

Carbon Structural Adjustment: The key to profiting from the low carbon transition

Dr Karlson 'Charlie' Hargroves, Curtin University Sustainability Policy Institute, Curtin University (corresponding author)

charlie.hargroves@curtin.edu.au

+61 407 071 729

Curtin University

1 Kent Street, Building 207

Bentley, WA 6102

Professor Peter Newman, Curtin University Sustainability Policy Institute, Curtin University (Thesis Supervisor)

Abstract

Given the imperative to respond to climate change by achieving changes to the operation of economies around the world in the coming decades, attention is now being given to possible strategic approaches including the emerging field of 'Green Growth' strategies. This paper begins by considering lessons from green growth strategies aimed at developing countries that may inform efforts to achieve a low carbon transition. The paper then investigates structural adjustment programs as a potential framework to extend green growth methodologies to achieve profitable low carbon transitions, and discusses the concept of '*Carbon Structural Adjustment*'. The paper concludes by presenting a road map for the development of carbon structural adjustment strategies aimed at key structural areas of the economy, implemented through strong actor and stakeholder engagement. Understanding that current progress is slower than required the paper calls for consideration of methods to increase the '*willingness to adjust*' structures within society to achieve a low carbon transition.

Introduction

Now that much of the world, some 195 nations, has committed to '*keep a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels*' as part of the 2015 United Nations Climate Change Conference (COP 21) in Paris, questions are being asked about how to effectively transition economies to low greenhouse gas emissions operation in the medium to long term in a manner that delivers ongoing prosperity, jobs, and profits. According to Christiana Figueres the Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), '*The Paris Agreement confirms the irreversible transition to a low carbon, safer, and healthier world*'. At COP21 each of the participating countries made greenhouse gas emissions reduction commitments, such as China committing to 60 to 65 per cent by 2030 (compared to 2005 levels), the European Union committing to reducing emissions by at least 40 per cent by 2030 (compared to 1990 levels), United States of America committing to 26 to 28 per cent

by 2025 (compared to 2005 levels), and Australia committing to 26-28% by 2030 (compared to 2005 levels).

These targets will create significant pressure, along with opportunities, to reduce greenhouse gas emissions in the coming decades. Hence it is fast becoming clear that the world will need to swiftly transition from showcase projects and initiatives that demonstrate the potential for significant reductions in greenhouse gas emissions to a systematic and collaborative process to achieve a cost-effective and equitable transition to a low carbon future (Lovins and Lovins, 1997). This paper presents further evidence for the case that in order to meet such ambitious targets an agenda of structural change will need to be effectively designed, motivated, and delivered, that builds on and further underpins the growing number of *ad-hoc* autonomous structural change efforts to reduce greenhouse gas emissions around the world. The paper provides evidence to suggest that in the same way that fiscal structural adjustment was formulated as a solution to underdevelopment in third world economies in the 20th century, a new form of structural adjustment, '*carbon structural adjustment*', will need to be formulated as a solution to the unsustainable growth in greenhouse gas emissions in the global economy in the 21st century.

The concept of carbon structural adjustment focuses on economy wide structural changes intended to induce the greater uptake of low greenhouse gas emissions technologies, processes, and practices. In order for such an approach to be successful it will need to draw on lessons learned from efforts to progress the green growth agenda's and merge this knowledge into structural change processes (Hargroves 2015). It is likely to be the case that some of the tools and strategies that have led to the highly successful fossil fuel based economy may not be as useful to achieve reductions in greenhouse gas emissions and assist in a transition to low carbon societies, and new tools and strategies will be needed. However to complicate matters, despite a recent surge in renewable energy investment, much of the World's economy is based on fossil fuels and there are many interests that are best served in the short term by not changing this. Hence should such a transition away from fossil fuels take place it will require a 'whole of society' approach that involves actors such as governments, business, universities, civil groups, and the community working together for mutual benefit in an effective and efficient manner. (Hargroves and Smith, 2005)

Lessons from 'Green' Economic Development Strategies

The 2013 report by the OECD titled 'Putting Green Growth at the Heart of Development' asked the question: '*What type of growth can generate both wealth and well-being for all citizens of current and future generations, while at the same time respecting the environment?*' There is much investigation and debate internationally as to the answer to this question with the term 'Green Growth' being created to encapsulate how global development can be achieved with strong environmental outcomes. At its heart green growth is focused on '*...encouraging economic activity to take place where it is of best advantage to society over the long-term.*' (OECD, 2013) Much of the focus on green

growth is targeted at developing countries as they are most vulnerable to environmental impacts and often rely heavily on natural resources, with little resilience to resource price shocks. However much can be learned from this valuable growing field of understanding that can inform international approaches to low carbon transitions.

The green growth agenda relies heavily on the valuing of natural capital in economic decision making, especially important in developing countries where the wealth generated from natural capital can be as much as 25 percent of per capita wealth, compared to 2 percent in OECD countries (OECD, 2013, p23). However as this area of economics is in its early stages of development there can be diminishing returns from such a focus as identifying numerical values to be applied to ecosystem services is highly complex and in reality may be ultimately unachievable. This is not to say that the economics of natural resources and ecosystem services should not be considered, but rather to caution that it needs to be complimented by other considerations (Hargroves, 2015).

According to the OECD (2011), "Efficient resource use and management is a core goal of economic policy and many fiscal and regulatory interventions that are not normally associated with a 'green' agenda will be involved. And in every case, policy action requires looking across a very wide range of policies, not just traditionally 'green' policies." The OECD (2013, p18-19) suggests that green growth demands holistic strategies that include:

1. Equitable and efficient tax systems (including green taxes),
2. Phase out of environmentally harmful subsidies (including reconsideration of fossil fuel subsidies),
3. Free and open trade including environmental products and services (and note that eco-labelling may in fact create non-tariff trade barriers),
4. Policies that incentivize investment in green technologies and practices (including forest management and organic agriculture),
5. Industrial and other sector policies that promote innovation,
6. Risk assessment and management,
7. Labour market and skills policies that maximize the benefits for workers to help to ensure that adjustment costs are equitably shared, and
8. A host of flanking and complementary policies to explicitly address poverty reduction and social equity issues.

Each of these strategies will have economy wide implications and given the imperative to respond to climate change in the coming decades such changes need to be fast tracked. Hence rather than piecemeal approaches a systemic economy wide approach is needed with the OECD (2013, p25) pointing out that green growth '*... must support the structural transformation of the economy to achieve higher productivity and more value-added products*'. This calls for what could be referred to as 'green structural transformation'

strategies, with a key part of such an agenda being strategies related to inducing and accelerating a transition towards greater uptake of low carbon technologies and processes. Based on a review of green growth strategies, the findings of the IPCC (2007), and the extensive study of the associated literature it is clear that there are two key focus areas:

1. *Target fossil fuel intensive operations*: It will be critical that options for reducing greenhouse gas emissions in the most fossil fuel intensive areas of the economy are identified, paying particular attention to areas that provide the opportunity for actors across society to build momentum while acting to prepare to change the more complex and expensive areas of the economy. This may involve:
 - Identifying key areas of the economy that are contributing to greenhouse gas emissions and identify options to cost-effectively reduce emissions.
 - Investigating the economics of such options, such as through a marginal abatement cost curve investigation for particular economies (See Stern, 2006).
 - Identifying multiple benefits through combinations of options, such as a focus on a shift to low carbon cement that then delivers embodied energy savings to buildings.
2. *Enhance innovation that leads to reduced greenhouse gas emissions*: An equally important area will be to identify leading innovations that are delivering cost-effective or profitable reductions in greenhouse gas emissions and investigate ways to enhance the uptake of such options (Halliday, Hart, and Ahuja, 1996; Lovins *et al*, 2002; Pears, A., 2004; The Climate Group, 2005; von Weizsäcker, Hargroves *et al*, 2010). However, to achieve such a future this platform needs to be harnessed to address. This may involve:
 - Identifying innovations in the economy that are leading to meaningful reductions in greenhouse gas emissions.
 - Identifying common barriers to greater uptake across the economy and within particular sectors.
 - Identify methods to reduce such barriers and foster innovation in a way that enhances sector and economy wide capacity.

In order to consider interventions in these two key areas it is important to understand that the outcome must be a scenario where economic growth can continue to increase, in the short to medium term, while the associated pressure on the environment reduces, as shown in Figure 1.

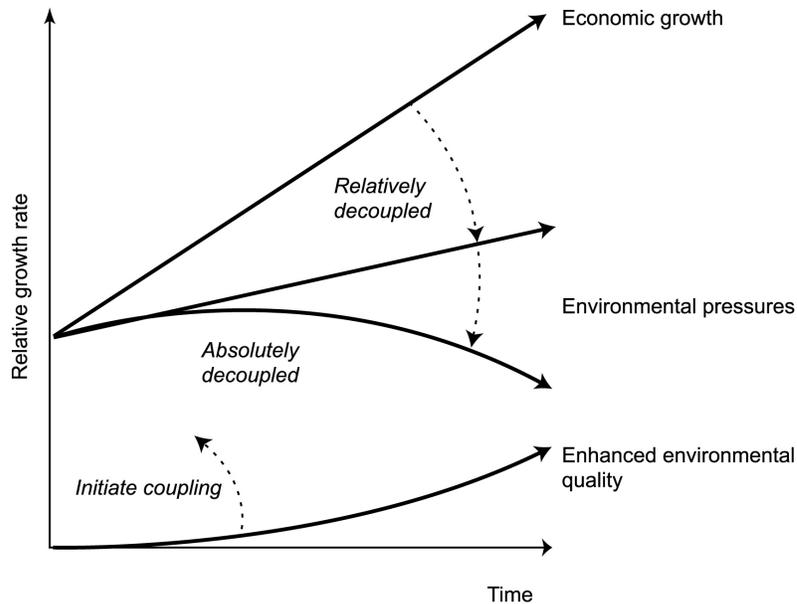


Figure 1: Conceptual and stylised representation of a decoupling graph (Source: Smith, Hargroves, Desha, 2010)

Responding to Climate Change with War Time Urgency

It may be the case that the response to climate change is the first time that an economy wide shift has been called for based on concerns of future impacts of current practices, rather than emerging from the lure of enhanced profitability of new technology and process advances. Furthermore, not only is the type of innovation being specified to require low/no greenhouse gas emissions it is being called for as a matter of urgency, presenting a significant challenge, with Hekkert *et al* (2007) reflecting that *'Increasing the innovation speed at a national level is a highly complicated process, yet influencing the innovation direction is even harder.'*

In previous decades innovation has focused on the potential for creating short-medium term economic gains with the option to externalise environmental and social impacts, such as greenhouse gas emissions (Dunchin and Lange, 1994). The challenge of responding to climate change is that innovation will need to deliver solutions to these previous externalities while also delivering continued economic growth, and in doing so avoid medium to long term impacts on the economy and society from such externalities. This will be a significant challenge and without appropriate interventions it is likely that the market will 'cherry-pick' the most profitable sustainable development technologies and then turn to more lucrative technologies in areas such as on nano-technology, augmented reality, defence technologies, or genomics - which despite the potential for them to contribute to low greenhouse gas emissions outcomes may detract investment from finding and implementing low greenhouse gas emissions solutions.

Hence there are valid concerns about the viability of transition to low carbon societies being achieved using the same mechanisms and relying on the same drivers that were

used to create the previous paradigms, hence new approaches will be needed. When considering such a transition to sustainability Geels (2011) suggests that *'researchers need theoretical approaches that address, firstly, the multi-dimensional nature of sustainability transitions, and, secondly, the dynamics of structural change.'*

The key to achieving a low fossil-carbon transition is a focus on overcoming what Unruh (2000) referred to as *'lock-in mechanisms'*, with Geels (2011) reflecting that, *'With regard to structural change the problem is that many existing (unsustainable) systems are stabilized through various lock-in mechanisms, such as scale economies, sunk investments in machines, infrastructures and competencies... Additionally, consumer lifestyles and preferences may have become adjusted to existing technical systems. These lock-in mechanisms create path dependence and make it difficult to dislodge existing systems'*. Such lock-in mechanisms present a significant barrier to achieving low carbon transitions and are in part responsible for the slow progress the world has made on reducing greenhouse gas emissions.

In order to swiftly free up lock-in mechanisms efforts need to be made at the structural level of the economy, which will have far reaching implications, with Freeman and Perez (1988) pointing out that, *"Certain types of technical change have such widespread consequences for all sectors of the economy that their diffusion is accompanied by a major structural crisis of adjustment, in which social and institutional changes are necessary to bring about a better match between the new technology and the system of social management of the economy – or 'regime of regulation'. Once, however, such a good match is achieved a relatively stable pattern of long term investment behaviour can emerge for two to three decades."*

To date there is little precedent for addressing *'lock-in mechanisms'* across an economy to create avenues for preferred technologies or processes to be mainstreamed, with the closest being that of war time urgency. Smith, Hargroves, and Desha (2010) point out that the Second World War triggered a shift and significant structural change process in the US economy, pointing out that *'In the period 1939–1945, unemployment in the USA fell from 14.6 percent to 1.9 percent, and GDP grew 55 percent.'* (Smith and Hargroves 2010). During this time a bipartisan national approach was implemented with *'war-time'* urgency, and involved significant co-operation across the economy. Although there is a great deal to learn from this period of industrial development, the challenge faced by climate change is that it is gradual and its early impacts are easily ignored, unlike the events of Sunday morning, December 7, 1941.

Hence, it is clear that government, working with business, universities and the community, can rapidly transform the focus of an entire economy, and that a key part of any agenda to significantly reduce greenhouse gas emissions will be the rapid innovation and development of low greenhouse gas emissions technologies and practices across all sectors of the economy. This will require the development of a range of complimentary measures through a portfolio approach, and will need full commitment from governments, the private sector, and civil society if it is to yield meaningful results in the coming decades.

Taking a structural change agenda to achieve the low carbon transition

Further to war-time urgency a further example of swift economy wide changes is that of conditional lending, typically by the IMF and the World Bank, through what are known as 'Structural Adjustment Programs' or SAP's. It is here that we find a strong model for informing economy-wide strategic interventions to transition society to low greenhouse gas emissions, which has been largely overlooked in the past due to its poor environmental and social outcomes. The key elements of such an approach include:

- Changes to the level of taxation,
- Controls on inflation,
- Stabilising of investments,
- Devaluation of local currency,
- Privatisation of government assets and industries,
- Reduction of wages,
- Reducing government expenditure (typically on health, education, and social welfare) and subsidies,
- Lifting trade restrictions and reducing local business protections, and
- De-regulation of industry (typically related to labour protection and environmental requirements) to reduce production costs.

According to the IMF (2006), structural adjustment is focused on '*changing the way in which an economy is organized in order to raise productive capacity*'. Hence the application of structural adjustment is effectively undertaken to secure sustained productive capacity and income for a country in order to service a development loan. However this goal is often hindered over time by a number of medium to long term social and environmental impacts that affect the economy, such as the rapid liquidation of natural resources for profit and the increased use of fertilizers and pesticides to boost agricultural production, and hence it draws heavy criticism. The challenge lies in the fact that much of the application of structural adjustment mechanisms has been based on methods that have had success in the past, rather than in creating methods that will have success in a carbon constrained future. This has led to a focus on resource profiteering and although this can provide wealth creation opportunities in the short term by increasing exports of natural resources it undermines longer term economic development.

Hence in order to '*raise productive capacity*' (IMF, 2006) of economies over the coming decades it is clear that efforts need to be focused at a structural level with the reduction of greenhouse gas emissions as a core operating principle. Rather than focusing on increasing productive capacity to generate greater revenue through fiscal structural adjustment, an agenda of carbon structural adjustment would encourage economic development in a manner that reduced greenhouse gas emissions, this may involve a re-

casting of mechanisms used in structural adjustment programs, many having direct implications for cleaner production related technologies and processes, such as:

- *Financial Mechanisms*: Rather than focusing taxation on employees and business income, a carbon structural adjustment approach would follow the recommendation presented in '*Natural Capitalism*' (Hawken, *et al* 1999) and '*Factor 4*' (von Weizsäcker, E., *et al* 1997) to shift the focus to resource taxation that places an additional price on the use of resources that resulted in undesired environmental and social impacts that will have a direct impact on economic growth. According to Hawken *et al* (1999), long time advocates of this approach, '*Shifting taxes towards resources creates powerful incentives to use fewer of them.*' Further, subsidies would be shifted from supporting fossil fuel based energy to supporting renewable and low greenhouse gas emissions alternatives.
- *Minimum Performance Standards*: Rather than a focus on the deregulation of industry sectors to create opportunities for short term greater wealth generation, a carbon structural adjustment approach would create regulation and policy that is designed to drive innovation in industry to profitably reduce greenhouse gas emissions, while capitalising on this innovation in the world market in the form of carbon trading or increased exports in technologies and expertise.
- *Research and Development*: Rather than resulting in cuts to government programs and spending on research and development activities, a carbon structural adjustment approach would encourage governments to invest in industry led research and development in the area of low carbon technologies and processes.
- *Industry Development*: Rather than forcing business to look to options for short term profit, even at the cost of medium to long term economic opportunities, a carbon structural adjustment approach would see governments providing consistent policy structures and associated assistance for industry and business to benefit from the uptake of low greenhouse gas emissions technologies and practices in collaboration with industry groups.
- *Curriculum Renewal*: Rather than reducing spending on education a carbon structural adjustment approach would support a comprehensive renewal of education programs to align them with the goal of achieving economic growth and a significant reduction in greenhouse gas emissions.
- *Skills Development*: Rather than focusing on the export of raw commodities, a carbon structural adjustment approach would focus on opportunities for value adding to raw commodities to create increased wealth generation through increased exports of low greenhouse gas emissions technologies and expertise.
- *Behavior Change*: Rather than inflict the community with a higher cost of living, increased unemployment, and reducing social welfare, a carbon structural adjustment approach would focus on supporting communities to reduce fossil fuel demand in a

way that delivers energy cost savings, reducing the economic burden from energy. (See McKenzie-Mohr, D., 1999 for further details)

There is much work being done to encourage a transition to low carbon societies and it is assumed that this, combined with the mounting evidence of the impacts of not taking such action, will result in a serious call in the coming decade/s for economy-wide structural approaches. When such a call is made it will be important to undertake a strategic process to identify specific areas of the economy to adjust, establish the value in doing so, identify barriers and enablers, select tools and interventions, and develop a strategy specific for each economy and its sectors. This new form of economic development would focus on bringing about a rapid reduction in greenhouse gas emissions in a manner that underpins and supports economic growth and increased societal well-being. A key focus of such an approach will be to encourage the greater development and uptake of low greenhouse gas emissions technologies and processes.

'Directed technological change should not be conceived as picking winners, but as making sure the market has enough winners to pick from to achieve cost-effective low-carbon outcomes. While directed-technological change is essential to meeting the challenge of deep decarbonization, there are many alternative technologies under development now and that may emerge in the future... Efforts aimed at building public support and acceptance for key technologies will also play an important role.'

Pathways to Deep Decarbonisation Project (SDSN and IDDRI, 2014)

In order for such an approach to be successful it will need to draw on lessons learned over the last two decades from efforts to progress the sustainable development and climate change response agenda's and merge this knowledge into an economy-wide structural change agenda.

Developing a Carbon Structural Adjustment Roadmap

The following part is based on a model developed by the Author and presented in In order to inform the development of carbon structural adjustment strategies the following steps are recommended for each of the structural areas: (Hargroves, 2017).

- 1) *Identify Key Aspects of Areas to Adjust,*
- 2) *Identify Potential for Value Creation,*
- 3) *Identify Steps, Enablers, and Actors,*
- 4) *Identify Roadblocks, Challenges, and Delays,*
- 5) *Identify and Map Tools, and*
- 6) *Develop Strategic Approaches.*

By mapping this approach to key structural areas a 'Carbon Structural Adjustment Roadmap' can be created that provides a framework for achieving a low carbon transition

in a manner that significantly reduces greenhouse gas emissions while strengthen economies, as shown in Figure 2.

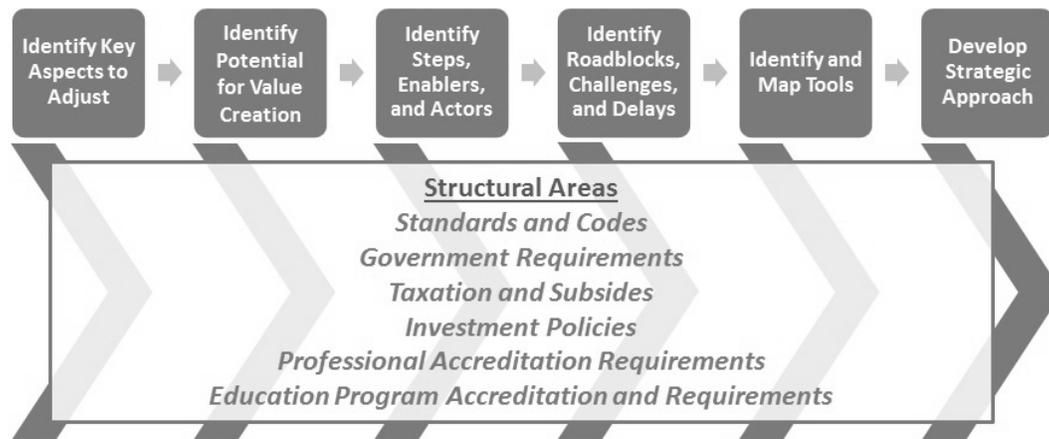


Figure 2: Schematic of Key Elements of a Carbon Structural Adjustment Roadmap
(Source: Hargroves, 2014)

Each of the first 5 steps create the momentum, understanding, and framework to undertake structural adjustment in each of the structural areas. The sixth step then focuses on the creation of strategic approaches and in order to inform the identification of priority activities it is recommended that two factors be considered, a) the likely 'Carbon Impact Factor', and b) the likely 'Willingness to Adjust'. (Hargroves, 2015) According to Hargroves (2017) '*The carbon impact factor takes into account the impact on the greenhouse gas emissions ... and the willingness to adjust takes into account the roadblocks, challenges, and delays ... along with a range of other considerations including gauging political will, potential business and industry support, and community views*'.

The Carbon Impact Factor is important to demonstrate the potential greenhouse gas emissions savings for various structural adjustment activities. The willingness to undertake structural adjustments however is a more complex variable, however the willingness to adjust each structural area can be influenced, such as: (Hargroves 2017)

1. *Standards and Codes:* The willingness to adjust standards and codes can be influenced by the development of voluntary programs that build industry support and create experience to road-test potential changes (Price and Yun, 2003). This may be influenced by demonstration projects for new technologies or practices.
2. *Government Requirements:* The willingness to adjust government regulations can be influenced by community behavior change programs that can build voter support for action towards reducing greenhouse gas emissions.
3. *Taxation and Subsidies:* The willingness to adjust taxation and subsidies can be influenced by providing transparency on the payment of subsidies and the impacts on the economy. Furthermore, understanding of the various options for adjusting such

structures can provide clarity on the feasibility of using them to encouraging activities that reduce greenhouse gas emissions.

4. *Investment and Procurement Policies:* The willingness to adjust investment and procurement policies can be influenced by industry associations through the development of a voluntary industry led sustainability rating tools for infrastructure sustainability, such as the Infrastructure Sustainability Rating Tool in Australia (Hargroves, 2014; ISCA, 2014) that can lead to the inclusion in request for tenders of the nomination of a minimum rating to be achieved by the project.
5. *Professional Accreditation Requirements:* The willingness to adjust professional accreditation requirements can be influenced by providing the industry or sector with evidence of the value of ratcheting requirements in-line with advances in technology or processes. Furthermore an indication of the interest in such professional attributes by major employers in the sector can influence the emphasis placed on particular areas.
6. *Education Program Accreditation and Requirements:* The willingness to adjust education programs can be influenced by programs to recognize and reward leadership in the coverage of low greenhouse gas emissions related topics in programs. (Byrne *et al*, 2013)

Hence greater consideration needs to be given to potential opportunities to increase the willingness to adjust structural areas across economies in order to achieve a transition to low greenhouse gas emissions.

Conclusion

The 21st Century will be seen as a period in the history when the impacts of its civilisations on the world's biosphere rose to a level where it changed the conditions of life on Earth. Humanity is at a point in its development that offers the most sophisticated and technologically advanced platform upon which to tackle large scale complex problems, one that has the potential to underpin a transition in the coming decades to a global society that is able to sustain its preferred living conditions (Smith, Hargroves, Desha, 2010). To achieve such a future this platform needs to be harnessed and directed to address the significant complexities involved in reducing greenhouse gas emissions, along with other pressing environmental and social challenges. In order to achieve significant reductions in greenhouse gas emissions globally a structural change approach needs to be designed to induce a new wave of innovation, with strong collaboration between governments, the private sector, and civil society.

The response to climate change will result in the first wave of innovation that has been called for based on concerns of future impacts of current practices rather than emerging from the enhanced profitability of new technology and process advances. There are valid concerns about the viability of such innovation being autonomously established in time to avoid dangerous climate change using the same mechanisms and relying on the same drivers that were used to create the previous waves. In order to induce changes across

economies to significantly reduce greenhouse gas emissions effort needs to be made to build on precedent for government working with business, universities, and the community, to rapidly transform the focus of entire economies.

Given the representative democracy nature of the governance system in many countries, combined with the structure of market based economies, it is unlikely that despite identifying areas of various structures across the economy that need adjustment that efforts will be undertaken in the short term. In order to accelerate changes to structures of the economy to deliver reductions in greenhouse gas emissions not only do such changes need to be carefully designed and implemented, such as through implementation of the Carbon Structural Adjustment Roadmap, but the willingness to do so must be increased.

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