both possible and imperative to make market demand a driver of green economic growth in the forestry sector.

⁵² <http://www.sustainableforestprods.org/>

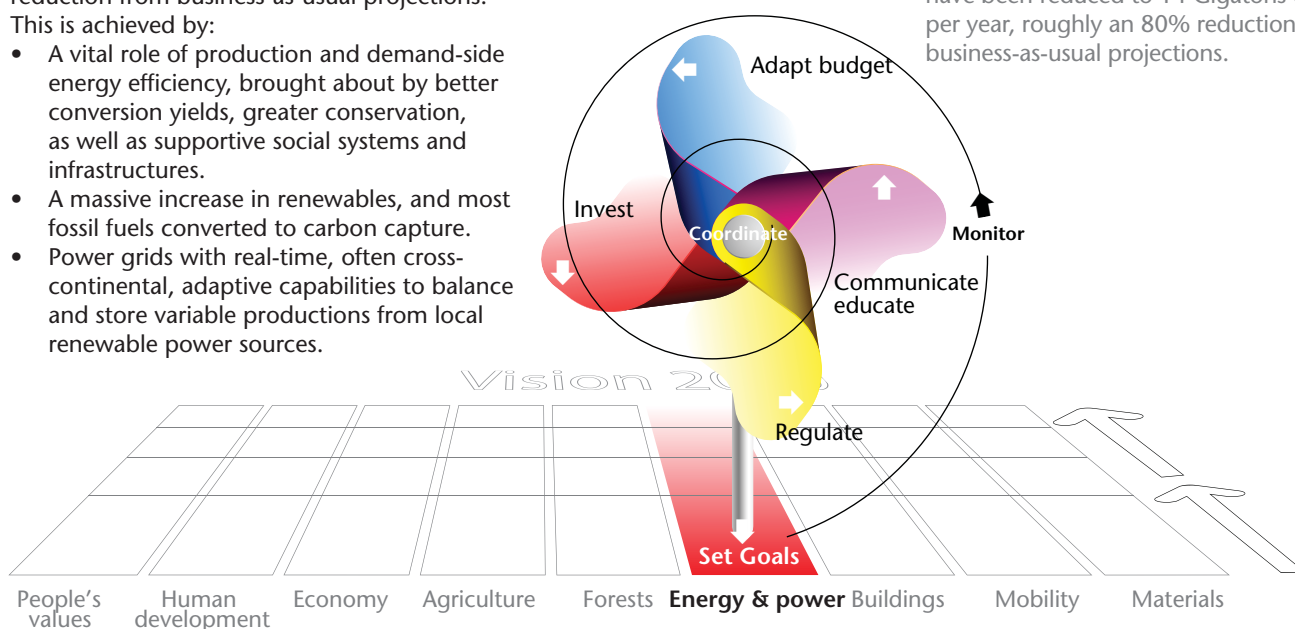
Energy and power

The 2050 Vision

Global energy demand has increased, but secure, affordable and low-carbon energy is universally available, and used efficiently. The energy sector's environmental footprint has been reduced. Its global emissions have been reduced to 14 Gigatons of CO₂ per year, roughly an 80% reduction from business-as-usual projections. This is achieved by:

- A vital role of production and demand-side energy efficiency, brought about by better conversion yields, greater conservation, as well as supportive social systems and infrastructures.
- A massive increase in renewables, and most fossil fuels converted to carbon capture.
- Power grids with real-time, often cross-continental, adaptive capabilities to balance and store variable productions from local renewable power sources.

Global energy demand has increased, but secure, affordable and low-carbon energy is universally available, and used efficiently. The energy sector's environmental footprint has been cut. Its global emissions have been reduced to 14 Gigatons of CO₂ per year, roughly an 80% reduction from business-as-usual projections.



Set goals

- Set national and local energy demand and supply objectives that contribute to the science-based safe limits for climate change.
- Make universal access to modern forms of energy an official policy objective.

Communicate & Educate

- Ensure clear and timely information about the evolving costs and impacts of energy efficiency solutions and low-carbon and climate-safe energy sources.
- Develop the capacity and training of the supply chain of experts and enterprises that can deploy energy efficiency and low-carbon services and maintenance.

Regulate

- Use efficiency standards and emission caps to stimulate progress.
- Create favorable and stable investment conditions in low-carbon energy solutions.

Adapt budget

- Move subsidies from fossil fuels to renewable forms of energy, advanced energy efficiency and low-carbon technologies.
- Increase the price of wasteful energy uses and carbon emissions.
- Support low-income households for minimum access to clean energy.

Invest

- Contribute to the retirement or retrofitting of the most energy-inefficient and carbon intensive assets.
- Foster basic, pre-competitive innovation in efficiency & zero-carbon energy solutions.
- Create or modernize the energy infrastructure that enables access, efficient use, and resilience to the variability of distributed, renewable energy sources.

Monitor

- Adopt and publish a set of progress indicators that measure the energy and CO₂ productivity of the economy.

Coordinate

- The tighter supply-demand balance for fuels, the internalization of climate mitigation, and the incremental costs of new technologies will drive up the price of the kWh. The mix and timing of policy measures must be designed to provide more jobs and benefits on the low carbon and efficiency side, and to ensure that users have time and incentives for advanced efficiency measures, to curb total energy costs, and boost their competitiveness.



Energy and power

⁵³ WMO Statement on the status of global climate in 2010, World Meteorological Organisation, Geneva

⁵⁴ OECD/IEA – Technology Perspectives 2010, International Energy Agency, Paris

⁵⁵ IEA, Energy Technology Perspectives 2010 – International Energy Agency, Paris unless stated otherwise all figures are based on the IEA publications. ⁵⁶ IEA (2011) Energy for All – Financing access for the poor. Special early except of the World Energy Outlook 2011. OECD/IEA, Paris.

⁵⁷ World Health Organization (WHO) (2004) 'Indoor smoke from solid fuel use: assessing the environmental burden of disease' in Environmental burden of disease series, No.4, WHO, Geneva.

⁵⁸ International Energy Agency (IEA) (2010) Energy Poverty – How to make modern energy access universal. Special early except of the World Energy Outlook 2010 for the UN General Assembly on the Millennium Development Goals. The IEA estimates that to achieve the MDGs, an additional 395 million people need to be provided with electricity and additional 1 billion people provided with access to clean cooking facilities by 2015.

⁵⁹ IEA (2011) Energy for All – Financing access for the poor. Special early except of the World Energy Outlook 2011. OECD/IEA, Paris.

⁶⁰ WBCSD (2009) – Water, Energy and Climate Change

Current context

In Cancun 2010, after years of difficult negotiations, the parties the UN Framework Convention on Climate Change endorsed the scientists' recommendation to limit the average temperature increase to 2°C above pre-industrial levels. Climate models relate this temperature ceiling to a 450 ppm carbon dioxide threshold in the atmosphere. At the end of 2010, CO₂ levels reached 390 ppm, the highest level in history. That year also reached record surface temperature values, and closed the warmest decade on record⁵³. Large, extended weather extremes, such as droughts, floods, heat waves and storms, afflicted people, crops and the economy of many regions.

This correlation of the facts with the climate models provides serious reasons to change the world's energy system, responsible for 84% of CO₂ emissions, and around 65% of all GHG emissions⁵⁴. Such change, in the context of population growth and rapid urbanization, requires foresight, and firm social and technological solutions. In total, the energy supply could climb from a 2007 baseline of 12 Gtoe (billion tons of oil equivalents) to 22.1 Gtoe in 2050;⁵⁵ an 87% increase or 1.4% yearly, on average. This could have dramatic consequences for climate change, and

would probably be very difficult from the standpoint of investments and affordable fuels supply.

Yet about 2.7 billion people still depend on traditional biomass for cooking and heating. 1.3 billion have no access to electricity,⁵⁶ and another billion have access only to unreliable electricity networks. Endemic insufficient power deprives the 'energy-poor' of productive activities, income, and essential social services, including education and healthcare. Furthermore, the World Health Organization estimates that approximately 1.5 million people, mainly girls and women, die prematurely every year from the pollution of household air, by inefficient biomass combustion.⁵⁷ Economic and social progress, and the achievement of the Millennium Development Goals, depend on the closure of this fundamental gap. Providing access to modern energy – affordable and clean cooking devices, and a first connection to electricity – to the billions still lacking it, will only have a minor impact on energy and climate security. The IEA estimates⁵⁹ that demand for fossil fuels (mainly LPG and biogas) would grow by 0.8%, and GHG emissions by 0.7%.

The energy system is not constrained by fossil fuel supply. Coal is plentiful. Conventional oil discoveries have picked up since 2000, mainly in the Middle-East, Russia and Caspian region, but consumption continues to exceed this rate of discoveries. Unconventional sources such as oil sands and shale oil would require significant investments for exploitation in sensitive environments. Proven gas reserves can secure at least 60 years of current production. New technologies have tapped into additional gas sources, but the economic extension of unconventional gas production remains uncertain, with its environmental and technical challenges.

The questions around shale gas extraction have focused the attention on its water requirements. But, more generally, except for photovoltaic and wind, all energy sources are water intensive⁶⁰. The



water used at the fuel extraction, washing and transportation stages requires decontamination and retreatment. Steam production and cooling of power plants demands the largest share of fresh water, and resilience to temperature changes and evaporation losses. Some countries already experience production limitations due to seasonal water stress, and competition with other uses for irrigation and human consumption. Water intensity will become an increasing factor in electricity technology choices.

But ahead of fuels and water supply bottlenecks, it is a political response to try to avoid the risks of climate change that will set the limitation of primary energy growth, and the reduction of fossil fuels in the total mix. Taking into account the ecosystem's ability to re-absorb a share of natural and anthropogenic CO₂, only a headspace of 60 ppm between the current level of 390 and the danger threshold of 450 is left to accommodate the emissions of forest destruction, our boilers and kilns, our heaters and ovens and our combustion engines.

Thus the International Energy Agency analyzed numerous technology and policy options, in order to propose a plausible scenario that could both satisfy energy needs and climate mitigation objectives. Its 2010 "Blue Map" scenario presents the case for widespread and rapid deployment of efficiency, transmission, and low-carbon technologies at a near-commercial stage of development. It curbs primary energy growth to 16 Gtoe by 2050. Other organizations propose scenarios with even higher levels of renewable sources and efficiency. This plurality creates a useful competition of options around the mainstream IEA view that fossil fuels may still represent 50% of all energy sources by 2050.

Taking forest emissions apart, total energy related emissions now need to be taken down from the current 30.6 Gtons of CO₂ to 14 Gtons in 2050, according to the Blue Map scenario. The scenario also recommends an emission peak of 32 Gtons around 2020, to reduce the risk of failure through delayed action. Yet, in the recent World Energy Outlook 2011, the IEA concludes that 80% of the CO₂ emissions expected over the next 25 years are already locked-in by the lifetime of the facilities in place and under construction.

Thus is the collective quandary of the on-going climate negotiations. Even if developed and technology-rich countries were to completely satisfy their energy needs completely from non-carbon energy by 2020-2030, all other high-growth emitters would still need to take radical steps to join the ideal 14 Gtons abatement curve. Current pledges made in the follow-up to the Copenhagen Accord do not add up to this goal, even if they demonstrate serious concerns for climate risks, as well as the best political commitments to date. The hope for a top-down, binding global climate regime fell apart in Copenhagen. The Durban Platform of Enhanced Action resets this hope for 2020, this time with support from all major emitters. In the meanwhile, progress on the current pledges will depend on a growing mosaic of bottom-up government, business and citizen initiatives, at many levels.

Apart from binding objectives, it is sources and levers for significant and predictable financing that will spread high efficiency, a switch to cleaner fuels, and renewable sources adapted to local circumstances. A considerable investment is required to achieve efficiency gains, and deploy the technologies to produce, by 2050, 16 Gtoe of primary energy with only 14 Gtons of CO₂ emissions: USD 46 trillion more than the business-as-usual producing 22.1 Gtoe. But this energy decrease translates into net savings of fossil fuels; lower demand also depresses fossil fuels'

market price impacts. At a 10% discount rate over the period, the economy would eventually be better off by a net USD 8 trillion, according to the Blue Map evaluation.

A large part of this additional investment is required in the electricity sector. The Blue Map expects that electricity demand will almost double its output to cope with the opportunities of growing demand; electric mobility, heat pumps and universal access to electricity. At the same time, it recommends a radical change in the mix, to cut its CO₂ intensity by an average factor of 8. This rests on a number of evolving assumptions:

- The economic feasibility of carbon capture from coal and gas plants, and the social acceptability of geological storage; direct reduction of CO₂ into energy carriers such as methanol, and recycling into carbon-based materials, may also emerge as CC-RU (re-use) solutions.
- The economic integration and balancing of growing and variable supplies of solar, wind and ocean sources.
- The risk-adjusted cost of capital of nuclear base load plants following renewed concerns about safety, and the disposal of radioactive wastes.

Most of the technologies needed are already available. From that standpoint, a vision to create a low carbon future is realistic. The key is to anticipate and realize this transformation, in time, at a scale that has never been achieved before, racing against public inertia, conflicting political priorities, and financial bottlenecks. Looking at the rate of progress and political will of the last years, the chances to establish a climate-safe energy regime are slipping away.

A business perspective on policy options

Energy and climate discussion have been core to the WBCSD since its foundation. Over time, it has contributed with thought leadership to the UNFCCC negotiations, as well as with a succession of tools for business, including the Greenhouse Gas Protocol. In the past decade, WBCSD has elaborated principles and pilot schemes for carbon pricing and trading, provided recommendations on enabling frameworks for technology diffusion and R&D, and contributed to the design of international mechanisms, such as the technology and finance mechanisms currently under discussion in the UNFCCC process. It is also stressing the strong linkages to sustainable livelihoods, climate change adaptation, and solutions to water conservation.

The WBCSD members have a natural disposition for practical, bottom-up initiatives, and business models implemented by empowered and skilled employees in direct contact with customers, suppliers and communities. They are acutely aware that the challenge of sustainable development unfolds in a Green Race for innovation in energy and water efficiency, zero-carbon electricity, energy storage, and a host of products and services that will foster green growth at the micro and macro level. As from 2009, several farsighted governments have collectively injected USD 233 billion of fiscal stimulus and incentives, in order to accelerate the development of renewables, carbon capture, energy efficiency, electric vehicles and distribution grids. However, more is urgently needed.

- Clear targets for low-carbon growth, both nationally and internationally.
- Specific national targets, and plans for delivering universal access to clean, reliable and affordable energy.
- Make energy efficiency and zero carbon energy on the demand- and supply-sides financially attractive.
- Strengthen public awareness, engagement and institutions.
- Public support for the development and dissemination of low carbon technologies.

Public policies and financing must be adapted to local conditions, and encourage implementation at community level, in ways that produce the ideal balance of benefits, and do not single out ambitious climate targets at the expense of other social, economic and environmental benefits.

Clear targets

The power sector needs several decades of advanced planning and certainty. Beginning with the shared, stretched objective to maintain the global average temperature increase within the safe limit of 2°C, governments must continue

to set national carbon emission objectives that eventually fit the scientific assessment of the Intergovernmental Panel on Climate Change assessment and recommendations.

They must also agree on a transparent, reliable measurement system. Even if it remains difficult to agree on international binding targets, a set of aspirational targets or pledges associated to financial instruments and regulations will go a long way to sending strong signals toward low-carbon growth to business, consumers and trading partners. They will reduce the risk of irreversible emission lock-in by the next power generation and consumption investments.

Universal energy access

At the country level, the establishment of national priorities and goals for access to modern energy services, supported by specific plans, targets and systematic monitoring are critical for progress on access to energy⁶¹. Successful electrification and biogas production need long-term planning and financial resources for implementation, maintenance and repairs. These plans and resources should be aligned to the proposed UN objective of universal access to energy by 2030.

Business is the primary provider of electricity or biogas production and distribution hardware, clean cooking devices and operation, and maintenance services. It is also a provider of capital. In 2009, it financed 22% of the total \$ 9 billion directed to energy access. But this number falls far short of the \$ 48 billion required annually until 2030, to ensure universal access⁶². A substantial surge of multilateral, bilateral and domestic public finance will encourage private sector financing, as long as these other sources are predictable, and combined with infrastructure development, clear standards and regulations, long-term operating concessions, and consumer payment discipline, to assure a reasonable level of risk and return for business investors.

A large number of energy access projects also have CO₂ reduction benefits. They could therefore qualify for carbon financing mechanisms, if governments would simplify the process, and create the necessary investor confidence.

Financing low-carbon and efficiency

Financing is crucial to achieve low-carbon green growth. It needs to be deployed at several levels.

The Green Climate Fund to assist developing countries for mitigation and adaptation must be firmly established and funded, to underpin trust that developed countries can be counted upon to help countries in need, to implement low carbon and efficient energy technologies, to ensure their development objectives.

Financial instruments for risk-sharing and insurance can encourage energy investors to move into regions where the local regulatory and institutional capacity is still too uncertain for a strict business rationale, despite the clear needs of the local population and industry.

Establishing a carbon price is one of the most powerful mechanisms available to reduce national greenhouse gas emissions⁶³. It creates a change in the economy by integrating a proxy value for the collateral and differed damages caused by carbon emissions, not accounted for by the economic calculus. It can be set in many proven ways – white emission certificates, a carbon tax, a carbon cap with a non-compliance fine, a base-line with a compliance credit⁶⁴. In any case, it stimulates all concerned carbon users and emitters to seek ways to avoid emissions, at a lower cost and capital than the regulatory price or credit tag. By creating market rules that allow exchanges of carbon allowances, governments seek to achieve efficiency and avoidance at the lowest possible cost. By linking markets and trades, they allow movement of technologies and funds. Money moves directly between emitters via authorized traders. It is therefore vital to continue to set up trades in carbon allowances beyond the Kyoto Protocol timeframe, and re-design a functional system with low transaction costs, for joint implementation of low-carbon projects, to improve on the cumbersome Clean Development Mechanisms. The more government includes emitters and creates certainty on carbon markets, the more business will focus technology and investments on rapid low carbon growth.

⁶¹ Niez, A (2010). Comparative Study on Rural Electrification Policies in Emerging Economies: Key to Successful Policies. Information Paper, OECD/IEA, Paris.

⁶² IEA (2011) World Energy Outlook

⁶³ WBCSD – Carbon pricing, 2010

⁶⁴ WBCSD (2011) – Carbon Pricing – the Role of a Carbon Price as a Climate Change Policy Instrument

Some industry voices often demand subsidies rather than emission pricing. Subsidies give credit to early action, and reduce the risk of putting up all the up-front capital. At a certain point, however, they turn around into rents that reward inertia and lock-in of problematic practices and technologies. They then become a counter-productive use of public resources. Thus the IEA estimated that, while renewable energy sources deployment was supported to the tune of \$ 66 billion, fossil fuels continued to receive USD 409 billion in 2010,⁶⁵ in the form of various subsidies. An OECD analysis shows that removing the burden of such subsidies would result in a more efficient allocation of resources, with real income gains.⁶⁶

Hence, all forms of fossil fuel subsidies should be rapidly eliminated. Vulnerable households should get special attention to cope with the transition away from fossil fuels. It is high energy efficiency, renewable sources, and low-carbon technologies, that now need financial support and risk insurance guarantees for early action and private investments.

Institutions and engagement

Low carbon energy sources, and efficient technologies, bring their share of questions regarding impact on landscapes, ecosystems, human safety, longevity and decommissioning. There is also debate about their true grid parity competitiveness under various oil, gas and carbon price expectations. Governments must ensure transparent information, and fair public debates, around the options, to create a low-carbon and climate safe economy.

In developing countries, investment and progress will be contingent to stable policies, transparent investment regulation, and favorable local conditions; a functioning education system, a receptive business environment, and targeted capacity building programs. These conditions (and risk-sharing schemes mentioned above) will encourage private sector investments and participation in Public Private Partnerships.

An active engagement of business in national and international energy strategies will increase the likelihood of success in reaching common objectives.

Technology development and dissemination

On one hand, much know-how is already available, but dissemination not only lacks the policy and incentives listed above; in many places it still lacks, an integrated chain of competent suppliers and service companies to offer the available energy efficiency and low carbon solutions. Governments must also take steps to foster training and capacity building in the complete chain of administrative, technical and commercial services that permit, license, supply and maintain renewable energy generation, and high efficiency appliances.

However, the IEA Blue Scenario also recognizes a number of technology gaps – in carbon capture, grid and variability management, and demand-side efficiency – that are too challenging for one company alone. There is a pressing need for “pre-competitive” technology R&D that governments should be funding, at least in part.

⁶⁵ IEA (2011) World Energy Outlook

⁶⁶ OECD – Towards Green Growth – (OECD 2011)

Buildings

The 2050 Vision

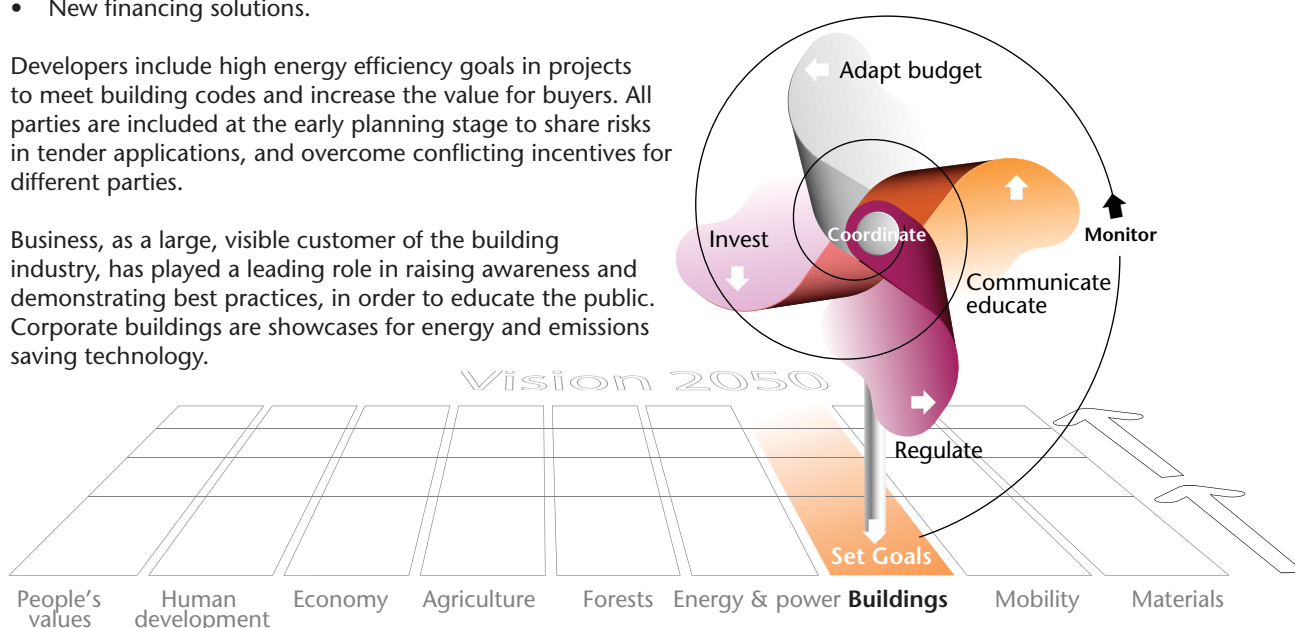
New buildings are zero net energy, and existing ones are retrofitted towards the same goal. Many new jobs have been generated, and the building sector has become more knowledge intense. This has been achieved through:

- Integrated building design.
- Affordable, high-performing materials and equipment.
- Stringent, enforced energy codes for new and existing buildings.
- Energy performance labels on all buildings.
- Energy metering and controls, and information flow between utilities and appliances.
- New financing solutions.

Developers include high energy efficiency goals in projects to meet building codes and increase the value for buyers. All parties are included at the early planning stage to share risks in tender applications, and overcome conflicting incentives for different parties.

Business, as a large, visible customer of the building industry, has played a leading role in raising awareness and demonstrating best practices, in order to educate the public. Corporate buildings are showcases for energy and emissions saving technology.

New buildings are zero net energy, and existing ones are retrofitted towards the same goal. Many new jobs have been generated, and the building sector has become more knowledge intense.



Set goals

- Make zero net energy a must for all new constructions, and a goal for modernization of the existing building stock.

Communicate & Educate

- Support employment, training and licensing of energy services professionals, able to integrate all energy efficiency techniques.
- Develop an energy-aware culture that motivates people to innovate and adopt energy efficiency in all activities in and around buildings.

Regulate

- Adopt codes and standards for energy and water efficiency, including compliance verification.
- Tighten codes to zero-net energy for new buildings.
- Set urban planning rules that optimize energy and mobility efficiency.

Adapt budget

- Provide credit facilities and support special funds for efficiency packages and building retrofits.
- Provide incentives for on-site renewable energy systems to achieve grid-parity with non-renewable sources.
- Price public energy and water supplies at least to marginal reinvestment costs to promote efficiency (but also protect access of energy-poor households).

Invest

- Move new technologies and retrofits rapidly to public buildings.
- Support research on advanced retrofitting schemes, on-site renewable and energy storage.
- Support city- and nation-wide scale up of smart metering.

Monitor

- Impose energy (and water) metering at the responsible tenant level.

Coordinate

- Adopt a roadmap for transformation that integrates the convergence of all policy and financial measures with the capabilities of the private sector.



Buildings

Current context

If it were only about technology deployment, Vision 2050 would be relatively easy to achieve. We know how to build very low energy buildings, equipped with energy and water efficient appliances, and supplied with roof- and façade-mounted electricity and heat generators⁶⁷. However, such buildings are still merely one-off, iconic examples. Yet their deployment into the new construction market is urgent. Buildings require about 40% of most countries primary energy.

Population and urbanization trends in all populous economies will continue to stimulate energy demand, and push CO₂ emissions well above recommended safe levels. On a Business-As-Usual, the International Energy Agency estimates that energy demand in the building sector would grow 1.3% per year (electricity at twice this rate), and exceed 2005 demand by 80%, in 2050⁶⁸. Most of the growth will occur in urban residential and tertiary buildings, as towns and megacities will concentrate 70% of the world population by 2050. This concentration at least offers an “urban advantage” in attacking the challenging transformation to fit all new buildings with the technological possibilities, and penetrate the existing building

stock with an extensive renovation program. There is, however, no time to waste. The design of buildings is cast in features of concrete and hard material for about 80 years. Retrofits are difficult and disruptive, even with short payback periods.

Going towards net zero energy for buildings deals with the following equation:

**Total energy use = population x space per capita
x energy per space unit x users' economy**

Population growth is a given for the next 2 generations. So is space per capita, because of the trends to more comfort, dispersed families, with fewer people per household, and emerging economies' households catching up on richer countries' space requirements. The burden of progress in energy efficiency falls on the shoulders of builders and investors for their efficiency design standards, and on the users, for fully living up to the available efficiency (the user's economy) possibilities.

This is also true for water usage, sewage and solid waste streams. Initial design is all- important. Retrofitting of existing “end-of-pipe” water features is, however, easier than building structures, their materials and components; most water appliances have a short retirement period that can be accelerated through appropriate incentives. Heating, cooling, pressurizing and moving water always needs energy. Energy and water efficiency go hand in hand with a positive feedback. In the end, it is also up to users to make the most of the technical efficiency features. This is even more important for domestic, office and hospital wastes, that mainly depend on people's attitudes and processes. Typically, 80% of a building's impact on energy, water and wastes arises during the many years of its occupation.

Architects and building engineers now already have a wide spectrum of strategies to achieve radical reductions in a building's energy demand.

⁶⁷ Examples are featured by leading business and architecture organizations: Holcim Foundation for Sustainable Construction; Skanska; US Energy Star; Swiss Minergie; German Passivhaus

⁶⁸ OECD/IEA – Energy Technology Perspectives 2008, Scenarios and Strategies to 2050



- The envelope design and insulation, its windows and openings, are central for a natural balance of solar heat and daylight, and a practical minimization of forced heating or cooling, depending on the site's climate conditions.
- Continuous progress is being made on efficient lighting, water heating, ventilation, and other domestic appliances.
- They can be tied together and managed with all the other components, using or releasing energy to reach the lowest overall external demand.
- Part, all, or even a surplus, can be generated by solar thermal and photovoltaic panels, integrated in the building's roof and façades.
- The urban density advantage opens more possibilities in positive integration of land-use, transport, and the recycling of energy, water and waste flows within intelligent grids. It also allows the economies of scale of collective facilities.
- Demolition of energy-wasting constructions provides space for state-of-the art replacement, rather than costly and insufficient renovation.

Progress is pushed on all fronts by the innovative fringe of the appliances, materials and building sectors. Their potential market is estimated in the range of US\$ 0.9 to 1.3 trillion dollars per year, at maturity⁶⁹.

Why then is it not happening faster?

The building sector is known for its rigid, protective norms, its fragmentation into millions of small companies, and low-skilled, sometimes informal, work forces. In this risk-adverse sector, most novel designs remain stuck on the drawing board. Even the large global firms spend little on research and development. But this general truth is not helpful. Therefore, in a 2007 study, the WBCSD clarified the real barriers and the essential points of leverage for change⁷⁰. The study confirms the functional gaps between the technical disciplines involved in a project, as well as in the management discontinuities of the delivery process. This results in many operational islands. They are believed to reduce costs through internal competition but, in reality, hinder useful feedback, from final users to designers. They also create a series of split incentives between those who could make the investments for efficiency, and those who would benefit during the life-time of the building, from the reduced consumption of energy or water. This is exacerbated by the shift in the market from owner-occupiers, who could make the comprehensive efficiency trade-off calculations to more real estate developers and investors, who yield to the pressure for high returns and short payback time.

Well-designed energy efficiency features require around 5% higher construction costs. However, the WBCSD study found that the various actors of the building value chain overestimate the costs of solutions by a factor of 3, and underestimate the energy and climate impact of buildings by a factor of 2. This false reality discourages efficiency investments and fixing the incentives gap. This also prevents occupiers from undertaking or requesting an efficiency retrofit of their apartment or office. Moreover, they do not have the full information on their energy consumption and costs, either because of a lack of detailed metering, or the all-inclusive form of the rental contract. Leaving lights and appliances on throughout the space and day, heating or cooling a few degrees too much, are widespread habits often encouraged by the very efficiency of the features in a perverse "rebound" effect.

Thus, despite the technical feasibility of zero energy and resource efficient buildings, the financial pressures on builders and real-estate investors, their awareness and habits, as well as those of the whole chain of actors up to the building's occupants, remain major barriers to green growth in this important sector.

⁶⁹ WBCSD – Energy Efficiency in Buildings ; Transforming the Market, August 2009

⁷⁰ WBCSD – Energy Efficiency in Buildings ; Business Realities and Opportunities, October 2007

A business perspective on policy options

Determined to unlock this potential for transformation, the WBCSD has conducted 4 years of extensive research⁷¹ to define the mix of measures that would enable coordinated and intensive action by individuals, business and governments. The study focused on six geographies – Brazil, China, Europe, India, Japan and the USA – and their four prevailing building types – residential single-family and multi-family homes, commercial offices, and retail buildings. It therefore covers two thirds of the world's energy used in buildings. A model and data bases, created with leading universities⁷², can simulate and forecast the evolution at 5 year intervals up until 2050, of financial costs, CO₂ emissions and energy requirements that result from a range of decisions affecting construction and retrofitting designs, public policy choices, market conditions and user behaviors. It can therefore clarify the best set of concerted actions. This unique model and its database are available⁷³.

The analysis conducted in this way confirms the possibility of many energy efficiency projects at energy prices based on US\$60 per barrel of oil: investments of US\$ 150 billion annually would cut the carbon footprint of buildings by 40%, with a 5 year discounted payback to the owners. A further US\$ 150 billion per year cuts another 12 % of carbon emissions, with discounted paybacks between 5 and 10 years. An additional carbon cost of US\$ 40/ton of CO₂ brings the total abatement from 52% to 55%. This is still short of the International Energy Agency Blue Map scenario of a 77% reduction from Business-As-Usual.

Yet none of this will even start to happen spontaneously in the face of the knowledge, behavior and economic barriers that restrain change in the building sector. The WBCSD study therefore concludes that transformation must be enabled by a set of government- enforced building codes and related incentives mechanisms, established in collaboration with the concerned business sectors. Their net costs may amount to 7% of total building costs worldwide, but should also be seen as the cost of correcting the harmful market failures that allow buildings to pollute and push climate risks beyond irreversibility.

Strengthen codes and labeling for increased transparency

Climate adjusted energy-efficiency requirements must be included in building codes, and be tightened periodically to zero net energy for new constructions. The same must apply to appliances, with due consideration of their global trade.

The adoption of codes and standards must be enforced and verified. Safety, health and fire audits are performed in most countries, and could be combined or alternated with energy and water efficiency audits. This also means that meaningful metering must be extended to responsible tenants in houses, offices and shops. Audit results and performance must be disclosed in public registries, in order to encourage efficiency behavior, and provide feedback and support for corrective actions. Energy efficiency labels should be applied to all buildings, to clarify compliance as well as future costs to prospective owners.

Legal barriers that hamper energy retrofits should be identified and removed.

Deploy incentives for energy-efficiency investments

Provide fast-track permits for projects that meet or exceed efficiency codes. Secure credit facilities and special funds to bridge the payback delays for first cost comprehensive efficiency packages with best available technologies. Set incentives and minimum efficiency targets for insurance and pension funds real estate investments portfolio. Support retrofitting with property tax and other benefits tied to proof of performance.

Associate the electricity and gas utilities to demand-side management incentives for retrofitting. Provide subsidies or feed-in tariffs for on-site renewables that provide reasonable paybacks to reach near parity for grid gas and electricity costs.

Encourage integrated design approaches and innovations

Influence urban planning for maximum integration, for mixed residential, office and commercial settings, and for optimal building density.

⁷¹ WBCSD – Energy Efficiency in Buildings ; Transforming the Market, August 2009

⁷² Birla Institute of Technology, India; Carnegie Mellon, USA; Lund, Europe; Tsinghua, China; UFSC, Brazil

⁷³ www.wbcd.org/web/eeb.htm

Move rapidly to integrated designs and zero net energy for all government projects, and retrofit the most inefficient government facilities.
Enforce predictable price signals for energy costs, not on the basis of average existing generation fleets, but on full reinvestment costs of next capacity installments.

Develop and use advanced technologies to enable energy-saving behaviors

Retrofitting and zero net energy packages with faster payback require public research and development funding.
There is also an urgent need to empower users with smart metering and load factor controls, and ensure their deployment to a majority of the population.

Develop workforce capacity for energy saving

Support training and credible licensing schemes for energy services professionals. The capacity to understand in a variety of standards, and integrate and maintain appropriate technologies in a cost efficient system, adapted to a specific situation, is still the missing link in the building and energy supply sectors, and even more so, in the large potential market for retrofitting.

Mobilize for an energy-aware culture

National energy security, environmental quality, and long-term competitive strength and employment are at stake in the transformation of every household, office and shop into near net zero energy consumers. This objective deserves a sustained public awareness and motivation campaign.

These six headline government policy measures are documented in more details in the Roadmap for Transformation that addresses converging actions, in the near- medium- and long-term, by all agents of the complex construction process: investors, developers, architects, engineers and contractors, materials and appliances suppliers, utilities and occupiers. The WBCSD members do not wait, sitting on the sidelines, for others to start acting. Already 100 have signed up to a Manifesto for Energy Efficiency in Buildings to undertake for their own, rented or managed building stock, the following actions:

- 1 Create a baseline for energy and CO₂, and set transformative change targets.
- 2 Publish the company's policy for minimum energy performance levels.
- 3 Define and deploy the company's strategy and audit program to meet and verify the targets.
- 4 Publish performance and progress annually in the company's CSR or other reports.
- 5 Promote building energy efficiency in the company's zone of influence, through advocacy, marketing, research and development, education and training.

⁷⁴ WBCSD ; Roadmap for Transformation of Energy Use in Buildings, August 2009

Mobility

The 2050 Vision

Access to mobility is available to all, increasing social and economic activities. Transport volume more than doubles in passenger and ton-kilometers, but the number of transport deaths approaches zero, and negative environmental impacts are substantially reduced – CO₂ emissions by some 60 - 70% , NO_x - and particulate emissions, are almost eliminated. This is achieved through:

- A shift to intelligent transportation systems that enhance efficiency, safety, speed, reliability, comfort, access by the elderly, children and disabled persons, and enhance the availability of inter-modality of public and private transport.
- Promotion of the smart use of vehicles, traffic flow management and eco-driving.
- Advanced technologies, such as electric vehicles and highly fuel-efficient aircrafts based on light materials, superior aerodynamics and engine efficiency.
- The reduction Well to Wheel Green House gases intensity of light-duty vehicles by 80% through downsizing, lighter weight, more efficient drive-trains, and low-carbon fuels.
- A decrease of carbon intensity of at least 50% in other modes – road freight, aviation and shipping.
- Alternative fuels such as sustainable biofuels, hydrogen and electricity from low-carbon sources.

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Policies speed up research, development and deployment of these technologies. Holistic mobility management involving decision-makers, planners and industries, improves the transportation infrastructure. It enables people to satisfy their desire for eco-efficiency and freedom of mobility, by letting them choose among a hierarchy of integrated transport modes, from efficient, high- capacity public travel, to local road traffic and soft modes, such as biking and walking



Set goals	• Set a combination of vehicle performance standards and modal mix objectives that are coherent with improved road safety, congestion, noise, and an absolute global CO₂ emission reduction of 70%.
Communicate & Educate	• Organize continuous public awareness campaigns and educational programs that link individual mobility behavior to its safety and environmental impacts, and opportunities for improvements. • Provide real-time information to incite better driver choices.
Regulate	• Favor public transportation via urban planning and zoning, parking, road access rules and attractive tariffs. • Push for trans-frontier common rail standards, & interoperability of freight movements. • Set vehicle and fleet emission standards for all modes of transport. • Reinforce speed limits, vehicle safety and personal protection standards.
Adapt budget	• Introduce pollution fees, and tax the use of public mobility space, to finance alternative mobility systems. • Promote the adoption of alternative fuels and fuel-efficient vehicles through a balance of tax incentives and levies.
Invest	• Contribute to integrated urban planning and the infrastructures of public transportation, roads, ITS, zero-emission vehicles pools, and rapid-battery charging and hydrogen refueling stations. • Support the transformation of the local vehicle industry, to develop and adopt a generation of low to zero-carbon engines. • Provide risk-sharing instruments to leverage private investments toward mobility infrastructures and high efficiency fleets.
Monitor	• Foster reliable emission and pollution measurements at the local and aggregate level, to create transparency about progress. • Provide visible indicators of progress at the city and region level
Coordinate	• Plan and manage all mobility flows at city and regional level • Facilitate sharing of practices and development resources.



Mobility

of transport mode would cause between 16 and 18 Gtons of CO₂ emissions, against a total 2050 Blue Map safe mitigation target of 14 Gtons for all energy related emissions.

Current context

Mobility is a key factor for economic growth and improving living standards. On current trends, passenger travel and freight transport will continue to grow, as they are essential to creating an affluent society, by the free movement of goods and services, as well as access to work, education and leisure.

Growth in OECD countries will be moderate, as vehicle ownership is reaching a saturation of the mature population. Population aging may even cause a serious “mobility divide” in a couple of decades. Public transportation and city policies reduce traffic and congestion. On the other hand, growth will continue in India, China, and other high growth economies, particularly as local production is expected to turn out affordable vehicles. By 2050, the total stock of light duty passenger vehicles could triple, and reach 2.2 to 2.7 billion⁷⁶.

Thus, the International Energy Agency projects more than a doubling of the baseline energy requirement for the mix of all transport modes. It estimates that it would be difficult to supply the volume of liquid fuels required by this forecast⁷⁷. It also warn about the danger for climate stability to allow the corresponding CO₂ emissions: on a “well to wheel” basis, the total fleet

Pushing our transportation modes below the desired maximum CO₂ allowance of 5 Gtons, a 70% reduction from the business-as-usual trend, will be difficult. Electrified rail can feed its energy, on the go, from a remote source that can evolve to zero or low carbon electricity. All other modes need to embark a stock of energy sufficient to cover the range between reloading points. In this critical aspect, nothing beats diesel, gasoline and kerosene for energy density per volume. They are also easy to distribute, meter and store on board. Those simple advantages have prevailed, even though they need complex mechanical engines to convert them into CO₂, waste heat, and, in the end, only about 25% is available for motion power.

Fuel efficiency has already gone a long way. There will still be progress in tires, body light-weighting and streamlining, and power train efficiency, that should amount to a combined 25% lower energy needs from the baseline. Higher CO₂ efficiency power trains can come with technologies such as hybrid or pure biofuels and compressed bio-synthetic gas, as long as they can prove a low net carbon balance, a sustainable life-cycle impact, and be farmed in ways that conserve soil fertility, and preserve food security.

2011-2012 is the stage of renaissance of the rechargeable battery-electric motor power train for medium range light weight vehicles and longer range plug-in hybrids. The mechanical simplicity and conversion efficiency of the electric power train is still held back by the very low energy density of its storage (100 + times lower than diesel). But it fully benefits from the evolving carbon footprint of the grid or even, as already proposed by some vendors, from a rooftop photovoltaic or wind generator. At the beginning of the learning and production curve, acquisition costs

⁷⁶ IEA, Energy Technology Perspectives 2010 – chapter Transport, 2011, International Energy Agency, Paris

⁷⁷ IEA, Energy Technology Perspectives 2010 – chapter Transport, 2011, International Energy Agency, Paris



will be significantly higher, and the lower mileage and maintenance costs will not be sufficient to attract a large market, without additional cash or fiscal incentives. Electricity produced by on-board hydrogen⁷⁸ fuel cells are another development route for zero CO₂ vehicles that are likely to be more adapted for large commercial vehicles.

While there is creative competition of low carbon mobility solutions, the IEA scenario also counts on an important switch from individual mobility to public transportation, car sharing and rail, from business air travel to videoconferencing, and from road freight to rail. In addition, mobility management that fosters collaboration between transit operators with user-friendly services and ticketing-travel cards, enable commuters to make better mobility choices. For instance Japan has successfully managed to maintain CO₂ emissions below their 2002 level. On the strength of this experience, the Japanese Automobile Manufacturers' Association estimates that such measures could ensure that CO₂ emissions peak in 2025, and decrease thereafter. Still, the IEA scenario expects the 2050 vehicle stock to stabilize around 1.8 billion. This avoids 2 Gtons of CO₂ from the baseline, another 5 Gtons reduction comes from vehicle efficiency improvements and electric vehicles, and 4 Gtons from alternative fuels. But it remains 2 Gtons short of the most desirable goal.

Business as usual would soon run into fuel supply bottlenecks, and exacerbate prices. Transport cannot continue to claim 40% of oil resources. The low carbon scenario imposes a 10% investment cost on the fleet improvement, but saves significantly on fuels. Therefore, by 2050 there is no net cost, and the improved vehicle stock keeps saving fuels and avoiding carbon. There are also collateral benefits in lower road pollution that affects health and ecosystems sensitive to particles, NO_x and SO_x.

Road safety cannot be overlooked. Nearly 1.3 million people die each year, and another 20 to 50 million are injured as a result of a road traffic collision. 90% of road accidents occur in low to middle-income countries. The UN launched 2011-2020 as the Decade of Action on Road Safety.⁷⁹ It calls, in particular, for speed calming measures, enforcement of personal and vehicle safety features, education on safe driving, better road design and availability of affordable public transportation. Road safety requires a comprehensive, three-pronged approach to drivers' behaviors, enhanced vehicle safety designs, and maintenance of the traffic environment.

Sustainable mobility is also about a modal mix with enhanced benefits of comfort, swift access and movement. In this mix, public transport becomes more important but it must be convenient, clean, reliable and affordable. Otherwise empty trains, trams and buses end up with higher CO₂ emissions per passenger-km, and unrecovered infrastructure and operating costs.

A 2050 world will clearly have more cars and intercity traffic. But it may also have a quieter, safer, more efficient city mobility system, that leaves space for nature and culture where people live and work.

A business perspective on policy options

The WBCSD is committed to play a role in reducing the negative impacts of mobility, while ensuring that all people have its benefits, such as safe access to jobs, education, family, services and leisure.

⁷⁸ Hydrogen's energy density advantage is more than lost as a result of its difficulty to deliver and store on-board

⁷⁹ International Road Federation – Global Plan for the UN Decade of Action for Road Safety – www.irfnet.ch

Improving or creating a safe, functioning and sustainable mobility system needs public authorities to take the lead in:

- Creating a shared, long-term vision and technology roadmaps.
- A transit oriented development and integrated mobility planning.
- Pricing the use of public space.
- Providing users with real-time information.
- Setting vehicle performance standards and information.
- Providing time limited incentives for fuel and mode switching.
- Make high-carbon fuels more expensive.
- Enforce road safety practices.
- Develop a sustainable mobility rating system.

The following 3 “I’s” will aid approaches to sustainable mobility:

- Innovation in vehicle technology, energy, information and infrastructure.
- Integration across sectors, addressing multiple problems from production to end-use.
- Improvement, removing systematically all negatives, enhancing positives.

Creating a shared long-term vision and technology roadmaps

The development and launch of innovative technology involves risk. Vehicle technology and infrastructures are interdependent. The private and public sectors must share a long term vision and balance multiple priorities such as climate risk, energy efficiency, safety, air quality, congestion and affordability. They must also efficiently coordinate their planning and investments in order to minimize their respective risks.

Transit oriented development and integrated mobility planning

The integration of different transport modes, and the connection of city suburbs to all services and administrations by frequent, clean and safe transit services are crucial, to move people away from private vehicles, and provide opportunities to those who cannot afford to own a vehicle. Travel cards and tariff structures must include low-income and elderly citizens.

Efficient transit systems increase the attractiveness of cities, and also bring real-estate value. Public lanes are still limited in most cities, and choices must be made to create and allocate multi-functional city space for the most efficient mobility system that serves the majority of citizens, including those walking and cycling.

A **single transit agency** should stimulate the design of efficient interconnections, enabled by intelligent mobility management systems, and should oversee the coordination of all mobility investments to those ends. Each city has its specific historical background, socio-economic profile and mix of challenges. There is no single best solution, but a diversity of approaches.

Local governments and cities must play central roles in ensuring that integrated mobility plans combine various undertakings and share best practices and innovations that are adapted to the local circumstances. Consistency with the long-term vision and technology roadmaps is best ensured through regular milestones for progress. This also avoids duplication of efforts, rework and delays.

Integrated mobility plans will mobilize the cooperation of all stakeholders involved in transportation such as vehicle manufacturers, energy suppliers, infrastructures developers, users, city planners, and local authorities, to work in harmony for time and cost efficiency. They must also develop in synergy with urban infrastructure planning.

In cooperation with the transportation industry, local governments and cities could build a collection of case studies to illustrate best practices, and share experiences in mobility planning.

Regional and country wide integration of road and rail freight, rail and air passenger traffic, is still critical to reducing environmental impacts, and ever-increasing parking space. Cross-border interoperability of railways must be accelerated through coherent standards, regulations, permitting procedures and infrastructure modernization, in order to increase the efficiency of trans-frontier traffic.

The backbone infrastructure for better mobility systems will require large investments. Innovative financing models and public-private partnerships need to be associated with the large investments and operating costs required by the

backbone infrastructure for those improved mobility systems.

Price the use of public mobility space

Good information about mobility choices should be combined with parking, traffic, pollution and congestion fees that enable the financing of continuous improvements and accessibility of public transport services. In cities that have introduced road fees, commerce and business continues to flourish, while citizens have less noise and pollution, and more playgrounds and green space.

Providing users with real-time information

Real-time information about fuel performance, traffic flows and parking availability influences drivers' awareness and behaviors to be safer and fuel-efficient. On board displays combined with positioning systems could be enhanced and supplied by public or private information services. This also could help the selection of optimum mobility modes – car-sharing, public transport – based on personalized criteria.

Set vehicle performance standards

Light duty vehicles are not bought on the basis of their environmental performance, except by a fringe of the market. Cars are lifestyle products, purchased as much to fulfill dreams as to serve as a functioning utility. Progress toward fuel efficiency is behind the innovative capacity of car and truck makers. Moving to the next 25% efficiency potential will not be spontaneous. Governments must make this "Green Race" attractive, and set standards that can be periodically stretched towards more demanding fuel performance. Such standards can foster integrated responses from vehicle body and engine design, to alternative fuels, traffic flow controls and computer assisted driving.

Provide incentives to switch to low carbon mobility.

The most radical zero carbon mobility solutions, such as electrical or plug-in hybrids, are already available. They will initially carry a discouraging price gap. Like other environmental solutions in their market infancy, they need support from fiscal deductions or vehicle switching bonuses. Those incentives can be phased out, as increased competition narrows the price gap.

Real-time information in vehicle displays of instant fuel consumption and traffic flows and parking availability helps drivers to save fuel and time.

Green purchasing to convert the fleets of public services sets important signals of confidence in new technologies, and pushes volumes forward on the decreasing cost curve.

Range between charges is also a deterrent for early adoption. An infrastructure for efficient repowering and vehicle sharing will add momentum to market acceptance. Digital broadband infrastructures replace the need for mobility to execute reliable and speedy administrative transactions, communication, and other functions.

Adequate agro-forestry practices can secure the need for food and liquid bio-fuels from waste biomass to replace crude oil distillates in markets that cannot afford electrical mobility, and for aviation, in particular. A combination of R&D, farmers' education, and infrastructures from farms to processing and markets, requires government support in the form of funding, standard setting, and green purchasing.

Price high carbon out of the market

Even when new fuels and efficiency improvements are launched, there is a lock-in advantage for existing car fleets and, particularly, for depreciated commercial trucks, ships, and planes. Shipping and airline fuels also benefit from tax exemptions, in many countries. Governments must set calendars that accelerate fuel switching, power trains overhaul, or final retirement of equipment, with a combination of incentives for replacement, and surcharges of obsolete fuels.

This is not just for cars, but also to realize the energy efficiency improvement potential for trucks, planes, trains and ships. The whole economy, and its energy security, will benefit, because on current trends, the thirst for fuel will run into bottlenecks and scarcity prices.

Enforce road safety practices

The WBCSD members have recognized that their drive to zero employee fatalities and severe injuries must confront the issue of road safety in commuting between

home and work, traveling on business assignments and in the transportation of their supplies and products. They have therefore gained experience and results from enforcing the use of personal and vehicle safety equipment, good vehicle maintenance, and continuous training for reinforcing defensive driving behavior.

Such policies must also be adopted by governments. In addition, they need to ensure that road designs include safety and speed calming features. They must set and enforce speed limits appropriate to their roads and urban environments. People must have a choice of affordable, safe public transport or protected lanes for cycling and walking.

Develop a mobility rating system

Each mobility system has positive and negative impacts. Life cycle analysis can inform a large part of the performance profile. It could be completed by economic, time efficiency, comfort and other important dimensions. Such indices and rating schemes could guide local governments and cities in shaping their sustainable mobility plan. It could spark emulation between cities, and a desirable competition for sustainable mobility between automobiles and public transportation systems.

The transportation sector drives a large fraction of economic wealth. It also carries a large environmental and health footprint that cannot be sustained. To become a real driver of green growth, it needs to go through a challenging transformation, at a speed it has not experienced before. A few leaders are ready and willing, but are unable to accelerate too far alone. It is up to governments to create the rules and incentives that will provide an opportunity for all, except those unwilling to change.

Materials

The 2050 Vision

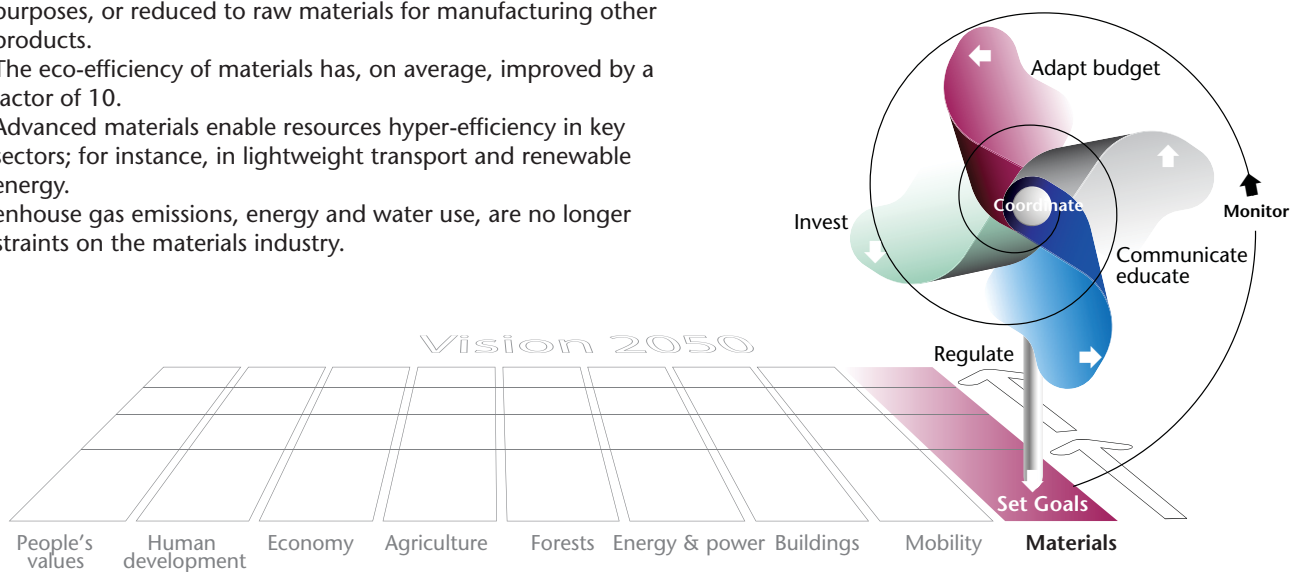
Material demand, consumption and production have been transformed to match the limits of non-renewable resources.

- Closed-loop recycling, making the concept of waste obsolete, is normal business practice, and societies have a circular approach to resources.
- Used products and materials, including wood, can be reengineered to function again for multiple and distinct purposes, or reduced to raw materials for manufacturing other products.
- The eco-efficiency of materials has, on average, improved by a factor of 10.
- Advanced materials enable resources hyper-efficiency in key sectors; for instance, in lightweight transport and renewable energy.

Greenhouse gas emissions, energy and water use, are no longer constraints on the materials industry.

Material demand, consumption and production have been transformed to match the limits of non-renewable resources.

Greenhouse gas emissions, energy and water use are no longer constraints on the materials industry.



Set goals

- Declare a convergence of all nations toward a maximum 2 global hectares of regenerative bio-capacity per capita to match human development and the limits of non-renewable resources.

Communicate & Educate

- Intensify general education, and the understanding of material flows and consumption impacts on the biosphere.
- Create a desire and culture for green growth, and the awareness of individual contribution and benefit possibilities.

Regulate

- Generalize science-based, harmonized, life-cycle impact data declaration, in the form of simple consumer labels at the point of sale, and more detailed access on request or internet.
- Establish landfill phase-out schedules.
- Set and tighten recycling levels and content standards for all non-renewable resources.

Adapt budget

- Introduce predictable, progressive price signals toward the true value of primary materials (through taxation, extraction permits, subsidy elimination, etc.), to preempt the impacts of future shortages and irreversible ecosystem degradation.
- Ensure competitiveness of recycling through temporary transfers of subsidies.

Invest

- Support research and innovation in circular material flows.
- Participate in public-private partnerships for collecting, sorting, moving and refining non-renewable materials.

Monitor

- Improve depth, coverage and reliability of material flows data.

Coordinate

- Advanced signals and incentives, progressive implementation and tightening must overcome the traditional resistance to intervention in the free extraction and disposal of non-renewable resources.



Materials

As UNEP's appointed International Resource Panel points out in its 2011 report, the⁸¹ measurement of total material flows is still a field under development. Only those materials in formal trade and markets channels are well measured through national and international Material Flow Accounts. Water is mostly overlooked in the statistics.

Our ability to systematically manage these huge material flows is still hindered by delayed and incomplete knowledge. In particular, we only track part of the total picture: extraction, harvesting, transport, transformation and waste disposal provoke "shadow" displacements of materials, biomass and water. Mining overburden, sludge, soil erosion, ashes, etc. are not counted in the economy (except for the energy to handle them), but they cause their share of environmental impacts and land loss. To identify the magnitude of this shadow portion, the Wuppertal Institute in Germany has researched the material efficiency of major traded commodities⁸². Some typical examples:

Current context

In 2009, the total quantity of materials extracted is estimated at 68 billion tons⁸⁰, of which 19 billion traded internationally. This measure includes all materials extracted for use in the economy: fossil fuels, ores and minerals, construction minerals, and biomass from agriculture, forestry and fisheries. The total is up to about 50 billion tons in year 2000, from 42 billion tons in 1990. On current trends, material flows continue to grow fast.

⁸⁰ Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.H., Haberl, H., Fischer-Kowalski, M. Growth in global materials use, GDP and population during the 20th century, Ecological Economics 2009

Also see <http://www.uni-klu.ac.at/socsec/inhalt/3133.htm> for several studies on material flows.

⁸¹ UNEP (2011) Decoupling natural resources and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel

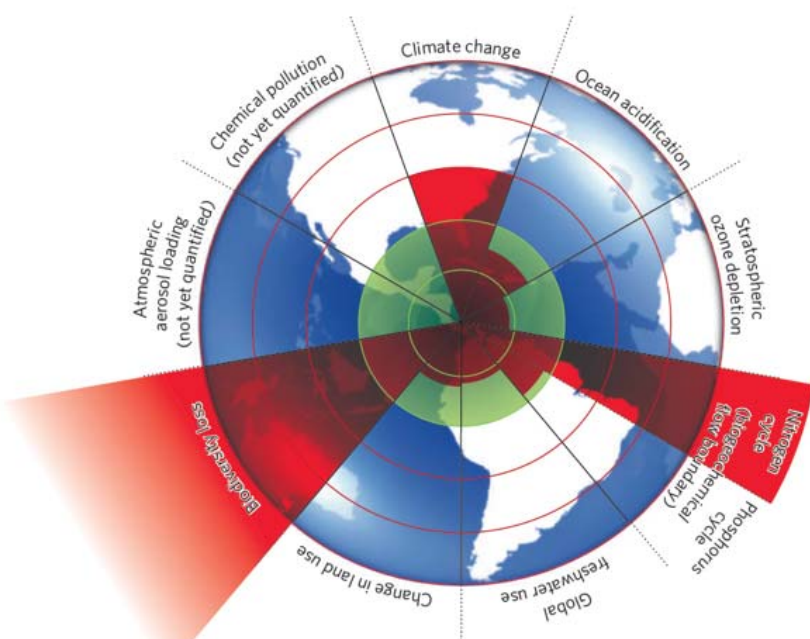
⁸² Wuppertal Institute for Climate, Environment and Energy (July 2011) MIT tables

⁸³ Johan Rockström and al. Planetary Boundaries: Exploring the Safe Operating Space for Humanity – Stockholm Resilience Centre

For 1 kg of Associated materials efficiency in kg

	Abiotic material	Water	Air	Biotic material	Erosion loss	soil moved
Primary aluminium	37.00	1 048	11			
Recycled aluminium	0.85	31	1.0			
Steel plate, blast furnace	8.05	56	0.4			
Bricks	2.11	6	±0			
Portland Cement	3.22	17	0.2			
Float glass	2.95	12	0.7			
Crude oil	1.22	4	±0			
Coal mix	2.11	9	0.5			
Natural gas	1.22	<1	0			
1 kWh electricity – OECD	1.55	67	0.5			
Polyethylene foil	3.01	168	1.8			
PVC bulk	3.47	305	1.7			
Calcium Ammonium Nitrate fertilizer	5.48	39	2.2			
Cotton	8.60	6 814	2.7	3	5	
Paper unbleached	8.94	268	1.3	2		
Paper recycled for newsprint	0.24	15	±0	0		
Timber – Douglas fir wood	0.63	9	0.2	4.37		
Beef	6.53	370	1.7	27	9.6	2 677
Chicken	8.99	344	2.3	6.7	6.6	3 832
Bread	1.30	99	0.2	1.1	0.3	304
sugar	3.10	24	0.8	1.6	0.4	336

This sample of major commodities supports the view that human activity mobilizes at least twice the quantity of materials recognized in Material Flow Accounting, and many times more water. Where available, the numbers show the advantage of



These man-made material flows have reached or exceeded the scale of natural Earth-system processes. Research at the Stockholm Resilience Centre identifies 9 critical processes with boundary conditions that should not be exceeded permanently. The 9 processes are interlinked. The conversion of minerals, fossil fuels and atmospheric nitrogen into reactive forms that are widely dispersed on land, in water bodies and the atmosphere drive all systems closer and beyond safe boundaries. The risk of abrupt, irreversible change (tipping point) with catastrophic impacts on ecosystems and human societies cannot be excluded beyond these boundaries.

Azote Images/Stockholm Resilience Centre

Water occupies a special place in the flow of materials. It is the element of all aquatic life, a key constituent of drinks and food, and the solvent and dispersant of most living and industrial processes. It is the transport medium for waste streams, and closed water cycles enable material recycling. Water is a major energy carrier, and the coolant of choice in energy transformation. It delivers economic, environmental and social benefits, all at the same time. While the total quantity of water is about constant on the planet, fresh water is not universally available, and it is nearly impossible to substitute. In the past 50 years, fresh water withdrawals have trebled, mainly due to irrigated agriculture, whilst its pollution is increasing. Some parts of the world have already reached a point where local freshwater availability does not keep up with demand – frequently leading to food shortages, competition and conflict.

Energy, water and food security are so closely linked that efficiency measures must be taken simultaneously on all three fronts, to ensure sufficient freshwater availability for the whole 2050 world population. This will drive the recovery of energy and materials from effluents and closed loop practices in cooling, aquaculture, plantations, and possibly the recharging of aquifers.

In 2009 the “metabolic rate”, defined as material extracted per capita, was 10 tons/capita/year.

The “material intensity”, defined as material extracted per unit of GDP, was 1.3 kg/ \$ (\$ at 1990 exchange rates).

	Biomass	Fossil energy carriers	Ores + industrial minerals	Construction minerals	Total
1975					
Total material flow – billion tons	12.5	7.2	2.9	8.4	31.0
Metabolic rate – ton/capita/year	3.1	1.8	0.7	2.1	7.6
Material intensity – kg/\$ (1990 ex. Rates)	0.8	0.4	0.2	0.5	1.9
1990					
Total material flow – billion tons	16.5	9.5	3.7	11.8	41.6
Metabolic rate – ton/capita/year	3.1	1.8	0.7	2.2	7.9
Material intensity – kg/\$ (1990 ex. Rates)	0.6	0.4	0.1	0.4	1.5
2000					
Total material flow – billion tons	17.8	10.0	4.5	17.5	49.7
Metabolic rate – ton/capita/year	2.9	1.6	0.7	2.9	8.1
Material intensity – kg/\$ (1990 ex. Rates)	0.5	0.3	0.1	0.5	1.4
2009					
Total material flow – billion tons	20.3	13.0	6.5	28.4	68.1
Metabolic rate – ton/capita/year	3.0	1.9	1.0	4.2	10.0
Material intensity – kg/\$ (1990 ex. Rates)	0.4	0.3	0.1	0.6	1.3

Numbers do not exactly add up due to rounding

Source: Krausmann and Al: Growth in global materials use, GDP and population during the 20th century. Ecological Economics 2009, Vol.68(10), 2696-2705 – Up-date August 2011

Total material flows increased sharply during the last decade, with a surge in construction minerals. Therefore, the material extracted per capita moved up 19 % in the last 10 years, whereas it took the previous 25 years to grow by 6%. Yet biomass and fossil energy carriers grew in line with population at an almost constant rate. The shift from an agrarian to an industrialized and urban society in developing economies will continue to drive increases in material flows. It also accumulates a legacy of buildings and infrastructures (already estimated at several hundred tons per capita), that will demand energy and maintenance, before possibly becoming future sources of recycled materials.

For more than 100 years, the discovery and exploitation of new reserves of materials, compounded with continuous productivity gains in their extraction and processing, resulted in a steady downward cost trend. However, the laws of physics

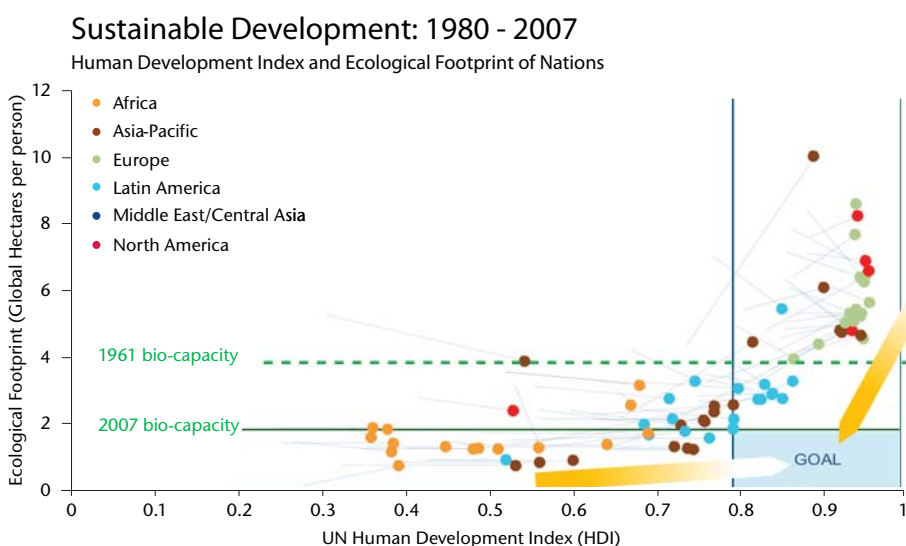
are inflexible. Elements cannot be made. Their planetary stock is finite. They can be moved, combined and traded, but, at some point, scarcity will set in, and drive prices upward. This seems to have started about ten years ago, for a number of materials. According to a detailed research by the investment management firm GMO,⁸⁴ we have entered a new era with lasting resource shortages and price pressures on most materials, that will change the rate and quality of our growth options. According to GMO, conventional oil, copper and iron ore already seem to have reached their availability peaks. There are also tensions on basic food commodities, soybeans, wheat and corn despite of increased use of fertilizers.

The unprecedented growth in extraction of minerals did not prevent the monetary economy to “decouple,” and grow even faster than the physical economy. On the whole, today, it needs 20% less biomass, fuels and industrial minerals to create one dollar of income than in 1975. This relative decoupling is encouraging, as one looks for ways to step up decoupling, not only from economic growth, but also from environmental impacts.

We drive environmental impacts through our material flows. They disturb ecosystems locally at the point of extraction, cultivation and harvest. Biomass, fuels, and a part of metal ore tailings and mineral residues quickly become dispersed as waste and emissions, with regional and global impacts. So do equipment and appliances at the end of their useful life. Buildings and infrastructures also displace ecosystems, seal land, and require continuous flows of energy, water and supplies. There is now strong empirical evidence that the scale of manmade material flows reduces and exceeds the capacity of the planet’s ecosystems to absorb and regenerate wastes and emissions.

That capacity is finite. According to the Ecological Footprint Network,⁸⁵ humanity reached an “overshoot” situation in the mid 70’s. It would need 18 billion hectares of bio-capacity or, in other words, of productive land and aquatic eco-systems, to supply the equivalent of current resources extraction, and safely absorb wastes and emissions. With no more than 11.9 billion hectares of bio-capacity available, the earth needs 18 months to deal with 12 months of global man-made material flows. It is as if we already consumed the bio-capacity of 1.5 planets. Business-as-Usual will continue to erode our natural capital. The frequency of supply bottlenecks, commodity price peaks, and natural crises, will threaten human development in many parts of the world, as our economic activities continue to deplete the stocks of resources, and saturate the sinks for emission and wastes.

Vision 2050 can be summed up with 2 major indicators: reaching a stage where all nations meet a human development index⁸⁶ greater than 0.8, and live within the current average global bio-capacity. The position and development trend lines attached to each nation on the following chart shows that typically a higher level of development was achieved by driving material flows into the upper-right zone of unsustainability. It also shows a group of African, Asian and Latin American countries, a large fraction of the human population, moving towards higher development, likely to move across the safe level of bio-capacity⁸⁷.



⁸⁴ Jeremy Grantham – Days of Abundant Resources and Falling Prices Are over Forever, GMO quarterly Letter April 2011, <http://www.gmo.com>

⁸⁵ Ewing B., D. Moore ;S. Goldfinger, A. Oursler, A. Reed, and M. Wackernagel. 2010. The ecological foot Atlas 2010. Oakland Global Footprint Network

⁸⁶ UNDP - <http://hdr.undp.org/en/statistics/hdi/>

⁸⁷ The Ecological Footprint Network displays an animated time line of this graph with the names of nations http://www.footprintnetwork.org/en/index.php/GFN/page/fighting_poverty_our_human_development_initiative/

Accelerating strategies that decouple human development from material needs and environmental impact is the only way. OECD and other rich countries need to “dematerialize” the most rapidly; developing nations need to leapfrog quickly into dematerialization, to enable their sustainable growth.

Many companies have pioneered decoupling and dematerialization after the first oil crisis, and the ensuing commodities price crunch. Forward- looking companies adapted the approach, under the concept of “eco-efficiency,” to deal with the sustainable development challenge. Eco-efficiency was defined by the simultaneous, instead of a trade-off pursuit of environmental progress and economic value creation. According to the WBCSD⁸⁸, it is achieved by the delivery of competitively-priced goods and service that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity, throughout the life-cycle, to a level at least in line with the earth’s estimated carrying capacity.

An important caveat is that “eco-efficiency is not achieved by technological change alone. ...sustainable development is also about redefining the rules of the economic game, in order to move from a situation of wasteful consumption and pollution, to one of conservation, and to one of privilege and protectionism; to one of fair and equitable chances open to all” .⁸⁹One should also add the dimension of personal values and behavior.

A steady push for eco-efficiency at the microeconomic level never fails to produce process innovations and results. Thus, various companies have found ways to completely decouple their income from fossil energy sources, water, wastes and noxious emissions. They have also redesigned their products, to enable their end-users to reduce their impacts, without losing usage value and performance. They have ensured recyclability at the end of useful life, and initiated reverse logistics schemes for improved recycling rates and quality; this, in turn, enables higher recycling content of prime products. They have created partnerships with other industries that can provide or use waste streams as substitutes for primary materials and fuels.

The OECD adopted the principles of eco-efficiency in 1996. In the following years, it added a train of policies to encourage eco-innovation and resource productivity⁹⁰. They caused a relative decoupling of energy and materials consumption from economic growth but, as yet, insufficient to stem their absolute continuous growth.

As shown in the growth table on page 76, on current trends, global material flows are bound to deviate considerably from the goals of Vision 2050.

A business perspective on policy options

A dedication to the principles of eco-efficiency has brought considerable progress and innovation in the management of product impacts through their life-cycle. Eco-efficiency is a critical factor of success in the Green Race, and it is compelling companies and entire nations to keep up with the forerunners. However, a lot more needs to be done now to integrate the know-how and technologies gained at the microeconomic level into a systemic and consistent economic development strategy.

When Vision 2050 calls for zero waste and closed-loop recycling, it is not naively defying the rules of entropy and economics. It tries to make the point that waste elimination and recycling must be pushed far beyond what is practiced now; particularly for critical resources that have reached their peak of economic and secure availability, or waste disposal acceptability. With technology and money, almost any material could be regenerated from waste to functional material or energy, or clean soil and fillers, at a profit or loss, according to the market conditions and policy rules. A resource- efficient, quasi- circular economy is technically possible. It can create income and jobs for the growing population, provided that governments foster business and consumer initiatives with the following combination of key policies:

- Labeling and certification schemes for benchmark performance in life-cycle resource efficiency, recycling content and recyclability.
- Tighten waste disposal legislation to ultimately phase out landfill of recyclable materials, in favor of circular material processes.

⁸⁸ WBCSD(1992), S. Schmidheiny, Changing Course, MIT Press,

⁸⁹ idem

⁹⁰ OECD (2011), Better Policies to Support Eco-innovation, OECD Publishing

- Invest to improve the collection and reverse logistic infrastructure for end-of-life materials to become competitive feedstock and fuels.
- Implement market- based instruments to establish the true value of primary materials and their recycled substitutes.
- Improve the coverage of material flow accounting and resource efficiency measurements.

These policy recommendations are not new. They have been in discussion for some time, and are on the implementation agenda of many governments. The changes they anticipate threaten the business and comfort models of many. Resistance and short- term alarm for job losses continue to delay or weaken their implementation. Yet, in a world where population needs overshoot natural resources, change is certain. If ill-prepared, it can degenerate with dramatic social, environmental and business consequences. It is cooperation, not resistance, which will enable business, governments and civil society organizations to resolve the systemic challenges of resource efficiency and sustainable economic growth.

Label and certify resource efficiency

Labels and information sheets and internet resources play an important role in informing the choice of purchasers about the performance and impacts of their purchases and behaviors. The fact that many consumers declare their confusion about purchasing choices, and the proliferation of on-pack labels, should encourage governments and producers to improve disclosure simplicity and the reliability of performance measurements, as well as the certification of benchmarks and best-in-class products. The experience with the European Energy Efficiency label demonstrates the possibility of simple and informative consumer labels. Not every detail, therefore, must be included in product labels at the point of sale; only the necessary and sufficient. Internet enables access to deeper layers of data, through scan- coded labels that can be accessed with mobile phone applications. Motivated consumers can thus be empowered with remote access to the desired information, even at the point of purchase. They may also seize the channels of the growing internet social networks to exchange experience, advice, and create critical mass for or against products and brands.

In the meanwhile, product designers, industrial and public procurement agents can make a major contribution if they require reliable, science-based life-cycle resource efficiency and impact assessments before making their material choices.

Phase out landfills

Most urban centers will run out of landfill space in the next decade. Governments should phase out the option of landfilling of all recyclable wastes, through clear calendars and financial measures. A circular economy will still need a network of waste collection platforms to ensure the economic reverse logistics that mobilize waste for energy recovery and industrial feedstock. With the right investments, many landfills can become material recovery services.

Turn graves into cradles

Vision 2050 proposes to foster the convergence of all nations into the development zone below the limit of 2 global hectares of regenerative bio-capacity per capita (see page 78). This requires setting limits and costs to the extraction of primary biomass, materials and fossil fuels. As a result, product designers, engineers and architects will push the 3R strategies, Reduce-Reuse-Recycle, to new breakthroughs. However, governments need to pay attention to the availability and economics of recyclable materials. Today, the high fixed costs of collection, and the low rate of recovery, make many materials too expensive to recycle. Important scale-up savings can be achieved by a combination of recycle content standards, material marking, and collection-separation facilities, as well as phase-out programs for toxic and other materials that interfere with reuse and recycling.

Value efficiency and re-use

A circular economy cannot be achieved with ambitious goals, standards and bans alone. Financial market signals encourage innovation R&D, production investments, and skills training. As long as it remains cheaper to extract materials from far-away sources, rather than re-use and recycle obsolete local substitutes, material consumption will deplete non-renewable resources, saturate waste disposal space, and overshoot greenhouse gas safe limits. Ultimately, scarcity at both ends of the cycle will change markets. But scarcity- related price surges can be brutal. Ecosystem collapses and natural disasters can set back business and social development, even in rich urban centers. It is wiser for governments to

introduce transparent, long-term, and certain price signals through fees, taxes and redirecting subsidies from resource intensity to resource efficiency. This strengthens the competitive advantage in the Green Race, makes business more resilient to supply shortages, and mitigates the risk of irreversible ecosystems damage. At the same time, financial and human capital can benefit from the transfers of resource-based levies, to assist green investments and job creation.

Improve material accounting

The set of market-based instruments and labeling-certification schemes must be based on ever better data concerning extraction, depletion, movement, use, stocks, disposal, recovery and recycling. Resource efficiency is more than a concept: it is a metric of development. Public authorities, and all actors in the supply chain, need to be accountable for verifiable and timely data, in order to manage progress at all levels.

Our aim is a transformation of global material flows to regain a balance with our supporting ecosystems, without denying development to any of the 9 billion people expected in 2050. This is a systemic challenge that requires local initiatives, decisions and actions, aligned with global perspectives. Local possibilities and results of eco-efficiency are already demonstrated. The policies proposed above, introduced rapidly, and regularly tightened over a span of the next 40 years, will amplify and replicate local initiatives. It need not be a top-down, global approach, as long as eco-innovation, technology cooperation and trade connects initiatives in ways that leave the Green Race open to all, but also maintains the integrity of the key conditions to green growth.

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