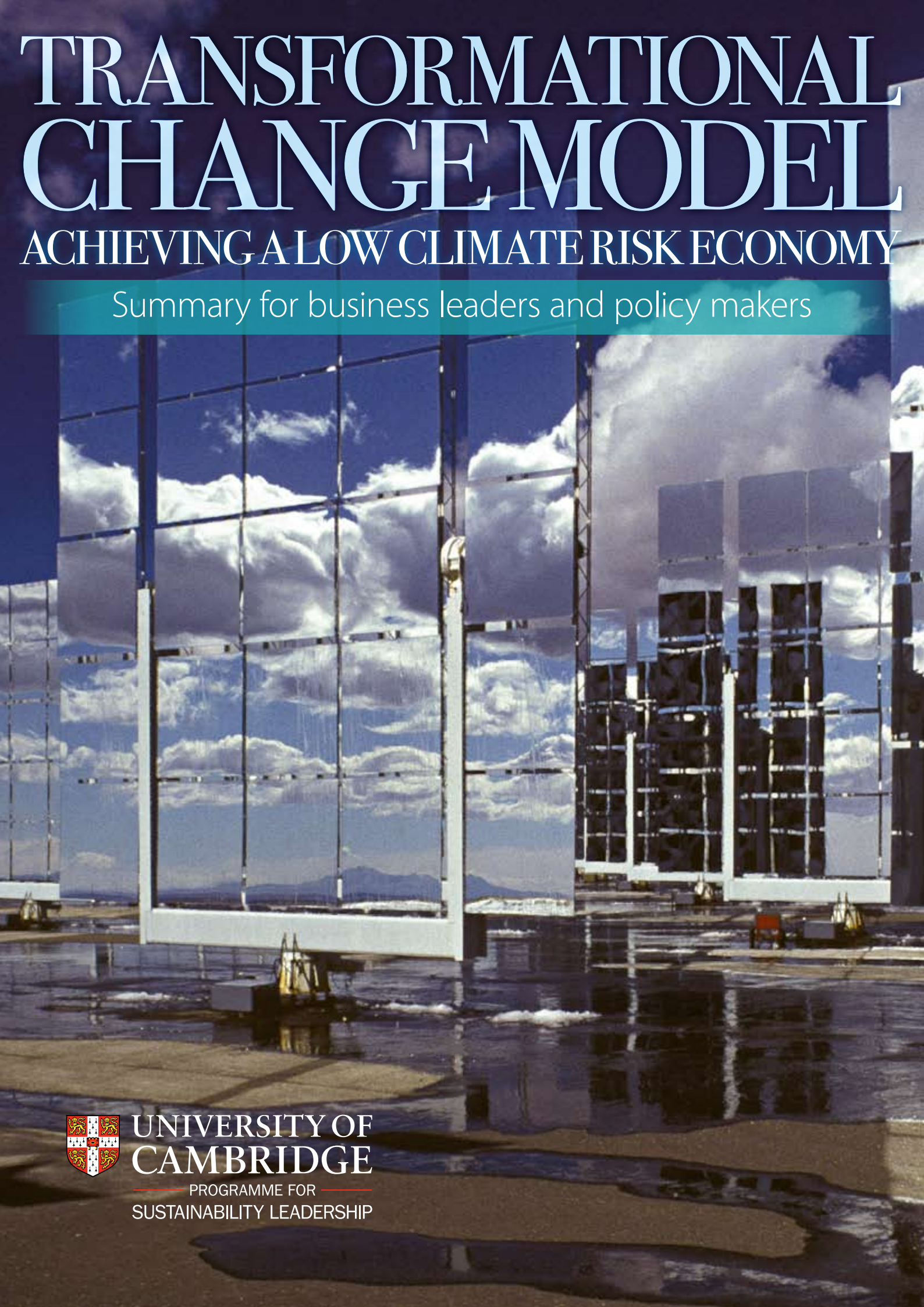
TRANSFORMATIONAL CHANGE MODEL

ACHIEVING A LOW CLIMATE RISK ECONOMY

Summary for business leaders and policy makers



UNIVERSITY OF CAMBRIDGE
PROGRAMME FOR SUSTAINABILITY LEADERSHIP

Background

Over the past year, the University of Cambridge Programme for Sustainability Leadership (CPSL, formerly Cambridge Programme for Industry) has identified the need to develop a transformational change model (TCM) which provides a draft framework for action to achieve a low climate risk economy.

Business leaders recognise that although they may have a vision of where they want their particular company to be in the future, they lack clear frameworks to support them in reaching those objectives. The TCM is designed to inform a wider policy debate about sustainability transformation. The full TCM report is available from CPSL and includes chapters on scenarios for the future, climate science and impacts, policies and state of politics in 2009, policy requirements, technological and behavioural change and organisational change case studies. This document is a summary for business leaders and policy makers.

Climate change threatens access to food and water, a continued improvement in health and the use of our surrounding environment. If the worst predictions of climate change are borne out the cost to a future society of just one of the projected impacts is unprecedented. London, Hamburg, Venice, New York, Miami, New Orleans, Buenos Aires, Lagos, Mumbai, Bangkok, Singapore and Shanghai are all in coastal flood plains. While one country can absorb the near total devastation of one of these cities (as was seen during Hurricane Katrina's impact on New Orleans) it is difficult to see how the world could cope with major impacts on all of those cities at the same time.

Overall, observational evidence from all continents and most oceans shows that many natural systems are already being affected by regional climate changes – particularly temperature increases – and these impacts are accelerating.

We have decided to call this work a model for a low climate risk economy rather than a low carbon economy. It is increasingly clear that in delaying a response to tackling climate change over the past 20 years the world now faces significant impacts as a result of the emissions that have already occurred (and continue to occur). It is also clear that the solution to climate change does not lie solely in a future of low carbon technologies but requires a fundamental shift in *why we do things*, *how we do things* and *the way in which we think about doing things*.

Over the past few years many organisations have been developing scenarios for the future. These scenarios usually (but not exclusively) include a view on the likely technology mix that could be expected in 2050 and the emissions reductions that are possible based on their proposed mix of technologies. In addition to the interviews with academics, policy makers and business leaders that took place as part of the research for this report, we looked at the following scenarios, to get a baseline idea of the breadth of options available to help tackle climate change:

- World Business Council for Sustainable Development (WBCSD), *Pathways to 2050 – Energy and Climate Change*
- WWF, *Climate Solutions*
- Shell, *Energy Scenarios*

- International Institute for Environment and Development (IIED) and New Economics Foundation, *Up in Smoke*
- World Bank, *Strategic Framework on Climate Change and Development (SFCCD)*
- International Energy Agency (IEA), *World Energy Outlook 2006*
- United Nations Foundation, *Framework for a Post-2012 Agreement on Climate Change*
- Princeton Wedges
- International Finance Corporation – *Energy Efficiency in Russia: Untapped Reserves*
- PricewaterhouseCoopers – *The World in 2050: Implications of Global Growth for Carbon Emissions and Climate Change Policy*
- Mackay, D. *Sustainable Energy – Without the Hot Air, UIT Cambridge*

Within the TCM report we set out three possible scenarios to achieve a low climate risk economy:

- Shut Down
- Task Manager
- Work Offline

We see the Task Manager scenario as the most desirable and we set out more detail on this scenario including key policy requirements.

It is clear that there is no silver bullet and no individual technology will be the solution. It is how the technologies are integrated that is important. For example, if we are to really tackle this problem, the key infrastructure components of energy, water, waste and mobility must work in unison rather than following the historical disconnected route.

With governments and politicians now increasingly focused on this issue, and with a strong call from business to create the political space required to start detailed discussions on the implementation of policies, it is now important to move beyond a vision for emissions reductions (usually outlined as emissions reduction targets) and into real action to identify the particular pathways that we are to take to achieve these targets. As the letter from the UK Corporate Leaders Group on Climate Change to UK political party leaders in September 2008 outlined: "Government and business must now work together to demonstrate real change on the ground by delivering the new projects and practices that are needed to create a low climate risk economy."

It is important to note that the TCM has not been developed as a consensus amongst all of those consulted, but brings together all their views into one place in an attempt to move the discussion around policy formulation forward. We do not present this model as the definitive solution, nor as a consensus view, but as a framework for those parties to come together to begin active discussions.

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Scenarios for the Future

Shut Down
In a Shut Down world political leaders decide that the uncertainty of climate change is too large a risk and therefore severely limit all emission sources by 2020 (globally emissions are brought down such that greenhouse gas concentrations are stabilised at around 450 ppm). This includes all liquid fuel transport and fossil fuel power stations and is driven by strong legislation on emission sources as well as strong legislation governing the behaviour of individuals. A massive capital investment is made to deploy all known technologies including a large role out of new nuclear as well as significant investments in wind and geothermal. Limited emissions are allowed for critical industrial processes (to be phased out over time). In this scenario the risk of climate change is mitigated and little adaptation is needed.

Task Manager
In a Task Manager world political leaders recognise the risk of dangerous climate change and decide to scale-back emissions in order to make the transition to a low climate risk economy as smooth as possible. Every country takes on strong emission reduction targets with developed countries agreeing to targets in the current round of negotiations (coming into force by 2012) which would be met mainly through efficiency measures and developing countries agreeing to targets in the subsequent round of negotiations (which should conclude by 2020). These targets are guided by science and result in no net emissions by 2050 (greenhouse gas concentrations are stabilised at around 550ppm). This would require a global emission reduction target of at least 50% by 2050 over 2000 levels (implying between 60 and 90% reductions for developed countries). By 2100, the global economy is based on a fully electrified, hydrogen and renewable system. Significant climate impacts will still be seen and strong adaptation measures are put in place including flood defences, changes in agricultural practices and infrastructure protection from extreme weather events.

Work Offline
In a Work Offline world no political agreement is reached at the international level (or very limited voluntary agreement). Each country implements efficiency measures for economic reasons and a limited investment is made into renewable technologies, mainly due to energy security concerns. However, emissions continue to rise at their current rate with efficiency measures not meeting the growth of the global economy and feedback loops in the climate system results in runaway climate change. Large capital investment is made into adaptation measures with large scale movements of infrastructure out of flood plains and the construction of more extreme weather resilient buildings. Local sourcing of agriculture is increasingly important as food crops fail in certain regions and global food prices soar. Water availability becomes increasingly problematic leading to large hydro-storage projects being implemented. There is a much larger risk from regional and global conflicts as a result of the increased pressure on resources and nation states become increasingly isolated and unconnected.

The Task Manager scenario is our preferred way forward because we do not wish to run the risks of large scale global conflicts in Work Offline and the potential of a large negative economic impact from a sudden change in energy resource in Shut Down. Although the requirements for this scenario are currently achievable, any delays will significantly hamper and potentially destroy the chance of this succeeding.

Task Manager: Delivering efficiency by 2020?

By 2020, society will need to be highly efficient and have the right frameworks and support structures in place to start rapidly deploying new technologies that will have, by then, completed full-scale demonstration. Climate risk will need to be built into the daily decision-making process and strong adaptation measures for our physical infrastructure will be in place. Most developed countries should have achieved approximately 30% reductions in emissions, a large part of which will have been from efficiency measures.

Each year, an estimated $200-250 billion is invested in energy-related infrastructure to replace existing capital stock and meet ever-rising demand (and another $1.5 trillion is spent on energy consumption). An increasing amount of research indicates that significant savings can be made today by companies investing in efficiency measures. However, business decisions, as with political decisions, are currently incredibly short-term.

Task Manager: Delivering a transition by 2050?

By 2050, the world should be well on the way to developing a fully renewable-based and climate resilient infrastructure. However, we will need interim measures to ensure that 'the lights stay on', but these measures still need to deliver the global emissions reduction targets. Therefore, there is likely to be a need for an increased interim use of nuclear power in the current developed countries until alternative renewable based technologies and infrastructure becomes available at a level necessary for total adoption.

Most importantly, governments around the world will have put in place strong regulatory frameworks that increasingly support the move to a fully electrified infrastructure (with improved energy storage potentially including hydrogen fuel) which takes its supply from renewable technologies deployed in the most appropriate environment.

Carbon emissions from the transport sector should decrease significantly. New transport systems in emerging economies should be developed to be wholly reliant on new electricity infrastructure and not a liquid fuel based infrastructure. The developing countries should have leapfrogged developed countries in implementing renewable based economies. Even with significant emissions reductions by 2050, it is unlikely that the scale of transformation achieved will be sufficient to avoid major climate change impacts. Therefore, in parallel to these developments, national and global frameworks for disaster risk management will need to be put in place. A key element to this is access to water and water storage.

Task Manager: Achieving a vision by 2100?

By 2100, the world's economy should be based entirely on renewable technologies and will be fully climate resilient. To achieve this, the distribution of energy around the world will need to be based on electricity.

One particular technology that needs significant investment over the next few decades is energy storage. This involves a range of possible solutions that already exist, from pumped water storage, compressed air storage and ground source heat pumps, to novel 'batteries' (both centralised and distributed) that can store significant amounts of energy over long periods. To support this deployment, there will also need to be a revolution in the way products are powered and in the management of the power grid. Many products will need to be able to cope with variable power and have dynamic demand management so that all aspects of the power grid are supporting each other. It is possible to develop a new renewable economy in this timescale, but we need to start now.

Policy frameworks for action

To enable serious work to begin on implementing policies that will drive business decisions, a clear long-term commitment by governments is needed. This global deal, under the United Nations Framework Convention on Climate Change (UNFCCC) process, should be agreed as soon as possible. It should include a global emissions reduction target of at least 50% by 2050 relative to a baseline of 2000. This target should be based on the latest available science. Developed and less-developed countries need to take on specific targets over this period. In particular a new framework for 2012-2020 should be agreed and include:

- Developed countries' emissions reduction targets: 25-40% target by 2020 (on 2000 baseline) and indicative targets of 80-95% by 2050;
- Less-developed countries' emissions reduction targets: voluntary inclusion to 2020, then targets set for 2050 based on capacity to achieve under overall 50% global target.

A global framework should include:

- Finance/trading mechanism for linking carbon markets in different regions;
- Technology transfer and investment framework;
- Requirement for national mitigation and adaptation plan.

To support adaptation a clear, long-term international arrangement for collecting and sharing climate data is required. This will need substantial investment in accurate national and regional forecasting of future weather and catastrophe patterns. Governments at domestic and all international levels can then assess their climate-related risk exposure and pool their analyses, as well as making them publically available.

With an international framework in place regional and national governments then need to put in place a comprehensive set of policies that will help deliver against the agreed emission reduction targets.

Policy type	2009-2012	2012-2020	2020-2050
Emissions reduction targets	Developed countries agree to binding 2020 targets and indicative 2050 targets.	Less-developed countries agree to voluntary targets.	All countries have agreed 2050 targets with national governments implementing emissions reduction pathways.
Carbon price	All developed countries should implement a cap-and-trade scheme with full auctioning.	Global framework set up linking existing carbon markets; Border taxes changed to avoid undermining carbon markets.	Less-developed countries should develop carbon markets (potentially by linking through CDM regional programmes).
Forward procurement	Targets set in advance for government procurement contracts over 2012-2020 period, including vehicle standards and white goods.	Targets set for building efficiency standards to encourage the creation of ESCOs (energy service companies) in developed countries.	Efficiency and energy standards in all government contracts globally.

Policy type	2009-2012	2012-2020	2020-2050
Standards and regulation	Change/merge regulators to have more of a systems view; Ensure planning authorities are streamlined to reduce costs of implementation.	Increased mandatory efficiency standards following forward procurement commitments by governments; Include better 'closed system' (cradle-to-cradle) regulations.	Use of the Japanese 'top-runner' standards to encourage more innovation in product design; Carbon sink regulations fully embedded; Electricity grids opened up.
Subsidy reform	Examine and reform all forms of subsidy to ensure driving appropriate behaviour change (e.g. VAT on energy efficiency measures should be removed).	Feed-in tariffs redeployed as technologies become cost effective.	Continuous monitoring of subsidies and their impact; Subsidies shift from technology sources to electricity infrastructure.
Support for discovery and demonstration	Increased spend on research and development.	International funding schemes to ensure global efforts are coordinated.	Support for demonstration of fully electrified and renewable economy.
Technology transfer	Reform of Clean Development Mechanism (CDM) to be programmatic (launch in 2012).	Substantial investments in multilateral funds for demonstration and deployment of technologies in emerging and less developed countries.	
Behaviour change	Governments should invest in information campaigns and education; Introduction of 'avoidable' tax and incentives to drive customer behaviour.	Create new market incentives for companies to be able to capture long-term value in service offerings.	
Land rights	Dialogue between land owners and government on carbon stored in soil.	Development of REDD (Reducing Emissions from Deforestation and Degradation) markets through capacity building in forest regions.	Regulatory framework implemented for carbon in soil and conserved forest stocks.
Adaptation	Development of international arrangement for collecting and sharing climate data; Full examination of changes in risk for access to food and water; Investment into adaptation measures that reduce risk to an insurable level.	Management plan for changes in healthcare and ecosystem conservation implemented.	Process set up to continually monitor and assess changing climate risks.
Carbon disclosure	Encourage voluntary standards for carbon disclosure.	Implement mandatory global standards for climate risk disclosure by companies.	

Summary of the key policy areas and timescales to deliver a factor-4 reduction in emissions.

Delivering technology and behaviour change

To successfully implement sustainable solutions with the goal of optimizing conditions for human development over time, a thoughtful approach to communicating goals, objectives and responses needs to be developed. The issues our society faces today are highly technical. The requirements of people, now and in the future, demand that we completely integrate not only aesthetic and scientific factors, but the real needs and desires of people: their senses, their emotions and their diverse identities.

Sustainability can perhaps best be thought of as being a political issue which has design and technical attributes. In this context, it can be considered that there are four critical stages to shifting from one paradigm to another.

1. **Be clear about the nature of the problem or opportunity.** There is a tendency to focus on attributes, rather than fundamentals, because the attributes are often more intuitively obvious. For instance we are highly focused now on climate change mitigation, adaptation and in some cases resilience. However, climate change is an attribute of the more fundamental issues of energy, resource use and population growth and even population growth is a function of available energy resources. How we value available resources, price them, choose to use them, share them, and so on drives the climate equation. Design can be considered to be an attribute of the more fundamental issue of energy because energy issues shape possibilities about location, mobility and building form itself. One needs to ask "If we were willing and able to fold all of the now external costs of energy into a true pricing would that in itself make design more effective?" That is not to say that design and technology are not critical elements in solving energy problems.

2. **Get the necessary stakeholders to agree that the problem or opportunity needs to be addressed.** It can be all too easy for professionals to propose solutions to problems that stakeholders either do not think need addressing or are of lower priority than other issues. Part of this is the result of not getting the question right. Part is what is referred to as 'the tyranny of experts' where the public is expected to simply defer to the intellectual superiority of others when experience is clear that this is often flawed. And part is a failure to appreciate and incorporate the wisdom of the masses when they are provided unbiased information that is accessible to them, not just to the experts. This is not to suggest that majority must rule. The literature is clear however that if trusted institutions and individuals are not convinced that the problem at hand is a priority then the majority will withhold their permission to act.

3. **Know what to do to solve the problem and be honest with the public about levels of confidence and limits to the potential impacts of actions.** There can be greater confidence (and influence) in addressing attributes of problems rather than fundamentals. Design can go a long way towards addressing aspects of some problems, but it cannot address the fundamentals. The fundamentals are political.

4. **Those in positions of power choose to act on the permission granted by stakeholders.** Without this conventional wisdom we will make much less progress than would otherwise be possible. The choice to act differently is a risk management issue – political risk, financial risk, resource management risk. Good design and good science can help reduce the risk of different courses of action. More fundamental however are culture, nostalgia, aspiration, fear and what Frances Bacon described as the preference for truths that we would rather believe.

Unless the basic human issues above can be aligned with what people would rather were true, then design and technological solutions will not be embraced at the rate that they need to be embraced.[1]

With the required empowerment in place we see three categories for solutions for large-scale 'carbon wins':

- Reducing carbon demand: the amount of energy needed to perform a particular task;
- Reducing carbon intensity: the relative amount of emissions per unit of energy produced;
- Preserving carbon sinks: being able to store carbon both naturally and technologically.

Reducing carbon demand

Remaking our world in the image of sustainability needs to go beyond techno-fixes or isolated solutions at the edges of present methods of working. It requires a total overhaul of the way that we build, move around, produce, manufacture, consume, manage land, and grow our food. We need to re-examine the way we use an integrative design approach to offer big wins for delivering efficiency in the large-scale problem areas of infrastructure and mobility, and manufacture and consumption.

Reducing carbon intensity

It is our rapid and intensive burning of fossil fuels that is the predominant cause of the greenhouse effect and climate change. On the other hand, an ever-growing portfolio of alternative energies and new technologies presents us with the vital tools for change that used correctly and with understanding, could transform our civilisation as we know it. These technologies include carbon capture and storage (for fossil fuel power stations), wind, solar (thermal and photovoltaic), biomass, geothermal, wave, tidal, hydroelectric and nuclear.

Preserving carbon sinks

Ensuring that the carbon remains captured is a vital part of the transformational change. The two key areas associated with land-use changes resulting in the release of carbon are agriculture and deforestation. These two areas should be brought into a global market mechanism as soon as possible with an initial phase of international government support to develop the required measurement and monitoring mechanisms in the forest regions as well as mechanisms for transfer of funds within those regions (funding for this phase could possibly be provided through the issuance of long-term government bonds). A key driver for land-use change is the growing world population and the increasing demand for food. A dialogue needs to be started between governments and land owners to provide information on what is needed and how to work in partnership to deliver sensible management mechanisms for carbon in agriculture.

Conclusions

2008 saw the twentieth anniversary of the setting up of the Intergovernmental Panel on Climate Change (IPCC) and the testimony of Dr James Hansen (of NASA Goddard Institute for Space Studies) to the United States Congress. While some progress has been made in the intervening time, a lack of momentum on the issue of climate change has allowed society to create scepticism around the science, and allowed government and business leaders to stall action on the transformational change that is required.

It is clear from the work that has gone into this transformational change model that with the right policy framework in place, the costs of this change can be kept to a minimum, and that these costs should be viewed as an investment in our future. With the wrong policy framework in place, or a lack of a policy framework, the costs of both incorrect action and inaction are incredibly high.

Tackling climate change must be seen as a long term economic strategy.

The scale of the change that is required in today's society to respond to the challenge of climate change is transformational. The current flow of 'value' through our economic system is inadequate for capturing long-term trends and 'externalities'. Therefore a new approach to measuring and managing the externalities is required. Business is starting to develop new ways of responding to the challenge including developing new business models and opportunities. While none of these currently address the full transformational change required to tackle climate change, they highlight the direction that business is taking to respond to the challenge. It is the role of policy makers to ensure that the momentum behind this change leads to true transformation in the next few years.

The business drivers behind each of these changes are complex and involve a combination of external pressures, leadership, business culture and innovation. However, it is clear that these transformations have occurred when the companies in question have stopped trying to find the 'answer' elsewhere and have decided to take a leadership role in responding to what is a clear risk or opportunity for their business. These changes have been led by the core revenue-creating areas of the companies rather than by a philanthropic desire to be 'sustainable'.

It should be noted that while some new technologies may be required to deliver a fully electrified and renewable economy, it is possible to achieve most of the scenario outlined here in a much shorter timescale. If government and business decide today that this is what they will deliver, and lay out a clear vision, then all indications show that the capital required and society 'buy-in' that is needed will be there.

The scenario outlined in this summary, and in the full report, can only be achieved through governments using regulations and standards across the board to help deliver the necessary behaviour and technology changes, working closely with business to ensure that the changes can be delivered rapidly.

There is no one 'silver bullet' technology and there is no one 'silver marksman' in either government or business – we all need to do this together if we are to have a chance of achieving a low climate risk economy. We require the biggest public-private partnership ever seen.

Acknowledgements

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While this document is not a consensus document and will not necessarily represent the views of the individuals or organisations listed here, the transformational change model (TCM) for a low climate risk economy was developed in consultation with the following groups, companies and individuals.

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