



AUSTRALIAN
CONSERVATION
FOUNDATION

FUTURE ECONOMIC THOUGHT

DISCUSSION PAPERS

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FOREWORD

ACF is seeking to engage an influential audience at this critical time to discuss the idea of transforming the economy to one that focuses on ecological sustainability, human and environmental wellbeing and resilience.

Our aim is to advance thinking on:

- the steps that are needed to map out pathways for transforming our economy to one that is environmentally sustainable and maximises well being;
- the most promising ideas for transforming how government and private decision-making is undertaken, with attention both to formal public policy processes and informal or political cultural influences.

ACF has commissioned discussion papers by Dr Richard Denniss, Executive Director the Australia Institute, and Richard Sanders, ecological economist and environmental scientist to facilitate this discussion. They outline leading thinking from around the globe on economic transformation, provide a theoretical underpinning of the unsustainability of current economic policy and identify key public policy areas where change is crucial for transformation.

The discussion papers are intended to inform both ACF's internal work program and through a later public release, inform a broader public discourse on these crucial issues.

Please find enclosed the two discussion papers. These are not yet for public release, and may still be further edited.

The objective of the roundtable on the 10th June in Sydney is to discuss the key promising ideas for economic transformation, informed by these discussion papers as thought starters, and set in place a pathway for enacting this well needed transformation.

ACF intends to create an ongoing dialogue and actions to progress this transformation of our economy.

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DISCUSSION PAPER 1: RICHARD DENNISS

INTRODUCTION

The goal of sustainability has been a dangerous and destructive distraction for both citizens and policy makers concerned with the development of a society that protects our natural environment and promotes the wellbeing of our citizens.

This paper argues that the goal of sustainability needs to be abandoned in all but its broadest metaphorical sense. That is, while the concept of leaving the same environmental and social assets for the next generation that we inherited ourselves is an essential element of a just society that, it is time that the rhetorical and policy framework that has built up around the term sustainability was cast aside.

The pursuit of a 'sustainability agenda' was well intentioned and had the potential to unite environmentalists, governments and businesses in the pursuit of significantly improved environmental outcomes, but it has achieved little and is increasingly acting to conceal rather than reveal the fundamental policy and behavioural problems that are damaging both the environment and society. Rather than fight to reclaim the meaning of the term sustainable from those who wish to use it to describe their uranium mines, their coal fired power stations and their aluminium smelters this paper argues that the pursuit of sustainability should instead be replaced with a fight against unsustainability.

In a perfect world, with perfect foresight and perfect information the pursuit of sustainability and the fight against unsustainability would be opposite sides of the same coin. However, in a rapidly changing world, when we have imperfect knowledge about our ecosystems, and no idea what problems and opportunities we will face in 20 years time, the two goals become fundamentally different.

Rather than seeking to define with precision exactly the kind of 'sustainable' transport, housing, manufacturing, consumption and agriculture systems we want in 50 years time, significant improvements in both environmental sustainability and personal wellbeing could instead be achieved via a focus on preventing the growth of unsustainable practices.

The avoidance of unsustainable activities, rather than the pursuit of sustainable activities, can be pursued at the macro level as well as at the sectoral level.

The same argument can be applied at a much broader level. Rather than trying to define what national wellbeing or sustainability is, or what rate of GDP growth is consistent with sustainability, significant gains can instead be achieved by simply accepting that a possible consequence of preventing some developments from proceeding is a slight reduction in the rate of GDP growth. Put another way, reducing GDP growth should not be an objective in itself, but the argument that the destruction of an ecosystem could help create jobs should be seen from the same point of view that abolishing occupational safety standards might help create jobs – i.e., irrelevant.

EXPONENTIAL GROWTH – THE LOGIC OF THE CANCER CELL

The pursuit of economic growth has, over the past 60 years, become a useful proxy for the pursuit of the national interest. Whereas political debate once raged about the kind of society that was desired, the distribution of income between workers and capitalists and the

role of morals in either constraining or advancing the wellbeing of citizens contemporary debate in Australia is focussed primarily on the rate of growth in the amount of things that are bought and sold, that is, it is focussed on the rate of growth in Gross Domestic Product (GDP).

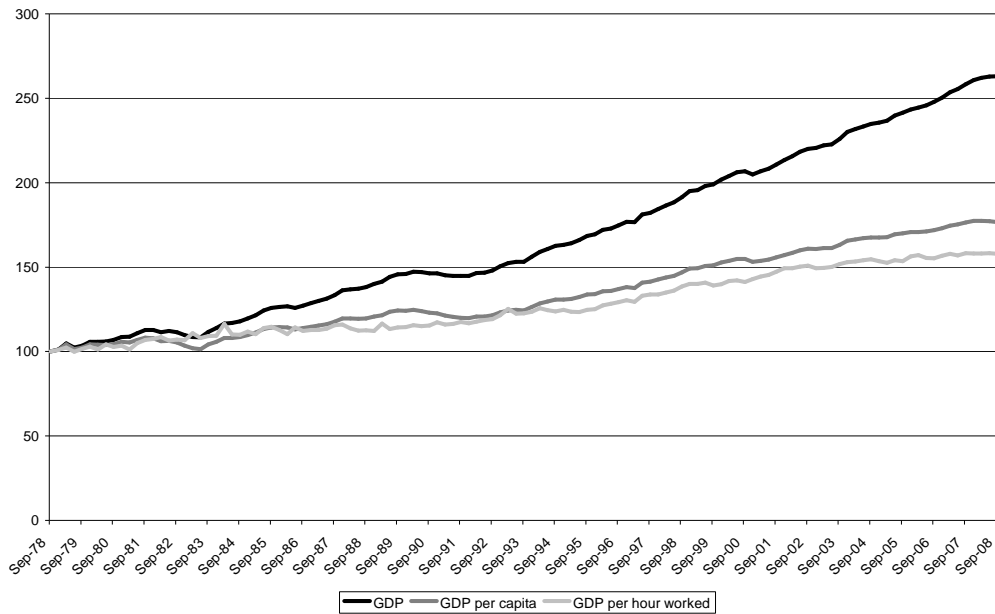
The measurement of GDP provides citizens and policy makers with a wide range of interesting and important data, including how many things were built, how many things were imported, how many things were exported and the dollar value of all these things. Given the high degree of correlation between the values of all these things and the number of people employed to build or provide them GDP also tells us much about the likely levels of employment and unemployment. All in all GDP is quite an important measure.

GDP is not, however, in any way related to wellbeing, happiness or progress. It is not even highly correlated with productivity or competitiveness. Again, all it tells us is how many things were bought and sold. In isolation GDP tells us nothing about the number of people employed in making all those things, how much better (if at all) they were at making them compared to the past, the amount of natural resources destroyed in production of those things, whether the things produced were destined for those with the greatest need or those who already have abundant things, or even whether the things most desired by society (whatever those things may be) are being produced in greater or lesser quantities. In short, GDP tells us nothing about progress except whether we have succeeded in the goal of making more things and selling them.

That said, while GDP growth cannot be interpreted as 'progress', nor can the absence of GDP growth be interpreted as evidence as achieving sustainability. The rate of growth of GDP is best interpreted as the residual effect of a wide range of individual decisions. If lots of people decide they want to spend more time being paid to make things and less time engaged in leisure then we can say nothing more certain about the impact of this decision on national wellbeing than that there will likely be more things produced and less time to enjoy them.

The Australian economy has grown steadily over the past 50 years. While there have been periods of slightly above and below average growth, there have been very few periods of recession (defined as two successive quarters of negative economic growth). While the current economic circumstances are likely to result in a period of recession, both domestically and internationally, it is important to place this downturn in an historic context. As Figure 1 shows, the level of market output in Australia (GDP) has grown substantially in recent years. Importantly, as Figure 1 makes clear, the level of market output per person, and per hour worked, has grown much more slowly than the level of market output for Australia for two simple reasons. First, more Australians are working than ever before, and Australians are working much longer hours than was once the case.

Figure 1: Growth in GDP, GDP per capita and GDP per hour worked 1978-2008



The data in figure 1 illustrates the trend growth in the level of GDP, the level of GDP per capita and the level of GDP per hour worked. All three measures are represented as index numbers, with a base year of 1978, making it easy to interpret the relative growth in each of those indicators over time. The figure shows that while GDP has grown by more than 250 per cent, GDP per capita grew by 174 per cent and GDP per hour worked rose by 157 per cent over the same period. In short, this data shows that much of the economic ‘miracle’ in Australia has been driven by the fact that more Australians are working, and are working harder, than has ever before been the case. The fact that GDP has grown by more than 250 per cent in the last 30 years is neither evidence of progress or productivity growth, on the contrary, it is simply evidence that more and more Australians are spending a greater proportion of their time producing market goods and services and less time producing goods and services in their homes and less time enjoying leisure.

While one of the outcomes of all this increased work effort is increased market output, which provides an increased capacity to overcome shortages of material goods such as food, clothing and shelter, the costs associated with this increase in work time are typically ignored in commentary and analysis about the state of Australia. For example, as the number of households with two full time workers increases so to does the demand for commercially provided cooking, cleaning and child caring services. There is also a significant reduction in leisure time associated with the pursuit of increased paid work.

This is not to say that individuals and families may not be better off undertaking paid work and, in turn, contracting out the provision of a range of household services. Rather, it is important that the financial and non-financial costs of such choices are well understood both by individuals and policy makers. Consider the following example:

A couple decides that they will shift from having one parent in full time work and another parent taking on the primary responsibility for caring for their children and looking after their home to having two parents in full time work. The addition of an extra full time worker to the labour supply means that the market sector of the economy can increase its output, which will be measured as an increase in GDP. Further, the increase in demand for take away food, house cleaning and child care will also lead to an increase in GDP. But the reduction in the value of household work (including cooking, cleaning and child caring) will not be measured as it was not ever 'market' activity and similarly, and reduction in leisure time or increase in stress associated with juggling two full time workers in the house will be ignored in the measurement of GDP.

The purpose of the above example is not to suggest that household work is good and market work is bad. For many people the opposite is indeed the case. However, while there is much discussion about the need to 'balance' work and family life the current measurement of GDP results in a form of double counting on one side of the ledger and no counting on the other side. That is, rather than balancing the increase in market output associated with increased work against the reduction in the value of non market output the conventional approach (i.e. the measurement of GDP) is to include both the wages that the parent earns, and the wages of all the people who now provide services to the home as an increase in national income, while completely ignoring the reduction in household production and amenity.

This skewed approach to measuring 'growth' is not just limited to the problems of unpaid household work; the destruction of environmental assets, reductions in social cohesion and increasing income disparities are similarly ignored.

Consider the following example:

A logging company is allowed to take old growth logs from a forest at no charge. They convert those logs into \$1 billion worth of timber and woodchips. In calculating GDP the value of the timber and woodchips is included, but the value of the forest that has been destroyed is not deducted.

As with the previous example, the above example shows that GDP provides an unbalanced mechanism for measuring the net contribution of some activities to the national 'wellbeing'. The unbalanced nature of this indicator ensures that policy decisions are often skewed towards the pursuit of economic 'development' and that environmental and social goals are only vigorously pursued when they are shown to facilitate further economic growth. As will be argued below, when there is an apparent trade off between the pursuit of a social or environmental goal and the pursuit of an economic goal it is the latter that typically takes precedence.

As the following quotations highlight, the limitations of using GDP as a measure of progress have been widely known among economists for more than 50 years.

The welfare of a nation can scarcely be inferred from a measure of national income.
Simon Kuznets

... sooner rather than later our concern with the quantity of goods produced – the rate of increase in Gross National Product – would have to give way to the larger question of the quality of life that it provided. *John Kenneth Galbraith, 1956*

The day is not far off when the economic problem will take the back seat where it belongs, and the arena of the heart and the head will be occupied or reoccupied, by our real problems - the problems of life and of human relations, of creation and behavior and religion. *John Maynard Keynes*

Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist. *Kenneth Boulding*

It is not enough to be busy. So are the ants. The question is: What are we busy about? *Henry David Thoreau*

Distinctions must be kept in mind between the quantity and quality of growth, between its costs and return, and between the short and the long run. Goals for more should specify more growth of what and for what. *Simon Kuznets 1962*

Despite the widely understood limitations associated with the use of GDP as a measure of progress, as the following quotations suggest politicians at all levels continue to prioritise its pursuit:

“The immediate and overriding priority for fiscal policy must be to support growth and jobs” *Prime Minister Kevin Rudd and Treasurer Wayne Swan*
<http://ministers.treasury.gov.au/DisplayDocs.aspx?doc=pressreleases/2009/010.htm&pageID=003&min=wms&Year=&DocType=0>

Mr Speaker, the longer our nation's economic challenges are neglected, the harder it will be to deal with them. In implementing our new vision for the nation's economic future, we don't have a moment to waste.

I'm confident Australians will see this as the Budget our nation now needs, to beat inflation, and lay the foundation for future growth.

It is the beginning of a long term plan to build a stronger economy that delivers for working families.

A coherent package of reforms based on four principles: honouring our commitments; delivering for working families; investing in the future; and beginning the new era of economic responsibility we need, to sustain growth in challenging times. *Swan 2008 budget speech*
<http://www.budget.gov.au/2008-09/content/speech/html/speech-07.htm>

The Government's top policy priority in the short term is to support economic growth and jobs.” *Bowen 2009*
<http://ministers.treasury.gov.au/DisplayDocs.aspx?doc=speeches/2009/002.htm&pageID=005&min=ceb&Year=&DocType=>

The following four goals will guide the achievement of the Strategic Plan and hence the plan for the future of the district.

GOAL 1: GROWTH

Plan for and facilitate sustainable growth and development. *Shire of Victoria Plains Plan for the Future of the District 2008*
www.victoriaplains.wa.gov.au/council/public_documents/PlanforFuture/file/at_download

As will be discussed in greater detail below, however, it is this very reluctance by those with decision making power to admit to the pre-eminence of the goal of pursuing economic growth that makes achieving 'sustainable' change so difficult. It is also argued below that without the existence of clear, well defined indicators to regularly highlight the (lack of) progress towards the goal of sustainability then it is unlikely that any substantial change to the existing decision making framework can be achieved.

THE (SUB)PRIMACY OF GROWTH

The pursuit of economic growth is a significant, not a singular, determinant of the policy goals and policy processes in Australia. For example, the maintenance of national security, and the maintenance of some individual rights (such as freedom of religion and the right to vote) provide examples of where the discourse of economics is rarely used persuasively. Consider the following hypothetical examples:

The Opposition today called on the Government to abolish the department of defence citing evidence from a cost benefit analysis carried out by Insider Economics. The cost-benefit analysis showed that when the \$25 billion spent each year on defence was assessed in context of the lack of any threat of invasion in the foreseeable future the Defence budget could simply not be justified. The Opposition Defence spokesperson said "its not that spending money is not a good idea in principle, it's just that when you think about how that same \$25 billion could be used to stimulate economic growth the numbers just don't stack up".

Or

The Government today called for the abolition of the tax free status of church based activity and for a substantial consolidation of the major churches in order to drive down costs and free up land and labour for more productive purposes. The Minister for Finance and Deregulation argued that 'at the moment what we see is a lot of valuable churches standing empty all week and barely half full on Sundays. Our plan to consolidate the churches will mean that there will be a lot of land freed up for more valuable purposes and with fewer priests talking to bigger congregations we will be able to free up some extra workers to contribute more to the economy. While its true that some church goers would prefer to keep things as they are, the fact is if we are to maximise the rate of growth we all have to become more comfortable with change,' he concluded.

As the above examples make clear, it is mistaken to believe that the pursuit of economic growth dominates all other political and policy considerations. On the contrary, non-economic arguments are used selectively, but persuasively, by governments, oppositions and interest groups on a regular basis. The question that must, therefore be addressed is why it is that such arguments have been largely unsuccessful in ensuring that governments pursue environmental sustainability and a broad wellbeing agenda rather than a narrow economic agenda? The following section suggests that the language of sustainability plays a major role in limiting the success of advocates for a better environment.

IS ANYBODY OPPOSED TO SUSTAINABILITY?

There is widespread community and political support for the 'goal' of sustainability as numerous polls have shown. That said, while there is general support for such goals, the

challenge is not to achieve general support, but to ensure that when particular decisions are being made by government the need to achieve broad goals takes precedence over the pursuit of economic growth. The problem with pursuing 'sustainability' or 'wellbeing' is not that it is hard to argue for as a principle, but that it is impossible to argue for in the particular. That is, it is easy for governments, property developers and even uranium miners to agree that sustainability and wellbeing are important, in general, but there is no reason that we society can't both continue to pursue such goals AND go ahead with just one more coastal development or uranium mine.

For example, Rio Tinto explains its role in the sustainable production of aluminium as follows:

Rio Tinto Aluminium in Weipa recognises its responsibilities to the unique environment and communities of the Western Cape that are impacted by its operations. Rio Tinto Aluminium Weipa is comprehensively involved in a number of projects to promote education, training, employment and a diversity of industry in the Western Cape region. The business supports partnerships that promote community growth and sustainability.

http://www.riotintoaluminium.com/localcommunities/296_524.asp

BHP is more explicit about the pre-eminence of maintaining their business operations:

For BHP Billiton, sustainable development is about ensuring our business remains viable and contributes lasting benefits to society through the consideration of social, environmental, ethical and economic aspects in all that we do... we adopt a holistic approach to business strategy, seeking to realise value for our stakeholders through a sustainable business philosophy.

<http://www.bhpbilliton.com/bb/sustainableDevelopment/ourApproachToSustainability.jsp>

The problem that needs to be overcome is as follows: Sustainability is a general concept and policy makers make specific decisions. There is, therefore, never a strong policy reason to reject a particular project that would increase GDP or employment in order to achieve a general goal of achieving sustainability or wellbeing. That goal can always be addressed separately (that is, later, and by someone else).

It therefore follows that if, as a society, we are to operationalise the pursuit of sustainability or wellbeing we will need to prevent developments that erode such goals rather than simply aspire towards projects that might deliver them. Put another way, pursuing 'worthy' projects, such as the construction of bike paths or tree planting is necessary in the pursuit of sustainability, but it is not sufficient. As well as pursuing such 'worthy' projects, we must also succeed in preventing further investment in those projects that undermine the broader goals.

Having identified the broad problem as being both the pursuit of sustainable policy solutions and the prevention of unsustainable developments the next issue becomes the identification of what is meant by sustainability.

Economist and Nobel Laureate Robert Solow defined a sustainable path as:

'one that allows every future generation the option of being as well off as its predecessors'

While the Brundtland report defined sustainable development as:

development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

In the words of the Commonwealth Treasury (2002, p. 1):

Sustainable development remains a contentious issue...partly because, beyond the basic idea, no common understanding exists of what sustainable development entails in practice, how it should be measured and how to develop policies consistent with the concept. Ideas differ about how best to promote human wellbeing as it applies to the current generation but also in terms of future generations' needs and preferences. In addition, no common understanding exists on how to balance economic, environmental and social considerations in a manner consistent with the concept.

The absence of a clear conceptual underpinning for sustainable development hampers implementation of the idea, as different stakeholders, at times, have formulated their own interpretations. From this point of view, policies that seek to balance competing uses of our resources may leave some unsatisfied.

There have, of course, been numerous attempts to define sustainability more effectively including the creation of the distinction between 'weak' and 'strong' sustainability (See Pezzey 1992). However, while the distinction between weak sustainability, in which all forms of capital are substitutes for each other, and strong sustainability, in which the maintenance of the stock of natural capital is pursued in its own right, is conceptually useful the pragmatic problems are still overwhelming. For example, apart from difficulties in placing a 'value' on the stock of natural capital, it is challenging, to say the least, for policy makers to overcome the problems of risk, uncertainty, the precise identification of critical thresholds and the weighting of different forms of 'natural capital'. In the set of economic accounts the relative weight attached to different forms of machinery is determined by the relative price of those assets. However, the assignment of different weights to different forms of natural capital is largely subjective. In the words of Treasury:

Assessing the overall state of the environment is difficult, as, unlike human-made capital, no numeraire exists that allows comparison of environmental assets. Consider, for example, the difficulty in aggregating individual environmental areas such as pristine wilderness areas, where some are improving and others are declining, as noted in the recent Australia State of the Environment 2001 report. Nor are there obvious weights to attach to different environmental assets. How do you compare a lake with a forest without a common measure of value? (*Treasury 2002*).

Suffice it to say, nobody has advanced an acceptable answer to this question.

HOW TO MEASURE UNSUSTAINABILITY

As discussed above, there have been numerous attempts to define and measure sustainability. While at a conceptual level it is difficult to achieve consensus on the precise notion of sustainability at the operational level it has proved virtually impossible.

Defining, and measuring, unsustainability on the other hand is much simpler. This does not mean that such efforts will be uncontroversial but there is little doubt that it is easier to define, and measure, the things that we seek to avoid than it is to predict, and measure progress towards, what it is we want as a society.

The Legal System

It is important to note the similarity between the conclusion that the pursuit of sustainability should be refocused towards the prevention of unsustainability and the underlying design features of the existing legal system. That is, as with most legal systems, the Australian legal system relies far more heavily on proscribing particular activities than on prescribing them.

For example, it is a crime to murder or assault another person, it is a crime to deliberately pour poisonous chemicals into a river and it is a civil offence for an individual to play loud music late at night or cover buildings in graffiti. While it is also an offence to not wear a seat belt, the overwhelming design principle of the legal system is to prohibit a small range of activities and allow individuals to take responsibility for the results of all other actions.

The pursuit of sustainability should, therefore, be seen as broadly analogous to the pursuit of social cohesion. Individual pieces of legislation (perhaps based on a charter of rights) should be used as a foundation for the prevention of unsustainable activities, but the effectiveness of such legislation needs to be carefully monitored to ensure that the net effect of the decisions made by individuals, local, state and commonwealth government officials is consistent with the stated goal. Any failure to achieve such goals should be seen not as a failure of individual decision makers, but of the decision making framework as a whole.

More importantly, the failure to prevent a rise in unsustainable activity needs to be seen as evidence of the need for policy change. That is, if crime rates rose year after year...you have to do something!

In measuring unsustainability what is being attempted is to define a limited list of measurable activities which are to be constrained if an increase in sustainability is to be achieved. As the following example shows, this approach is consistent with that used successfully in most countries to pursue social cohesion.

As discussed above, the task of defining and measuring progress towards sustainability has proven to be both conceptually and pragmatically difficult. Rather than being seen as a particular failure on the part of environmental thinkers this failure should instead be seen as consistent with the failure of thinkers in most spheres of endeavour to define 'progress'. Economists do not define what kind of economy they want to build in 20 years time, they simply describe what they see as the preconditions for success. Similarly, psychologists are loathe to tell people what they should do to make themselves happy, preferring instead to describe patterns of behaviour and ways of thinking that are more and less likely to be associated with subjective assessments of wellbeing. At its broadest level, philosophers have virtually given up on attempting to provide an answer to the question of 'what is the meaning of life', preferring instead to focus on the definition of 'meaning', 'life' and even 'what'.

Example: What is meant by sustainable transport?

Consider the goal of achieving a 'sustainable transport system'. While many authors have discussed the need to pursue such a goal, perhaps unsurprisingly they have failed to achieve consensus about what that might mean. The definition of a sustainable transport system is made difficult by a range of factors including differing notions of:

- The definition of sustainable
- The resources that need to be sustained
- The weights attached to different resources
- The timeframe over which resources need to be sustained
- The timeframe over which planning and investment decisions are being evaluated (eg is the city form seen to be fixed (short term) or variable (very long term))
- The technologies that are perceived to be available at the time
- The relative costs of potential technologies
- Social norms
- Assessments about social preference, political concern and the willingness of society to accept change

With these considerations in mind consider the difficulties of defining what constitutes a sustainable transport system for a city such as Sydney or Melbourne. These difficulties include:

- Are we mainly worried about the health impacts of particulate air pollution, greenhouse gas emissions, the impact of roads on environmental or cultural assets or the relationship between reliance on passenger cars on obesity?
- Are we trying to make changes in the next three years or thirty years?
- Do we think that society will value, and be willing to pay for, any changes or are the changes seen as an imposition and therefore must be very low cost?

If it is assumed that greenhouse gas emissions are the most important consideration, that changes must be made in the next three years and that there is strong community support for such changes then the 'sustainable' response would focus on rapidly reducing private car use through price and regulatory measures, a prohibition on investment in new roads and other infrastructure that underpins increased reliance on passenger cars and the provision of transport alternatives that can be rolled out in a short period of time such as mini-busses, busses, subsidised access to taxi, incentives to encourage transformation in working hours (eg people working 4 10 hour days commute 20 per cent less than people working 5 8 hour days).

However, if only one assumption is changed and the challenge becomes the definition of sustainable transport for a city that is primarily concerned with reducing greenhouse gasses

in the following three years but based on the absence of strong political support for such transformation the likely policy prescription would instead become to encourage individuals to switch their mode of transport in order to save themselves some money, encourage people to change their transport in order to improve their health, make minor investments in infrastructure (such as bike paths) to accompany rather than replace investment in additional roads and spend modest amounts of money advertising all of the above.

The main difference between the two approaches outlined above is that the first approach seeks explicitly to transform the transport system in ways designed to achieve a particular goal as an explicit objective of public policy while the later approach simply seeks to make the goal a sustainability a slightly more attractive option for those who would like to make sustainability an explicit personal goal.

Put another way, the first approach seeks to substitute an unsustainable transport system with a sustainable system, while the latter approach seeks to provide sustainable choices in the hope that the sustainable actions of some will offset the unsustainable choices of others. It is important to note that apparent desire of many advocates of sustainability for other individuals to choose to change themselves, rather than have such changes imposed upon them, has substantially limited the capacity of the environment movement to achieve substantial transformation.

In evaluating the success, or otherwise, of policies designed to achieve sustainability in the transport system the selection of criteria will be central. If the primary goal was to reduce greenhouse gas emissions then one approach would be to simply measure the greenhouse gas emissions associated with transport, with a reduction in unsustainable activity (greenhouse gas emissions) being interpreted as success.

Another, more common approach, however, is to measure any increase in expenditure on bike paths, increase in people walking to work, or even the simple existence of an advertising campaign designed to encourage changed transport behaviour, as successfully increasing the sustainability of the transport system. Such an approach is flawed for a number of reasons:

- Growth in the number of people riding bikes may have been dwarfed by growth in the number of people driving cars, or in the emissions of those people driving cars.
- There may be no lasting impact of an extensive advertising campaign, especially when at the same time expenditure on car advertisements is likely to have dwarfed any expenditure on walking/riding.
- Growth in expenditure on bike paths may have been dwarfed by growth in expenditure on roads.
- Population growth may have accounted for the growth in bike and foot travel while at the same time driving increased car use
- Growth in the amount of transport taking place, whether it is in the form of bike riding or car use, may be evidence of the continuing failure of city design.

While there is little doubt that a focus on any increases in the amount of sustainable activity that is occurring is likely to generate more 'good news', both for the government of the day and the advocates of such policies, there is also no doubt that such a focus on the good

news serves to conceal, rather than reveal, the underlying trends in the transport system as a whole.

An accurate assessment of the effectiveness, or otherwise, of policies to promote sustainability must be made by judging performance against the actual goal (e.g. reduced greenhouse gas emissions), not through reference to intermediate goals (e.g. increased bike usage) which may or may not be highly correlated with the actual goal.

While such an approach may be at odds with the desire of some advocates of sustainability to 'focus on the positives', there can be little doubt of the risks associated with the practice of focussing on small positives while the overall picture is largely negative. It is important to point out that while a strong desire to 'focus on the positives' will be unlikely to reveal the true picture of what is taking place, by virtue of this fact it will also attract a strong degree of support from governments and industry who do not share a desire to achieve transformational change. That is, those who seek to maintain the reliance on passenger cars, or who wish to avoid responsibility for constructing a substantial mass transport alternative are in no way threatened by a focus on the need to encourage people to change their individual behaviour. To that end, those who are comfortable with the status quo are likely to be enthusiastic advocates of policies that are unlikely to succeed.

Before moving on to discuss how sustainability of the transport system could be more meaningfully assessed it is important to make clear that policies to promote awareness and information, as well as policies to build alternatives such as bike paths are necessary to achieve the goal of sustainable transformation in the transport system, but they are not sufficient. That is, in the absence of strong policy measures to make increased car usage impossible to achieve the simple provision of information and increased 'choice' is unlikely to be effective. Consider the following analogy:

If a boat is being damaged while being driven at full speed through a shallow reef, patching the holes is a necessary condition to keep it afloat, but unless the speed is reduced and the course changed measuring the amount of repairs being undertaken will provide a poor basis for assessing the likely outcome.

Example: How to measure the unsustainability of transport?

The precise measurement, and relative weight, attached to measures of the unsustainability of the transport system will be dependant on the range of issues outlined above. However, as also argued above, the definition and measurement of unsustainability is conceptually and pragmatically much more straight forward. In order to measure the unsustainability of transport the following factors should all provide clear evidence of the extent, if any, of any transformation of the transport system:

- 1) Number of new cars sold
- 2) Number of cars registered
- 3) Average fuel consumption of new cars sold
- 4) Average fuel consumption of new cars purchased by government
- 5) Number of kilometres driven

- 6) Amount of fuel used
- 7) Length of existing roads
- 8) Amount spent on expanding (as opposed to maintaining) the road network
- 9) Land area covered by road paving
- 10) Value of land area covered by road paving

The ten indicators outlined above can all be unambiguously interpreted in the context of the goal of avoiding the expansion of unsustainable transport patterns with the possible exception of the measure of new car sales. That is, it could be argued that an increase in new car sales indicates a switch towards smaller, more fuel efficient vehicles which in the long run will result in a reduction in fuel use and greenhouse gas emissions. While this may indeed be the case, an analysis of the total number of cars that are registered should provide a simple test of such an assertion. Importantly, the potential tension between the number of new cars being sold and the measurement of 'sustainability' highlights the importance of the onus of proof discussed above. That is, if there is a clear list of indicators of unsustainability, such as that described above, then the onus is on the government, or the car industry, to provide proof that, contrary to the apparent evidence, society is moving towards a more sustainable outcome.

Consider the difference between focussing on negative indicators, such as those described above, and measuring a 'positive' indicator such as growth in the number of ultra low emission vehicles such as the Toyota Prius. For example, in the past three years the number of people intending to buy a Prius has increased five fold (Roy Morgan research 2009), which would appear to indicate a shift towards more sustainable transport decisions, when in fact governments are continuing to spend far more on roads than on public transport and, indeed, the number of new cars sold that are not ultra low emission vehicles dwarfs the number of 'good' cars sold. Similarly, while the growth in demand for the Prius can be hailed as evidence of increasing sustainability, the percentage of people expressing such demand has increased from 0.4 per cent to 1.9 per cent which implies that more than 98 per cent of the population is not acting 'sustainably'.

Other (good and bad) examples

In addition to transport, it would be relatively easy to develop indicators of policy failure for issues such as land use and energy. However, for some issues, such as biodiversity it would be much harder to develop such simple, unambiguous measures. The purpose of this section, and this paper, is to provide a brief summary of the issues associated with such measurement.

There is no doubt that, for some environmental issues, positive measures of progress may still be needed and, further, that for some issues no simple measures will ever be developed. That said, the argument being advanced here is that if we develop some simple and comprehensive measures of policy failure those measures will, if well designed, unambiguously result in policy and behaviour changes that will result in widespread environmental improvement.

Land use – while land use patterns are both complex to define and complex to measure, there are some forms of land use change that are unambiguously associated with policy

failure. For example, the rate of sprawl on the urban fringe of Australia's cities is unambiguously associated with poor urban design, increased energy use associated with transport and reduced habitat for native species. It is not necessary to specify exactly what a city should look like to specify the rate of growth, if any, in the surface area of that city that is considered acceptable.

Energy Use – There has been much debate about the relative merits of different policy instruments designed to reduce greenhouse gas emissions. While this debate is likely to be ongoing there is no reason that simple indicators such as total emissions from coal and total emissions from transport fuels. If these indicators are rising then policies are failing. We should not have to wait years to track our progress on such measures.

Biodiversity – as mentioned above it is not clear that it is feasible to develop a simple, and timely, indicator associated with biodiversity. This does not mean that biodiversity should not be of concern. Rather, it would appear that it is desirable to develop proxy indicators, such as land use patterns or extent of old growth logging, and link the growth of such indicators to the likely outcomes for biodiversity.

HOW TO USE MEASURES OF UNSUSTAINABILITY TO WIN THE PUBLIC AND POLITICAL DEBATE

While the notion that advocates of sustainability need to 'keep it positive' appears to have garnered widespread support in Australia, there is little evidence to suggest that it has been successful in achieving environmental or social transformation. This is not to say that there has not been widespread success in 'educating the population' about the importance of sustainability, or even in encouraging the widespread use of the language of sustainability. Indeed, as the examples taken from some of Australia's largest mining companies shows, everyone it seems supports the idea of sustainability.

Indeed, the acceptance of the goal, and the language, of sustainability has become so widespread the question must be asked 'is anyone opposed to the pursuit of sustainability?'. The answer, it would seem, is no. There is, however, quite specific and strident opposition to the idea that the concept of sustainability should be considered more important than the pursuit of any specific development proposal.

Consider, for example, the South Australian Government's response to claims that expanded use of acid leaching uranium mining was harmful to the environment:

The South Australian Government says expansion of the Beverley uranium mine will be good for the economy.

Acting Mineral Resources Minister Michael Atkinson says the Australian Conservation Foundation and Greens' environmental concerns about the expansion are ill-founded.

He says the Government is being responsible on uranium mining.

"This is South Australia's future - rather than the future of poverty that the Greens' policies would bring about," he said. *ABC Transcript*

<http://www.abc.net.au/news/stories/2008/08/28/2349517.htm?site=adelaide>

The use of positive language has, therefore, resulted in substantial changes to the words used in public debate, but it has arguably actually done more to muddy the waters of those debates rather than focus attention onto the problems that most need fixing. The use of measures of unsustainability can help to clarify the extent, if any, of our progress towards a sustainable society.

The reliance on negative indicators has a number of significant advantages when it comes to the goals of both achieving sustainability, and of increasing public support for the goal of sustainability. These benefits include:¹

Ease of measurement. The development of indicators such as the Genuine Progress Indicator (GPI), the Index of Sustainable Economic Welfare (ISEW) or even the ABS Measures of Australian progress (MAP) require large amounts of data much of which is unavailable, out of date or inconsistently collected over time. Perhaps the biggest problem associated with such measures is that their detail and complexity means that they can only be put together infrequently ensuring that in the contest for political and public attention they have little chance to dominate thinking in the way that monthly and quarterly releases of data on employment, GDP on inflation. Indicators of unsustainability are, on the other hand, freely available, frequent and easy to interpret. For example, data on fuel sales, new car sales and car registrations are available on a quarterly basis while data on expenditure on roads is available at least annually. Importantly, such data does not require complex analysis, interpretation or incorporation into any broader index for it to provide timely and accurate feedback on the (lack of) progress towards the existence of a sustainable transport system.

Ease of interpretation. Indicators such as the GPI and ISEW rely on a wide range of explicit and implicit weightings. The explicit weightings include the attempts to place a dollar value on things as disparate as loss of human life, loss of biodiversity and the value of peace and quiet. The implicit weightings flow from the decision to include a measure in the index or not. That is, if the value of biodiversity is considered too difficult to determine a price for and, in turn, it is excluded from the analysis then this is equivalent to an implicit decision to place a zero weight against the value of biodiversity loss. Significantly, if individuals or organisations seek to rely heavily on indicators such as the GPI or ISEW then they must first acquire in-depth knowledge about the construction, strengths and weaknesses of such indicators and, in turn, must be able to debate complex methodological issues which can be easily introduced by opponents to distract attention away from the underlying problem such indicators seek to highlight. The use of measures of unsustainable activity do not, however, suffer from this problem. To the extent that the data is seen to be independent and reliable the only issue that is up for debate is the desirability, or otherwise, of a growth or decline in an objective measure of societal behaviour.

Clear indicators force clear debate. As discussed above, the concept of sustainability has become so widespread (arguably debased) that it is virtually impossible to engage in meaningful debate about it. That is, there are very few major organisations or political parties who disagree with the notion that sustainability was desirable as it is much more rhetorically efficient to agree that it is desirable in principle while raising a range of

¹ The following list of benefits conflates pragmatic, philosophical, political and motivational benefits but the high degree of overlap between such categories renders any attempt at clear demarcation relatively meaningless.

pragmatic concerns about why the singular pursuit of sustainability is unhelpful in any particular instance. Data on the amount of new roads being built or the number of new cars being sold, on the other hand, can easily be used to force a debate on differing notions of sustainability, progress or growth. That is, data on indicators of unsustainability can easily be used to force a debate with those who see an increase in road construction and new car sales as providing evidence that Australia is 'on the right track'.

Measures of unsustainability are more flexible than measures of sustainability. In addition to the requirement to collect and analyse large amounts of data, the development of complex and comprehensive measures of progress require a high degree of definitional consistency over time if the results are to be meaningfully interpreted. That is, once you have defined what 'progress' is, it is essential to maintain that definition over time if progress towards it is to be measured. In addition to the pragmatic difficulties associated with this approach, there is a substantial philosophical problem associated with the idea that the functional form of progress can be determined in advance of the development of new technologies, social preferences or even the identification of some environmental problems. For example, it is unlikely that a definition of 'sustainable' developed in the 1980s would have placed much weight on the problem of climate change. However, if the goal of indicators is largely to avoid 'bads' rather than pursue 'goods' it is relatively easy to incorporate new measures of unsustainability as new data, or new problems, become apparent.

Flexible over time. Measures of unsustainability can be far more flexible over time than measures of sustainability. For example, as new problems emerge or old problems are solved the indicators used, or the attention paid to individual indicators, can be modified according to circumstance. When overarching measures of sustainability have been developed, however, such flexibility cannot be achieved due to the need to define progress towards a particular goal. If the goal is being regularly modified, the notion of progress is, by definition, being redefined.

Such a flexible approach makes it much easier to accommodate unexpected inventions, behavioural trends or environmental problems. For example, it is unlikely that 20 years ago climate change would have been at the top of most people's list of urgent sustainability issues. Similarly, the problem of waste disposal from the nanotechnology may or may not become a significant issue over the coming decade. The goal of avoiding the bad, rather than pursuing the good, requires much less foresight.

Consistent with people's desire to protect what they have. The notion of 'loss aversion' has attracted the increasing attention of economists and other behavioural scientists. Loss aversion is defined as the situation in which people fear losing something more than they value gaining something of similar value, for example, losing twenty dollars has been found to upset people more than winning 20 dollars cheers them up.

Numerous studies have found that most people are 'loss averse'. This presents an important opportunity in the framing of environmental messages. While there is no doubt that people are attracted by the idea of economic growth, if the things that they have to give up to achieve that growth are highlighted it is likely that they will be less enthusiastic than if only the positives of growth are communicated.

GDP can be challenged in the particular, not the general. By focussing on the impact of particular policy decisions (or non-decisions) on unsustainability it

is much easier to highlight the trade-off between a miniscule increase in the rate of economic growth and the concomitant reduction in environmental or social amenity.

Consistent with participatory democracy. The task of defining what is meant by sustainability and in turn developing specific proposals for achieving it is an inherently undemocratic process. That is, most Australians neither possess, nor desire to possess, expertise in city planning or ecosystem management, but this does not mean that they do not have strong and legitimate views about city design or land use patterns. It is very hard to include the thoughts and preferences of millions of people in the design of a 'sustainable city plan' or a 'biodiversity policy' but it is quite straight forward to ask people what kind of things they would like to see less of in their cities and what kinds of things they would like to see more of.

But don't we need to keep the message positive?

There is a strongly held view by some in the environment movement that it is essential that 'we keep the message positive', particularly when fundraising is involved. For example, the advertising company behind WWF's promotion of earth hour stated:

All of a sudden, global warming became a key media agenda item in 2006 and consequently public awareness about the issue grew dramatically. Most of WWF's competitors were using scare tactics to encourage action, whilst WWF Charity wanted to use positive messaging to empower the public.

While the strategy of avoiding the 'bad news' regarding climate change and other environmental problems may or may not be effective, there is no necessary conflict between a focus on avoiding unsustainable actions and the promotion of a positive message. For example, there is no reason for environment organisations to stop describing the kind of Australia, and planet, that they want. On the contrary, the depiction of such a positive picture of the transformed society is central to creating both awareness of, and concern with, the kind of negative indicators described above.

That is, at present data indicating that car sales have grown strongly is not likely to be of concern to many people outside of the automotive industry. However, if we are to transform the transport system it is essential for the public to understand that growth in car sales is actually a step away from the kind of liveable, low emission and safe city that we are trying to achieve.

The use of negative indicators should be seen as a way to highlight the barriers that stand between the society we have and the society most people say they want. Similarly, the use of negative indicators should be used to motivate both the public and politicians to pay attention to the (lack of) progress towards the stated goals.

Finally, if the environment movement is afraid to confront the public, or politicians, with the failure to achieve transformational goals then we have very little chance of success. As recent history has amply demonstrated, it is no longer difficult to convince governments to provide public commitments to our goals, but it has been virtually impossible to get them to stick to those commitments.

If the logic of 'keeping it positive' is that only positive messages motivate people we must ask ourselves 'what is the point of keeping people motivated if their motivation is not helping to achieve anything?'

WHERE TO FROM HERE?

The development of indicators of unsustainability have the potential to provide a significant impetus to change the direction of current policies and pursue, instead, the kind of transformation associated with enhanced environmental and social outcomes.

By ensuring that decision makers are held accountable, and the public is kept genuinely informed, measures of unsustainability have the capacity to build a bridge between the rhetoric of 'sustainability' and the reality of a transition towards a different society. But where to start.

The first step is to develop a small number of negative indicators that map easily onto an easy to articulate vision of social transformation. While the examples of transport, land use and energy were discussed above it would be worth while to undertake a scoping study to examine these and other options in greater detail.

The second step is for the ACF, and hopefully other environment organisations, to commit to using such indicators in both their public communication and their private discussions with policy makers. Such a step is essential in order to both build awareness of the role of such indicators as well as to signal to policy makers that there has been a significant shift in strategy. Rather than handing out praise to politicians who spend money on policies that may or may not be effective, the use of negative indicators would make it clear to policy makers that the price of praise is actual progress, not the completion of intermediate goals.

The third step is to convince the public, and policy makers, that the organisation best placed to collect such information is the Australian Bureau of Statistics (ABS). The ABS is an independent statutory authority that has both the resources, experience, and independence to collect *and release* the necessary data in a timely and authoritative manner.

The fourth step is demand that governments, at all levels, commit to achieving particular goals rather than particular policies. Consider, for example, the way in which the Reserve Bank of Australia (RBA) has been tasked with monitoring the data on inflation collected by the ABS and responding in a timely manner to ensure that inflation in Australia remains in the 2-3 per cent target range.

Both the ABS and the RBA are independent statutory authorities and the current and previous Commonwealth Governments have made it clear that they believe that keeping inflation in the range of 2-3 per cent is sufficiently important that if it appears to be rising the RBA is authorised to increase official interest rates at enormous costs to millions of Australian homes.

There is no reason that, if governments believed that climate change or other environment problems were sufficiently important that they could not create similar instruments of government policy. Indeed, the environment movement should recognise that as long as such machinery of government is absent it is clear that environmental problems are of a much lower priority than inflation

The final step is to be pragmatic, and forward looking, in the design and development of new indicators. This will be necessary as both new problems emerge and new technologies for monitoring are developed. As unintended problems, or opportunities, present themselves it will be necessary to revise and refine the negative indicators to ensure that they are, to the

greatest extent possible, unambiguously associated with the creation of the transformed society we seek.

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DISCUSSION PAPER 2: RICHARD SANDERS

"Ecological footprint" studies show that the total energy and materials needed to maintain and replace our artefacts has also vastly increased. As the world becomes full of us and our stuff, it becomes empty of what was here before. To deal with this new pattern of scarcity, scientists need to develop a "full world" economics to replace our traditional "empty world" economics. *Herman Daly, 2005.*

INTRODUCTION

Humanity finds itself in a planetary emergency, a 'perfect storm' of rapidly converging global crises that threaten the survival of human civilisation (Dunlop, 2006). These include: climate change (likely dangerous); sea level rise (possibly metres this century); ocean acidification; sixth major extinction event (ecological life support systems are going down); peaking of oil production; loss of soils; fresh water supplies; forest and fisheries; ongoing poverty and inequity (widening gaps) for a large proportion of humanity; and most recently the global financial crisis - to mention the most obvious symptoms.

Both UN Secretary-General Ban Ki-moon and Al Gore describe just one of these crises - climate change - as a planetary emergency. The rapid worsening of all these issues has been monitored in many reports including Warning to Humanity (1992), Millennium Assessment Report (2005), Stern Review on Economics of Climate Change (2006), Global Environmental Outlook 4 (2007), and the ongoing Assessment Reports of the Intergovernmental Panel on Climate Change (1990, 1995, 2001, 2007). These reports provide strong evidence that the condition of the planet continues to deteriorate in an alarming way. The reality is that the physical scale of the human enterprise has grown exponentially to the point where it is now about to overwhelm the ecological capacity of the Earth to continue to sustain us. Ecological footprint analysis shows we are living far beyond our ecological means and liquidating the planet's natural capital in the process (WWF, 2008). We are running the planet as if it were a business in liquidation.

Humanity is now at a crossroad - either we continue with 'business as usual' leading almost certainly to ecological and social collapse and the loss of many billions of lives - or we consciously choose survival and a new pathway into the future.

Ultimately, ideas are the human means of survival. The theme of the paper is that a fundamental disconnection between our currently held ideas such as economic growth and how the world works and the physical and ecological realities of our planet has brought us to this crossroad. In December 2007 Australia 21 brought together some leading thinkers to ponder the sustainability emergency. They concluded:

Underlying this global crisis, which threatens lives and livelihoods, is a failure of ideas: in particular a critical disconnection of the fundamental ideas (of amongst others politics, governance, economics, leadership, individual values, law, and technology) from the biophysical realities of our earth (Fisher, 2008).

It follows that the survival of civilisation requires that we reframe our ideas and conceptual frameworks by reconnecting them with the ecological realities of the Earth. In the same way that Copernicus's reconnection of thinking with astronomical reality (by shifting the Sun to the centre) freed western society from the power of the Church and the accepted social order and opening the way for the idea of progress to take hold. Reconnecting our thinking with

ecological reality can free us from 'business as usual' and provide the necessary insight to design our way to a sustainable society.

The phenomenon of worldviews lies at the heart of this discussion. A worldview is the unconsciously shared systems of beliefs that shape the way a society operates. The western worldview, and the institutions it has given rise to, are products of an outmoded 18th century view of reality that is completely disconnected from ecological reality. As the founder of the ecological footprint concept, William Rees (1990) argues:

... our current environmental dilemma is due to a much distorted perception of reality. Modern economic society operates from an outdated mechanistic perception of the natural dynamics of the Earth. If this premise is correct, our understanding of the environmental crisis is dangerously superficial, and the possibility of sustainable development based on the growth-oriented assumptions of neo-classical economics is illusory.

Some of the world's leading thinkers in the sustainability field go even further, questioning not only economic growth, but the very system itself. They have discussed overcoming what they see as the systemic roadblocks to sustainability in the following terms:

Our current socio-ecological regime and its set of interconnected worldviews, institutions, and technologies all support the goal of unlimited growth of material production and consumption as a proxy for quality of life. However, abundant evidence shows that, beyond a certain threshold, further material growth no longer significantly contributes to improvement in quality of life. ... Creating a sustainable and desirable future will require an integrated, systems level redesign of our socio-ecological regimes focused explicitly and directly on the goal of sustainable quality of life rather than the proxy of unlimited material growth (Beddoe, et.al., 2009).

These insights suggest that the root of the sustainability problem lie in our culture's system of worldviews, institutions, and technologies that is disconnected from biophysical reality and structurally orients human activities towards unlimited physical expansion. While well suited to the 'empty' world that gave rise to it, this regime is unfit for the now 'full' world and is maladaptive because it is 'locked in' by economic, political and technical inertia (Beddoe, et.al., 2009). If collapse is to be avoided, this inertia will need to be overcome to enable the shift a regime appropriate to a 'full' world, but as (Beddoe, et.al., 2009) point out, a regime shift "cannot occur without changing worldviews, institutions and technologies together as an integrated system". If this analysis is valid, then making such a regime shift is almost certainly a survival imperative for humanity. There remain only a few short years to make the regime shift that survival demands. The question is how this regime shift can be triggered and enabled.

Kuhn (1962) taught us that when the stories (or theories) that make sense of our world fail and new ones emerge that make better sense while also explaining the failure of the old ones. When this happens, a paradigm shift to the new stories (or theories) is possible. The global financial crisis and Alan Greenspan's (2008) admission that economists view of reality is not right and does not work, provides a unique opportunity for transformation because it throws doubt on the economic system and opens it to serious challenge and critical examination that in the past has simply been dismissed.

The objective of the paper is to canvas the key considerations requiring discussion in order to inform how the socioeconomic system can be transformed to improve human well-being while maintaining the ecological integrity of the planet. This is done from a 'big picture'

perspective that seeks to 'join the dots' in our thinking and show how the critical factors relate to one another.

Part One of the paper seeks to help understand the sustainability problem from the perspective of two very different worldviews. It evaluates how much sense these two contrasting perspectives make of the sustainability problem, which at root is concerned with how to achieve high levels of well-being from a relative trickle of nature's capital in order to live within the planet's carrying capacity. It shows that the conventional economic approach makes little sense of the current reality while the systems view makes a lot of sense and explains why the institutions of our outmoded 18th century worldview have given rise to the ecological emergency, to poverty and inequity in the world and to the global financial crisis. The conclusion of this section is that hope lies in adopting the new systems view of reality and institutions reflective of it.

Part Two develops and presents policy solutions to the sustainability emergency from the systems worldview perspective grounded in an ecological view of reality. An essentially ecological economic approach for achieving a sustainable economy and society shows how this can be achieved. It is grounded in what must physically happen in the world and ignores political reality in order to arrive at a technically valid solution. Some examples of current world's best practice are suggested as necessary but not sufficient stepping stones towards the necessary transition. Institutional reforms needed to realise this solution and the new ways we need to organise our society in order to remain ecologically viable are then spelled out.

Part Three examines ways in which the necessary transition can be realised politically. It revolves around ways to engage and mobilise society in the necessary transition. Essentially it requires new processes of public dialogue to educate and empower the citizenry to demand the necessary changes through the democratic process. No longer can the self proclaimed 'greenhouse mafia' and their ilk (Hamilton, 2007) be allowed to hold the future of civilisation to ransom. This discussion paper is intended as a contribution to the early stages of such a process.

PART 1: UNDERSTANDING THE PROBLEM

WORLDVIEWS - HOW SOCIETIES PERCEIVE AND THEREFORE ACT IN THE WORLD

Worldviews are unconsciously shared systems of belief that shape the way a society operates:

How a society relates to the world is profoundly affected by an elaborate set of unconscious "facts", unquestioned assumptions, and entrenched beliefs. These are derived from the shared experience of a people in the course of their social evolution and are transmitted culturally to each new individual as she or he matures in that particular milieu. Such a common philosophy or world-view shapes every culture's social relationships, its political institutions, and the nature of its economic enterprise (Rees, 1990, p.2).

A culture's principal tool of survival is its worldview, its conceptual map of reality. It is the consistent, comprehensive and interwoven explanation of everything that each language group has developed over time and transmitted from one generation to the next. It is the accumulated wisdom, passed down through the ages, of what works and what doesn't. It is

DISCUSSION PAPER

important to realise that the members of a culture are totally unconscious of their worldview and how profoundly it shapes their perceptions as evidenced by observations that people with different worldviews can experience the same reality in very different ways.

Institutions are a culture's norms and rules and include the structures that are common to all cultures such as kinship, economy, religion, governance and education. These both reinforce and reflect their worldview and are, therefore, inherently conservative, preserving the accumulated wisdom of the past.

However, when environmental circumstances change, or the culture outgrows its resource base, its worldview and associated institutions may need to adapt to the new reality, especially if they promote behaviours and outcomes at odds with the new circumstances. Historically, more than twenty cultures are known to have become unsustainable and collapsed (Tainter, 1990), almost certainly due to a failure or inability to adapt. As Beddoe, et.al, (2009) explain, this failure can be:

because of an absence of appropriate understanding of the situation or of institutions to mount a flexible response. Cultures become too locked-in to adapt to a changing environment; the ruling polity fails to establish institutions to respond to the crises; and decline occurs.

Such cultural 'lock-in' would appear to explain the current commitment to economic growth in spite of over 30 years of warnings that this will lead to disaster. Even the frightening warning by the chair of an IPCC scientific committee that we are now almost certainly facing six degrees Celsius of warming this century (Leake and Davis, 2009), and the evidence that oil and food production have peaked have not shifted the commitment to growth in the slightest.

In order to understand such cultural lock-ins it is helpful to gain some insight into the nature and power of worldviews. A very brief introduction is given to the western worldview followed by a deeper look at the emergent systems view of reality in order to set the context for looking at the sustainability debate which O'Riordan (1990) describes as "the clash of two worldviews".

THE COMPETING WORLDVIEWS

The Western Worldview

The western worldview has been the dominating force in human affairs for hundreds of years. The worldview forming the basis of contemporary western culture has evolved little beyond its origins in the thinking of Francis Bacon, Isaac Newton and Rene Descartes. Newton and his cohort understood the world as a clockwork machine created by God and running according to his natural laws. Descartes separated nature into the separate realms of mind and matter with the world of matter being best understood mechanically by dismantling it into ever smaller parts. Thus our worldview is often described as mechanistic and reductionist (Capra:1983).

The core beliefs of this worldview include the following ideas:

- Progress - the idea that humanity is on a trajectory of never ending material improvement and the idea that human ingenuity and technological advance can overcome any obstacle or limit imposed by nature

- The Market - the idea that the market organises society in a way that delivers the best of all possible worlds
- The Individual - the idea of supremacy of the individual as the primary locus of decision-making, and more recently, the idea there is no such thing as society (Thatcher, 1987).

These require little further examination since we are all familiar with these 'commonsense' ideas that lie at the heart of our culture. However, the emergent systems view of reality is not familiar and some of its key dimensions will now be introduced to align our thinking with this way of thinking.

The New Worldview - a Systems View of Reality

Over the past century, a new systems worldview or model of reality has been struggling to emerge with many of the breakthroughs occurring in the 1920s across a variety of disciplines including biology, quantum physics, ecology and psychology (Capra, 1996). As Ludwig von Bertalanffy, the founder of General Systems theory recognised, dealing with evolutionary thinking and life required a new science of complexity (Capra, 1996). The early foundations of this were the laws of thermodynamics, and according to the second law, any isolated or 'closed' system spontaneously changes in the direction of increasing disorder. This introduced the idea of the Arrow of Time - that the universe can not run backwards as suggested by Newtonian mechanics. A good illustration is the idea that a dropped and broken cup can never be restored to its original condition.

The systems model of reality embraces chaos theory, the theory of dissipative structures and of self organisation that make sense of the phenomenon of life. Capra's (1996) *The Web of Life: a New Synthesis of Mind and Matter* is a very good synthesis of the whole systems paradigm (or worldview) that is well grounded in the latest frontiers of scientific knowledge across a wide range of disciplines. The systems model of reality appears to have the necessary scope to firstly understand the nature of the sustainability problem in a meaningful way, and secondly, to illuminate possible ways forward.

The nature of the living world is that it is systemic - it consists of systems within systems within systems. Systems operate in accord with simple rules and principles and understanding these helps us to understand the way the world works. The living world is an expression of thermodynamic processes unfolding and one cannot understand the world meaningfully without understanding how it works thermodynamically. The living world evolves, indeed, it co-evolves as individuals, species and systems interplay through constant dynamic interactions all moving forward irreversibly in the direction of the arrow of time. Understanding the world in a historical evolutionary perspective puts everything into context which adds further depth to our understanding of how the world works. The following section elaborates on these three aspects of the systems view of reality.

A SYSTEMS APPROACH TO UNDERSTANDING SUSTAINABILITY

Unlike the western worldview which sees reality as a machine made of parts, the systems view sees the world as a living web of wholes nested within wholes. Koestler (1967) coined the word 'holon' to describe entities that are simultaneously both wholes and parts and their nested relationship as a 'holarchy'. Giampietro, (1994) applies this holarchic perspective to

sustainability, helping us understand the relationship of economy to society to ecology, while also illuminating how this helps us to understand the way the world works.

According to this theory, any holon (i.e. an entity or level) in a nested holarchic system displays two opposing tendencies that reflect its dual nature as both part and whole. On the one hand, as a whole in its own right, there is a tendency towards maintaining its autonomy. On the other there is the tendency of parts to operate in ways that maintain the integrity of the greater wholes of which it is a part. It is this latter tendency that holds complex systems such as human societies or ecosystems together. If the autonomy tendency of a subsystem over-rides its integrating tendency then the greater system or systems will break down.

From this perspective, economy is understood as being nested in society and society as being nested in ecology. These insights suggest that the economic subsystem must behave in ways that maintains the integrity of both the social and ecological systems of which it is part. It also suggests that if economic systems are behaving in ways that undermine ecological or social integrity (as would currently seem to be the case) then they must be modified so as to maintain both ecological and social integrity. This systems perspective suggests that the sustainability challenge is to adapt our social and economic systems and institutions to become consistent with maintaining ecological integrity. It also suggests that we need to identify what it is about our economic and social systems that are at odds with maintaining ecological integrity and thereby work out how they need to be modified.

This perspective also provides important insights into questions of governance and decision making. It suggests that economic decisions need to be ecologically and socially constrained. In other words, an economic decision should not proceed unless it improves social well-being *and* is ecologically viable in that it does not add to the cumulative impacts of economic activity on ecosystem viability. This is in contrast to the current view which assumes (if all externalities are included) that price reflects all these factors, thus ensuring socially and ecologically rational and desirable outcomes.

The systems approach also helps to understand the emergence of social complexity and the need for shared or mutually agreed norms or rules that limit individual autonomy in ways that maintain system integrity and are therefore, to the mutual benefit of all. Without governance to constrain individually rational behaviours that are socially and ecologically irrational if everyone pursues them, social, and ultimately, ecological integrity will unravel. In recent times with the emphasis on the rights of the individual within the freedom of the market, the central integrity maintaining role of government has been lost sight of.

The economic approach to reality assumes we live in a mechanical universe made of parts - where parts add up to the whole - a world of individuals that added together make up society. It sees the rights of the individual as paramount. It sees the sustainability problem as simply a matter of balancing competing economic, social and ecological considerations. On the other hand, a systems perspective suggests things are not quite this simple. And perhaps the systems view makes more sense even though it's not yet a part of our shared 'commonsense'. Perhaps the new story is beginning to make more sense than the old.

A Thermodynamic View of Reality

A thermodynamic view of reality is central to the systems perspective and understanding the essence of economic reality. While the natural tendency of the universe is to move towards ever increasing disorder and dissipation of energy and matter (called the entropic flow), the living biosphere moves in the opposite direction. Life (through photosynthesis) reverses the entropic flow, organising, structuring and concentrating matter and energy, thereby imbuing it

with the quality of low entropy which may be loosely translated as 'usefulness'. Through the eons of time this has created the complex dynamic world that we know today, including its atmosphere, soils and the web of life.

In order to survive, each any animal species goes about obtaining low entropy matter and energy from its supporting environment. How any animal species goes about obtaining its low entropy from its supporting environment can be thought of as its economic activity. For most species, the evolutionary wisdom of how to do this is imprinted in their genes. In contrast, humans rely on the transmission of knowledge to survive. Each culture develops its worldview or mythology (a story that makes sense of reality) through which its way of organising the relationships of its members (its social system) and its way of extracting low entropy or usefulness from the environment (its economic system) is passed from one generation to the next.

This ability to conceptualise and to transmit learned knowledge from one generation to the next differentiated humans from other animal species and has conferred an adaptive advantage on humans. Innovations such as the control of fire, tools, clothing and shelter have allowed humans, a tropical animal, to occupy some of the coldest regions of the planet. It has also enabled humans to invent their way around nature's limits or negative feedback loops.

HUMANS AS A STRAND IN THE WEB OF LIFE AND EVOLUTIONARY JOURNEY

In the course of the human evolutionary journey, the mode of economic organisation has evolved from hunting and gathering to agriculture and then to the industrial society.

In the period humans lived by hunting and gathering (of course some do still to this day) they were little different from any other animal species in their relationship with the broader web of life. Their numbers ebbed and flowed in response to the availability of food in their surrounding environments. In times of increased scarcity either their numbers declined or they migrated to greener pastures.

Then about 10 000 years ago a new mode of organization emerged - agriculture. Agriculture heralded the beginning of settlement and civilization. While hunting and gathering resulted in fairly minimal ecological impacts, agriculture involved quite significant interventions in, and disruptions of, ecological processes and systems. Indeed, Tainter (1990) has identified over 20 civilisations that have collapsed over the past 10 000 years, very often as a result of agriculture undermining itself and or the surrounding ecosystems. In many cases agriculture has degraded the landscape through salinisation (e.g. the 'fertile crescent' cradle of civilization surrounding the Tigris and Euphrates rivers), soil and nutrient loss (e.g. overproduction in the 'granary of Rome' in north Africa), and denudation of the surrounding landscape (e.g. the surrounds of eastern Mediterranean). While significant, these collapses were fairly localized and the civilization in question either migrated to be absorbed elsewhere or it disappeared if there was nowhere else to go.

The most profound shift in how humanity organized itself began a little over two centuries ago in the 18th century. Depending on the perspective, this shift is known as the Industrial Revolution, the Great Transformation (Polanyi), the Economic Revolution (Heilbroner) or the Ecological Transition (Bennett).

For Polanyi, the Great Transformation was the transition from a society where people met their needs through social relations, to an economy where people met their needs through

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economic relations. This involved huge dislocations in life including the enclosure of the commons which forced people to earn money in order to meet their needs.

Heilbroner's Economic Revolution was the emergence of the market system (as opposed to markets) as "a mechanism for sustaining and maintaining an entire society" (Heilbroner, 1980:25). As Heilbroner explains, until the seventeenth century, the market system could not even be conceived "for the thoroughly sound reason that Land, Labor, and Capital - the basic agents of production which the market system allocates - did not yet exist" (Heilbroner, 1980:25). Even the idea of gain for gains sake is a modern one - a concept Heilbroner points out was even foreign to the 17th century Britain of Sir William Petty who recorded men would only labour when necessary, preferring leisure to labour.

Bennett's Ecological Transition included the transition from societies where the only source of power was muscle power to the unleashing of unimaginably vast sources of fossilised energy. Without this vast source of energy it would not have been possible for humanity to transform the face of the planet in the ecologically unsustainable way it has. Indeed, it would not even be physically possible for the human population to grow to the present 6.5 billion. Smil (2002) showed that about 2.5 billion people alive today could simply not exist without the doubling of the planet's nitrogen cycle that has occurred through the production of nitrogen fertilisers made from fossil fuels. There is simply not enough biologically available nitrogen in the natural nitrogen cycle to make the protein of more than about 4 billion people.

The human capacity to invent a way around nature's limits is central to the sustainability story for it allows humans to temporarily far exceed the supportive capacity of their surrounding environment (or as is the present case, planet) in ways that other species can't. Tainter (1990) postulates that the human strategy for getting around nature's limits is to move to ever higher levels of social and technological complexity and increased food production. The problem with this strategy is that each increase in complexity requires a disproportionately greater per capita flow of resources to sustain that greater level of complexity.

The 'security' of increased food production also allows population to increase further multiplying the demand for resources to eventually unsustainable levels resulting in collapse. The sustainability lesson from Tainter is to avoid the strategy of increasing complexity. The collapse of any ecological subsystem is simply a return to increased simplicity and increased resilience (Gunderson and Holling, 2001). It suggests that in designing a sustainable society, simplicity may be a key design criterion to reduce per capita resource flows to sustainable levels.

The simple sustainability lesson from thermodynamics is that nature produces an essentially fixed rate of flow of low entropy matter and energy that spontaneously degrades with time. Humans, like all animal species, require a flow of low entropy to live. To use a mechanistic analogy, the biosphere is like a self-organising factory where the only input from the outside is sunlight. This factory is the web of life comprising all living things. It produces the conditions for its continuance and its plants produce a continuous flow of low entropy matter containing embodied energy by which it (each species and the whole) continuously reproduces itself.

Over the eons of time this low entropy flow has very slowly accumulated into two kinds of stocks of low entropy: non-living, non-renewable stocks such as fossil fuels and mineral deposits; and, the living, renewable stocks such as soils, forests, fisheries and ecosystems that generate the low entropy flows such as wood, fish, fresh water, air, climate and other ecosystem services on which humanity depends for its existence. In economic language these stocks can be thought of as capital (or natural capital) and the flows as income.

The modern industrial economy fuelled by fossilised energy, has allowed humanity to harvest exponentially growing quantities of low entropy sourced from all over the planet thereby allowing the human population to expand far beyond what would be possible in the absence of such fossilised energy. The sustainable flow was passed in the 1980s and since then the only way to keep growing the flow is by liquidating the stocks of natural capital. Returning to our factory analogy, humanity's exponentially growing demand for low entropy reached the point in the 1980s where we started to dismantle the factory itself in the quest for low entropy.

The key point here is that all economic activity uses up or dissipates natural capital. If the economic system consumes natural capital from the biosphere more quickly than it can be regenerated, this is by definition, unsustainable. A fundamental condition for sustainability is that the economic system consumes natural capital from the biosphere no more quickly than it can be regenerated by natural processes that are essentially ecological.

Now that we have started to understand the way the world works as a system and from a thermodynamic perspective, the discussion turns to the conventional policy response to the sustainability problem.

SUSTAINABLE DEVELOPMENT - THE CONVENTIONAL POLICY RESPONSE

In 1984 the World Commission on Environment and Development was established to address the failure of economic growth model of development to eliminate absolute poverty in the Third World while overcoming the global problems of environmental degradation and resource depletion. Its brief was to formulate realistic proposals to solve these issues and to "ensure that human progress will be sustained through development without bankrupting the resources of future generations" (WCED, 1987).

Its policy response was the concept of sustainable development as described in Our Common Future, better known as the Brundtland Report (WCED, 1987). It was very successful in bringing the idea rapidly to international prominence. It defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

Its response was to advocate "a new era of economic growth - growth that is forceful and at the same time socially and environmentally sustainable" to overcome global poverty, with the qualification that to be environmentally sustainable "requires a change in the content of growth, to make it less material- and energy-intensive in its impact" (WCED, 1987).

This idea of dematerialising the economy has become central to sustainable development because it would be the only possible way to continue to have economic growth while not increasing the environmental and ecological impact of the economy on the planet. Factor Four - Doubling Wealth, Halving Resource Use (von Weizsäcker, 1998) is one of the key books expressing this principle.

The Report also recognises the sustainability problem as having strongly interrelated economic, social and environmental dimensions - environmental sustainability, overcoming poverty and inequity of improve social well-being and economic progress. It suggest that sustainable development requires striking a balance between these three dimensions. This idea has been most commonly expressed through the idea of the Triple Bottom Line (TBL) which is about taking proper account of these three dimensions (Elkington, 1994).

The Brundtland model of sustainable development is the dominant sustainability paradigm. It sees the sustainability problem as an economic problem amenable to market based solutions through the pursuit of increased resource efficiency or eco-efficiency to achieve dematerialisation and to address market failures. Environmental economists see market failure as the main cause of most environmental problems. The environmental economic logic is that environmental factors are often unpriced or underpriced by the market so they get over-used resulting in environmental problems. The theory says the way to fix market failures is to 'get the prices right' on those things that are unpriced or underpriced and then allow the market to solve the problem. However, the outcome is (at best) economic efficiency, which as we shall see later, is not the same thing as sustainability.

Failure of the Conventional Policy Response

After two decades of the sustainable development approach just described, the ecological health of the planet has continued to decline to the point where it can now only be described as critical. Similarly, human well-being has shown little gain in the struggle against poverty and a new form of diminished well-being through over consumption has emerged in the rich countries, a condition Hamilton and Denniss (2005) describe as Affluenza.

This worsening situation throws doubt on sustainable development as a sustainability strategy. Is its prescription of economic growth and a market-based approach conceptually flawed as many critics argued after the publication of the Brundtland Report? The main criticism came from those who argued there are ecological and even social limits to growth and who saw economic growth as the problem and therefore rejected sustainable development as an oxymoron. The discussion now turns to the sustainability debate as a clash of worldviews and an initial examination of the validity of the two approaches. Then some of the critical elements of the current socio-ecological regime that are increasingly questioned and are faltering are examined. These include: the foundations of economic thought; the idea of economic efficiency, the idea of dematerialisation, human nature, and the way the financial system works.

SUSTAINABILITY DEBATE AS A CLASH OF WORLDVIEWS

The dominant paradigm of sustainable development centred on continuing economic growth has not gone unchallenged with sustainability being and remaining a highly contested concept. The challenging paradigm is grounded in the recognition that there are physical limits to the expansion of human activities on a finite planet. The 'limits to growth' school has been warning of a looming crisis since as early as 1948 in a large number of publications. In response were many countering publications by economists challenging the idea of limits to growth as dangerous.

The Economics of the Coming Spaceship Earth (Boulding, 1966) was perhaps the most illuminating of these publications, heralding the need for a change in perspective, from views of the world as infinite to the realization that it is finite. When he wrote, humanity had just been exposed to the first images of our planet taken from space.

The closed earth of the future requires economic principles which are somewhat different from those of the open earth of the past. ... the closed economy of the future might similarly be called the "spaceman" economy, in which the earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man (sic) must find his place in a cyclical ecological system . . .

... in the spaceman economy, throughput is by no means a desideratum, and is indeed to be regarded as something to be minimized rather than maximized. The essential measure of the success of the economy is not production and consumption at all, but the nature, extent, quality, and complexity of the total capital stock, including in this the state of the human bodies and minds included in the system. In the spaceman economy, what we are primarily concerned with is stock maintenance, and any technological change which results in the maintenance of a given total stock with a lessened throughput (that is, less production and consumption) is clearly a gain. This idea that both production and consumption are bad things rather than good things is very strange to economists, who have been obsessed with the income-flow concepts to the exclusion, almost, of capital-stock concepts . . .

The 'limits to growth' or spaceman economy approach has never gained traction for the simple reason that it flies in the face of our worldview, our institutions, our economic and political commonsense, and powerful vested interests - all of which are committed to the idea of economic growth as the path to progress and hold an unshakeable faith in the power of the market, or the invisible hand, to solve problems. However, this does not necessarily mean that the 'limits to growth' approach is wrong. Indeed, there is growing evidence that the 'limits to growth' school of thought had it essentially right the whole time. An initial evaluation of the approaches adopted by the two paradigms is now discussed.

WEAK VS STRONG SUSTAINABILITY

The Brundtland Report identified inter- and intra-generational equity as the two key conditions for the achievement of sustainable development. Intergenerational equity was identified as the necessary condition for ensuring that each subsequent generation has no less access to the material necessities of life than those generations preceding it. The second necessary condition of intra-generational equity derives from the first according to Brundtland:

Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation (*WCED, 1987:43*).

While there is general agreement that these are the necessary conditions for sustainability, there is little agreement on how intergenerational equity is to be achieved. Basically there are two competing views, an economically based view and an ecologically based view known respectively as the 'weak' and 'strong' sustainability models. What differentiates these two models is the extent to which financial and human-made capital can substitute for natural capital. This subtle difference reflects a fundamental paradigmatic divide. This question of capital substitutability is the critical question in the sustainability debate.

Natural capital (the factor of production called 'land' in economics) consists of renewable and non-renewable resources. The renewable form is living and active and includes biodiversity, species, habitats and ecosystems. If put under too much pressure it may become non-renewable. It spontaneously produces a finite rate of flow of goods and services. The renewable form is more than just resources - its primary value is life-support. The non-renewable form is passive and consists primarily of fossil and mineral deposits. Stocks are finite and flow rates are a matter of policy.

In contrast, human-made capital consists of financial capital (i.e. money or debt), manufactured capital (i.e. machines, buildings, tools, etc made by humans from natural

capital using human capital), and human capital (i.e. people's labour, skills, knowledge and culture).

The weak sustainability model argues that natural capital can be substituted by financial, manufactured and human capital (it is a central tenet of economics that all forms of capital are more or less substitutes for one another). Therefore, natural capital is not a limiting factor and can continue to be liquidated and transformed into other forms of capital by the economic process. This view argues that the welfare of future generations is assured so long as the total stock of the various forms of capital does not diminish. This view reflects mainstream economic thought (Ayres, et al.). This approach sees no limits to economic growth

The strong sustainability model argues that there is limited ability to substitute between natural and human-made capital - that these two forms of capital are largely complementary and that natural capital stocks are the limiting factor and must therefore be maintained. The following example clearly illustrates the different views:

For example, the annual fish catch is now limited by the natural capital of fish populations in the sea and no longer by the man-made capital of fishing boats. Weak sustainability would suggest that the lack of fish can be dealt with by building more fishing boats. Strong sustainability recognises that more fishing boats are useless if there are too few fish in the ocean and insists that catches must be limited to ensure maintenance of adequate fish populations for tomorrow's fishers (Daly, 2005).

Proponents of strong sustainability also point out that manufactured capital is made from natural capital. As Korten (2007) explains "without these natural systems, none of the other forms of wealth, including human labour and technology, can exist. They ask how do we substitute for the life-support functions of natural capital and even if we could, why bother when natural capital produces it spontaneously and at no economic cost. This view reflects modern ecological economic thought. This approach sees physical limits to growth and calls for a steady state economy in physical terms.

On the basis of this thinking, it is difficult to conceive how the weak sustainability model, or the cowboy economy, can serve as the basis for ensuring the welfare of future generations. While it may have made sense in the past era of an 'empty world', does it still make sense in a 'full world'? The discussion now turns to some of the core old stories - the foundations of economic thought; the idea of economic efficiency, the idea of dematerialisation, human nature, and the way the financial system works - and asks whether they still make sense in today's now 'full world'.

DO THE OLD STORIES STILL MAKE SENSE?

The Economic Perspective of Reality

The origins of modern political and economic thought lie in a worldview that God had created a mechanical clockwork universe that operated according to his rational natural laws. It was widely held by many philosophers of the time that human thought and behaviour were largely determined by natural laws similar to laws of motion Newton had discovered (Nadeau, 2006).

Adam Smith, the founding father of economics, in keeping with the thinking of his time, believed that natural economic laws ensured the society as a whole moved along a pre-ordained path of continual improvement irrespective of the disparate activities of individuals.

Adam Smith came up with idea of the invisible hand as the means by which the disparate activities of individuals added up to the rational whole that nature's laws demanded (Nadeau, 2006). Adam Smith (2002) published his Inquiry into the Wealth of Nations in 1776.

A century later, the founders of modern neoclassical economics, Jevons, Walras, Edgeworth and Pareto, who collaborated quite closely, were also influenced by this view of natural laws. They sought to transform economics into a rigorous scientific discipline by aligning it with physics. They reasoned that there were parallels between the natural laws of physics and the natural laws of economics. They drew on the work of one of the best known and most widely regarded physicists of his time called Helmholtz. Helmholtz was grappling with the inability of Newtonian mechanics to deal with heat, electricity and light hypothesized the existence of a protean field of energy that could unify these phenomena in 1847. However, this theory was eventually abandoned because it could not be tested scientifically (Nadeau, 2006:103). In spite of this:

The strategy used by the economists was as simple as it was absurd - they took ... [Helmholtz's equations] ... and changed the names of the variables. Utility was substituted for energy, the sum of utility for potential energy, and expenditure for kinetic energy" (Nadeau, 2006:104).

These equations based on failed physics equations remain the theoretical foundations of neo-classical economics to this day. Little wonder that JM Keynes wrote to his colleague John Hicks saying "I shall hope to convince you some day that Walras' theory and all the others along these lines are little better than nonsense" (Nadeau, 2006:112).

The conceptual basis of neo-classical economics continues to be recognised as being weak, even by a significant number of Nobel Laureates including Joseph Stiglitz, George Akerlof, Daniel Kahneman, Robert Aumeann, Thomas Schelling, Amartya Sen and Wassily Leontief (Hall, 2006).

For example, in his Presidential address to the American Economic Association in 1971, Leontief aired his concern that economics had taken a wrong turn. Elaborating in a letter to Science (1982) he found the basic models of economics "unable to advance in any perceptible way a systematic understanding of the operation of a real economic system". He continued:

professional economic journals are filled with mathematical formulas leading the reader from sets of more or less plausible but entirely arbitrary assumptions to precisely stated but irrelevant theoretical conclusions (Leontief, 1982).

This brief review of economic thought strongly suggests a total disconnection from reality, ironically resulting from economists' endeavours to ground economics in physics.

The reality is that this 'nonsense' as Keynes described it, remains the foundation of modern economic theory and serves as the basis for relying on the market as the key organising principle of society. Perhaps it would make more sense, as Al Gore (1992) suggests, to "make the rescue of the environment the central organizing principle for civilization."

The Economic Perspective of Human Nature

Central to the economic way of thinking is a portrayal of human nature as reflected in that caricature of humanity, homo economicus, also known as Rational Economic Man. For neo-classical economics to work, homo economicus has to be all knowing, driven by utility

maximisation and competitive. Could it be that our commonsense understanding of human nature as flawed, greedy, selfish and competitive is in fact a reflection of our economic mythology with little basis in fact? According to a modern economic text book, this may be the case:

The ideologies of the modern world which compete for our minds have been shaped substantially by the great economists of the past - Adam Smith, John Stuart Mill, David Ricardo, Karl Marx and John Maynard Keynes (Jackson and McConnell, 1988).

It is widely believed that Adam Smith saw human nature as being selfish and competitive as suggested in the well known quotation:

It is not from the benevolence of the butcher the brewer, or the baker that we expect our dinner, but from their regard to their own interest (Smith, 2002).

However, like many ideas that have become unquestioned beliefs of our culture, this is taken out of context. The chapter seeks to explain the division of labour and just five sentences earlier Smith says of man: "In civilized society he stands at all times in need of the co-operation and assistance of great multitudes," and two sentences later: "But man has almost constant occasion for the help of his brethren, and it is in vain for him to expect it from their benevolence only."

In the chapter, Smith is explaining the division of labour in terms of it being in each individual's interest to specialise so as to be able to exchange with others who also specialise, in order to meet a range of needs. It is quite clear that Smith sees human nature as being cooperative but that one cannot solely rely on another's benevolence - that there must be some form of reciprocity. This becomes clear a few sentences later where Smith says only "a beggar chooses to depend chiefly upon the benevolence of his fellow-citizens" - in other words where there is no reciprocity.

Similarly, it is commonly believed that Charles Darwin saw the origin of the species as the struggle of the "survival of the fittest". In fact, Herbert Spencer coined the term after reading I. The reality is that cooperation was the key theme in *On the Origin of Species* and it is often made clear in his writing that he sees human nature in this light (Laurent, 2003). For example, in his first edition of *Origin* at the beginning of his chapter on 'The Struggle for Existence' he says: "I should premise that I use the term Struggle for Existence in a large and metaphorical sense, including dependence of one being on another" (Laurent, 2003).

Darwin's view of human nature is perhaps most concisely conveyed in the following quote from *The Descent of Man*:

In however complex a manner this feeling [of sympathy] may have originated, as it is one of high importance to all those animals which aid and defend one another, it will have been increased through natural selection; for those communities who included the greatest number of the most sympathetic members, would flourish best, and rear the greatest number of offspring (in Laurent, 2003).

This brief review suggests that, the two key sources of the commonly held belief that human nature is competitive did not hold this belief themselves. An analysis of the literature examining this question suggests there are no studies supporting the idea that human nature is essentially competitive. However, there is a large literature (largely cultural anthropology) supporting the idea that human (and indeed, animal) nature is essentially cooperative (Kohn,

1986). This suggests a disconnection between observed human nature and the generally accepted economic view of it and indeed, with our society's view of human nature.

Understanding human nature is an important precondition for social transformation as our supposed competitive and greedy nature is repeatedly raised as an argument against even considering the idea. This argument appears to be highly effective in helping to perpetuate the status quo. However, there is ample evidence that a large proportion of society are striving for a less competitive, less materialistic, less selfish society. For example, the research of Ray and Anderson (2000) shows 26% of Americans are 'cultural creatives' described as "people who have made a comprehensive shift in their worldview, values and way of life" (Eckersley, 2006). "They are disenchanting with 'owning more stuff', materialism, greed, me-firstism, status display, glaring social inequalities of race and class, society's failure to care for elders, women and children, and the hedonism and cynicism that passes for realism in modern society" (quoted in Eckersley, 2006).

In the concluding chapter to their book, *Beyond the Limits*, scientists Meadows, Meadows and Randers (1992) argue that the solution to the environmental collapse predicted by their models lies in emphasising the better side of human nature:

The sustainability revolution will have to be, above all, a societal transformation that permits the best of human nature rather than the worst to be expressed and nurtured ... [but] it is difficult to speak of or to practice love, friendship, generosity, understanding or solidarity within a system whose rules, goals, and information streams are geared for lesser human qualities ... collapse cannot be avoided if people do not learn to view themselves and others with compassion (pp. 233-234).

In other words, emphasising the better side of human nature, particularly our cooperative and caring nature, can be a powerful force (and perhaps is necessary) for enabling the kind of social transformation or regime shift required to avoid collapse.

The Idea of Economic Growth within Ecological Limits

The concept of sustainable development hinges on the idea of dematerialisation. The dematerialisation argument is that if we can decrease the energy and material content of each unit of growth at the same rate as the economy grows, then the total material and energy content of the economy will remain constant (Jacobs, 1991; von Weizsaecker, 1998). However, there is a serious and apparently unrecognised flaw with this logic.

The flaw is that economic growth, being a percentage per annum, is an exponential function, which means a doubling every so many years. Aside from the fact that current levels of resource consumption are far too high, the mathematics of a dematerialisation path shows the rate of dematerialisation would have to increase exponentially at the same rate the economy grows. In other words, this would require accelerating returns to efficiency which is at odds with the reality of diminishing returns (Sanders, 1993). In the real world (as opposed to the imaginary world of economic thought) it becomes harder and harder to achieve efficiency gains through time, not easier and easier as the flawed economic logic demands.

A further problem with the idea of using efficiency gains to achieve dematerialisation is the Jevons (or Rebound) Effect. Jevons (who we met earlier) observed that when technology improves the efficiency with which a resource is used, there is a tendency to use even more of the resource. A hypothetical example often used is that of a car fleet where fuel efficiency is suddenly doubled, thus halving fuel use. Fuel becomes cheaper and so many more

people drive leading to even more fuel being used than previously. A similar argument (the shadow rebound effect) is where the savings from efficiency gains are spent on other things that more than offset those gains in resource consumption or ecological impacts.

Efficient Allocation of Resources

According to the economics text book, "a competitive price economy will tend to allocate the fixed supplies of resources available to society in such a way as to maximise the satisfactions of consumers" (Jackson and McConnell, 1988). This outcome is called economic efficiency. But what does economic efficiency actually mean and how meaningful is the outcome achieved, particularly in terms of the objective of sustainability?

There are two conditions for economic efficiency. The first is allocative efficiency which refers to the situation where resources are allocated to firms so as to obtain the particular mix of products wanted by society.

The second condition is productive efficiency which requires each good in the sought mix is produced at the lowest cost. In other words, economic efficiency refers to a situation in which the limited resources of the planet are allocated to produce the spectrum of goods consumers want (so long as they have the money) at the cheapest possible price.

But does this lead to the maximisation of the welfare of society? The form of efficiency that sustainability requires is technical or ecological efficiency. This requires that the maximum flow of beneficial service to humanity is extracted from a very constrained budget of energy and natural capital. In order to achieve this, the information contained within the price signal would need to be sufficient to reflect the relevant physical reality. The price would need to reflect a multitude of relevant physical or environmental factors at the very least. To assume that the interaction of supply and demand in the market reflecting what consumers want can provide this information is a very long bow to draw. Furthermore, mathematicians point out that it is simply not possible to solve such multiple variable equations on the basis of a single variable, namely price (Keen, 2009, pers.comm.). Economic efficiency is efficiency in terms of money (which is abundant) but not in terms of absolutely scarce material resources.

Once again, it appears that the economic notion of efficiency is disconnected from the type of technical or economic efficiency that sustainability demands.

Virtual Wealth and Disconnection from Biophysical Reality

Unlike the environmental economic sustainable development model, ecological economics considers the pivotal role of the financial system, also known as the virtual economy. In seeking to explain the global financial crisis, former World Bank economist Daly (Daly and Green, 2009) turns to the work of Frederick Soddy. Soddy was the 1921 winner of the Nobel Prize for chemistry, who turned his talents to economics; a field he felt lacked a connection to biophysical reality - and his 1926 book *Wealth, Virtual Wealth and Debt: The Solution of the Economic Paradox*. It is one of the foundations of ecological economic thought which is grounded in a thermodynamic view of reality. Quoting Daly (2009):

Soddy wrote that real wealth was subject to the inescapable law of thermodynamics and would rot, rust or wear out with age, while money and debt [virtual wealth] - as accounting devices invented by humans - were subject only to the laws of mathematics. Rather than decaying, virtual wealth, in the form of debt compounding at the rate of interest, actually grows without bounds.

Following from this, there are two dimensions to the economy, the real economy which produces real wealth and the virtual economy which produces virtual wealth. In the modern economy people live by obtaining virtual wealth (i.e. money or debt) which they use to purchase real wealth which Korten (2007) defines as "those things that have actual utilitarian or artistic value: food, land, energy, knowledge, technology, forests, beauty, and much else." Virtual wealth is an abstraction, but its power is that it is a claim on real wealth (Daly, 2009:6). As Soddy (1926; 137) explains, the holder of virtual wealth is owed real wealth! Korten (2007) describes virtual wealth as:

an accounting chit that has value only because by social convention people are willing to accept it in exchange for things of real value. Money, however, bestows enormous power and advantage on those with the power to create and allocate it in societies in which access to almost everything of real value requires money.

Virtual wealth can be obtained in many ways: by producing things (e.g. factories or farms); by stealing; or by investing which now constitutes the bulk of 'economic' activity. Investment may be either in the production of real wealth or in the production of virtual wealth. Today the bulk of investment is directed at the latter.

Soddy used a 9 inch ball of gold to illustrate the logical absurdity of a system based on investing virtual wealth in the production of more virtual wealth. If the gold is converted to money and lent at 5% compounding interest, in 600 years time "our 9 inch ball of gold, ... would arise legal claims to a golden ball equal in size to the earth, and weighing four times as much."

The following observation by Soddy illustrates the grand delusion we suffer:

The ruling passion of the age is to convert wealth into debt in order to derive a permanent future income from it -- to convert wealth that perishes into debt that endures, debt that does not rot, costs nothing to maintain, and brings in perennial interest. (Soddy, 1933, p.25).

Once again, we see a fundamental disconnection between economic and physical reality, this time through the mathematical impossibility of virtual wealth or money ever being realised with real wealth. As we shall see in the next section, the abstraction of virtual wealth can explain the real world issues of ecological unsustainability, poverty and inequity, and the global financial crisis. This suggests that virtual wealth is actually the systemic root of the sustainability emergency.

Explaining the Financial Crisis

Based on this analysis, which incidentally can also help explain the liquidation of the planet's natural capital and the growing gap between rich and poor, Daly explains the global financial crisis as a mountain of debt (i.e. virtual wealth) that has grown exponentially and vastly exceeds the real wealth it lays claim to. To the extent that the debt cannot be realised, its value is greatly depreciated. Daly and Green (2009)ask:

What allowed symbolic financial assets to become so disconnected from underlying real assets? First, our economy is based on fiat money (paper money issued by governments) that has value by convention but isn't backed by any physical wealth. Second, our fractional reserve banking system allows pyramiding of bank money (demand deposits) on top of the fiat government-issued currency. Third, buying stocks and "derivatives" on margin allows a further pyramiding of financial assets on

top of the already multiplied money supply. In addition, the financial sector was very inventive in coming up with new financial instruments that were designed to circumvent government regulation of commercial banks to protect the public interest.

The current liquidity crisis can be explained in this context by Minsky's Financial Instability Hypothesis and the theory of endogenous money expansion. It is essentially due to the banks speculating in the boom market and lending to whoever wants to borrow which drives asset price inflation and when this collapses the system goes into reverse (Keen, 2009).

Explaining the Liquidation of Natural Capital

Our new understanding of the concept of virtual wealth can explain why the planet's natural capital is being liquidated. Money (i.e. debt) is not wealth but virtual wealth which is a claim on real wealth. Wealth is derived from the natural capital of our planet. In the simplest analysis the root of the sustainability problem is the exponential growth of virtual wealth that amounts to an exponentially growing set of claims (virtual wealth or money) on a finite (and indeed, now rapidly diminishing) pool of natural capital (i.e. the source of real wealth). In other words, the combined purchasing power of humanity has grown exponentially to the point where the level of demand being exercised in the globalised market far exceeds the planet's capacity to supply natural capital on a sustainable basis. Consequently, natural capital stocks have to be liquidated in order to supply more than the sustainable rate.

Explaining the growing gap between rich and poor

Our discussion of virtual wealth can also explain the ever growing gap between rich and poor. Simply stated, the rich are able to grow their virtual wealth exponentially at compounding interest while the only means the poor have is to labour, and the low levels of virtual wealth they earn is expended in subsistence with no surplus to invest. Consequently, the rich can become rich at an accelerating rate while the poor have little opportunity to do anything but subsist. As Korten describes the situation:

The wealthy "have enjoyed rapid growth in their financial assets throughout the period of deepening environmental decline, thus bestowing on them claims against a growing proportion of the real wealth of planet and society, and creating an illusion that we are all growing richer, when the opposite is true. Take just one key indicator: the combined market capitalization - financial asset value - of the shares traded in the world's major share markets grew from \$0.8 trillion in 1977 to \$22.6 trillion in 2003. This represents an enormous increase in the buying power of the ruling class relative to the rest of society. It creates an illusion that economic policies are increasing the real wealth of society, when in fact they are depleting it" (Korten, 2007).

This section has shown a disconnection between key elements of the economic view of reality and reality itself. Previously we looked at the systems view of reality and saw that it seemed to make good sense of the way the world works. The next section on policies for a socio-economic regime shift is based on ecological economics which is strongly grounded in the systems view of reality. As such, it appears to provide a much sounder basis for policy guidance for the achievement of genuine sustainability.

PART 2: POLICIES FOR A TRANSITION TO SUSTAINABILITY

The global financial crisis dimension of the 'perfect storm' provides a unique opportunity for regime shift because it throws significant doubt on the economic system and opens it to serious challenge and critical examination that in the past has simply been dismissed. This opportunity has been recognised in the UK's Sustainable Development Commission's *Prosperity without Growth?* (Jackson, 2009) which rejects economic growth and consumerism in recognition of the ecological limits confronting humanity and comes close to a call for a regime shift.

Other calls for significant reforms in response to what was dubbed as the 'triple crunch' of the global financial crisis, peak oil and the climate crisis include a Green New Deal (Leggett, et.,al.,2008), and a Global Green New Deal (Barbier, 2009). However, these don't amount to calls for regime shift in that they don't question growth or the existing institutions, their emphasis being green growth, green investment and green jobs. There have also been calls for a Global Marshall Plan (Gore, 1992; Brown, 2008) with Gore's (1992) call to "make the rescue of the environment the central organizing principle for civilization" hinting at the need for regime shift. Brown's Plan B 3.0 (2008) remains well grounded in the conventional paradigm, being based on the economic idea: "Saving civilization means restructuring taxes to get the market to tell the ecological truth." However, as our earlier discussion has suggested, it is difficult to conceive how prices can reflect the ecological truth given their disconnection from physical or ecological reality.

While proposing a range of useful policy initiatives, these approaches remain essentially grounded in the old paradigm and institutions. As such they can be an important step in moving towards the necessary regime shift but are not sufficient in themselves. The danger is that they are seen as sufficient in themselves and society becomes complacent in the security of assuming these serious challenges are being adequately addressed.

The severity of the sustainability emergency is such that an emergency type response is required to help fast track the transition to sustainability and return the planet to its safe biophysical operating limits as rapidly as possible. This could be achieved through a much more ambitious Global Marshall Plan or Green New Deal that is transformative and entails a regime shift.

The challenge is to get the policy content of such a program right and ensure that at least the core of the policy content is transformative and drives a break from the current expansionary logic. The more immediate imperative is a rapid contraction fossil fuel use and emissions and other critical natural capital factors to levels that are within the planet's safe ecological operating limits. Since the current design of the financial system appears to be a key driver of the global financial crisis, the ecological crisis and global inequity and poverty, financial reform is a high priority policy objective.

FINANCIAL REDESIGN

The fundamental problem with the financial system is the principle of extending credit for any (usually lawful) activity that is likely to generate sufficient surplus returns of virtual wealth to cover costs, profit and interest. This makes sense from the perspective of conventional wisdom because it is seen as the key to wealth creation. The reality is this leads to the exponential growth of virtual wealth which ultimately results in astronomical claims over what are now heavily overdrawn stocks of natural capital. As the discussion on virtual wealth

made clear, sustainability demands that the financial system be redesigned in a way that prevents increases in virtual wealth.

The privilege of credit creation and seigniorage (the windfall profit from creating credit) should solely rest within the public sector for the public benefit. Additionally, the principle of borrowing to grow virtual wealth leads to the employment of scarce resources in the making of money rather than directing them to meeting the needs of humanity in the most technically efficient way. Sustainability requires that resources are directed at meeting needs rather than growing virtual wealth.

These insights suggest that the whole financial system and the powers of credit creation should be vested in the public sector under a system of very strict prudential supervision oriented to sustainability considerations. The global financial crisis has seen some nationalisation of banks on both sides of the Atlantic, demonstrating that nationalisation is politically possible. One often suggested reform of the financial system is to shift from a fractional reserve system (an inherently expansionary system) to a 100% reserve system (Daly and Green, 2009). This has no expansionary imperative which means the economy can be contracted without collapsing. Under such a system, the state could fund the physical infrastructural transformation of the economy to a solar energy basis (to be discussed shortly) while significantly contracting the scale of the physical economy.

Given that financial reform is probably the most esoteric and politically challenging policy objective, the best initial policy initiative might be to establish an independent royal commission into financial redesign with terms of reference that recognise the physical necessities of sustainability.

Policy measures:

- The government should establish an independent royal commission into financial redesign with terms of reference that recognise the physical necessities of sustainability;
- Introduce a reform to the financial system that prohibits compounding interest.

Beyond these measures, the government should also consider some of the reform policies suggested by the NEF (2008) including:

- Creation of new public money free of interest to fund projects for the public good
- De-merging private banks into smaller (small enough to fail) entities perhaps rechartered as credit unions (without the powers of credit creation)
- Facilitate the introduction of community currencies for local transactions within the community (to keep spending power in the local community)
- Time banking for community exchange on the basis of time contributed rather than a fee

In addition to reform of the financial system, it is also necessary to introduce reforms to the economic system.

SURVIVAL ECONOMICS

In purely physical terms, the sustainability challenge is to design a social and economic system to meet the material needs of humanity from a relative trickle of natural capital that represents the 'interest' from what remains of nature's capital. Since the current socio-ecological regime (the matrix of worldview, institutions, technologies, vested interests, and consumer behaviour) is geared to physical expansion, a rapid transformation to a new socio-ecological regime geared to living within tight material and energy constraints is now almost certainly a survival imperative for human civilisation.

In the main, the policy suggestions made here are in the nature of technical solutions to an emergency situation and are uncompromised by political considerations. They reflect an assessment of what must happen in the material world to ensure the continuance of civilisation. While this may appear naive, political compromise will result in diluted objectives that fall far short of those needed. Part 3 will deal with how these objectives may be realised politically.

At the heart of the transformation lies a proposed new approach to resource allocation. The world as it is today, especially after 25 years of global economic liberalisation, is largely the outcome of resource allocation based on market forces driven by the virtual wealth creating activities of entrepreneurs, corporations and states. Unfortunately, the 'invisible hand' of the market is blind to ecological integrity and social necessity with the planetary emergency being testament to that.

ECOLOGICAL ECONOMIC APPROACH TO RESOURCE ALLOCATION

The ecological economic approach to resource allocation is explicitly designed to meet the two key sustainability criteria of inter- and intra-generational equity where intergenerational equity requires each generation to live of the interest of nature's capital so that the stock of natural capital is maintained intact for all future generations. Being grounded in a systems view of reality and a thermodynamic understanding of reality, it is ideally suited to dealing with the imperative of living within tight ecological limits.

The ecological economic approach is to:

1. set a physical resource **throughput constraint** for the economy, then
2. put in place measures to ensure **distributional equity** of access to what will be produced from that throughput, and then
3. in the predefined context of 1 and 2, use the market to **efficiently allocate** that constrained throughput to its best use.

However, the third step needs to be questioned in light of the previous discussion suggesting that market allocation does not produce the technical efficiency that sustainability demands. An alternative approach to allocating resources in a technically efficient way will be presented in the coming section on efficiency.

It is important to note that this is a sequential approach to resource allocation that addresses ecological considerations first, then social considerations, before considering resource allocation. Note also, that this reflects the relationships of the nested systemic holarchy of

economy within society within ecology. How to put these 3 steps into practice is now considered.

Step 1: Physical Throughput Constraint to Ensure Intergenerational Equity

The first requirement for sustainability is to reduce the physical throughput or production of all critical resource factors in the global economy to a sustainable level as rapidly as possible. The most obvious example is greenhouse gasses, which need to be rapidly brought down to at least 350 ppm CO₂e as a precaution against runaway global warming.

For the most critical factors (e.g. greenhouse gas production, keystone species, water, energy, soil, fisheries, forests, etc) consumption rates for western style lifestyles may have to reduce to between 10% and 30% of current levels. Globally, in ecological footprint terms, a reduction will be needed from the current 1.3 planets to perhaps 0.85 planets to ensure ecological resilience. The economic challenge will be to maximise human well-being for all of humanity while reducing humanity's ecological footprint by some 35%.

The most fundamental policy objective must be the abandonment of economic growth as the primary goal of society and replacing it with making "the rescue of the environment the central organizing principle for civilization" as called for by Al Gore (1992).

Policy measures to realise this objective:

1. Begin a public education campaign to introduce the Australian people to the need for a fundamental transformation;
2. Establish an institution with the responsibility and authority to administer throughput constraints (perhaps a Sustainability Charter and Commission);
3. Establish a national system of physical accounts to inform the setting of physical critical natural capital budget constraints (Sanders, 2003; Harris, Lenzen and Sanders, 2005);
4. Establish a set of physical (as opposed to monetary) budget constraints for all forms of critical natural capital and for harmful emissions;
5. Establish a mechanism to identify current forms and modes of production that can be abandoned or greatly reduced with little or any impact on well-being;
6. Establish energy and material descent pathways and targets;
7. Establish targets for the phase out of fossil fuels;
8. Introduce a shorter working week; and
9. Introduce rationing for critical resource factors such as water and petrol.

Some best practice examples of some of these proposed policies from around the world are given shortly.

A key framework for operationalising this set of policies is to set up a system of national and global physical accounts showing both stocks and flows of energy and materials so we know

what is going on physically - at present we only have an indirect picture of this as seen through the lens of economics and dollar values. In the Australian context, the work of Foran and Poldi (2002) provides a sound basis for creating such a system of national physical accounts. Other leading work in this field that can guide this system is the materials and energy flow analysis (MEFA) work in Austria (Krausmann, Haberl, Erb and Wackernagel, 2003). However, these approaches have not been developed for the purpose of constraining throughput. Some thought on the nature of these accounts is now given.

The purpose of these accounts would not only be to monitor and budget for material and energy flows, but also to identify efficiencies (and more importantly, inefficiencies) as will be discussed in the efficiency discussion following. These accounts should be categorised into energy, renewables (being a subset of life-support), non-renewables and emissions. The rules for rates of use or emission used by ecological economists are:

1. Use renewable resources at rates that do not exceed the ability of ecosystems to regenerate them;
2. Use non-renewable resources at rates that, as far as possible, do not exceed the rate of development of renewable substitutes; and
3. Limit the use of all resources to rates that ultimately result in levels of emissions or waste that can be absorbed by ecosystems.

Regarding energy, the rule would need to be to minimise energy use to the maximum extent possible, and to obtain the maximum amount of the energy budget from solar, wind, tidal and geothermal sources.

Within each category it is necessary to have a ranking from most critical (in terms of both availability and ecological impact) to non-critical for each key type of resource or form of natural capital. The most critical factors will have to be husbanded with great care and rationed so as to maximise the welfare of humanity, while the non-critical can be used with more discretion and less constraint. Some best practice examples of throughput reduction measures in regard to the use of fossil fuels to address global warming are now presented.

Best Practice Measures in Transitioning to Renewable Energy

Climate change and the need to rapidly reduce greenhouse gas emissions is arguably the most pressing imperative facing the world. Australia is one of the world's largest per capita energy users with 90% of its energy being derived from fossil fuels. Over 32% of energy use is for road transport alone (the transport and storage sector accounting for over 40%). Manufacturing and construction account for just under 30%, with residential being next highest at over 12% (ABARE, 2004).

Australia has huge potential to transition to a solar economy with solar thermal electricity generation with thermal storage being claimed to be able to produce 90% of Australia's base load requirements. The solar thermal technology pioneered by Australian David Mills is price competitive with coal when Government coal subsidies and the cost of pollution are taken into account. Investment in an electrified national rail and public transport infrastructure running on solar thermal electricity and the installation of solar water heating in all buildings alone could vastly reduce Australia's reliance on fossil fuels. Redirection of subsidies from the fossil fuel sector into a nation building project such as this would make this transition highly cost effective (data still to be found). It should be noted, the level of renewable energy production that sustainability will require will be significantly less than

today because greatly reduced material throughput will significantly reduce the requirement for energy.

There are many best practice measures already in place elsewhere that can be implemented immediately as initial steps toward getting the planet rapidly back within its safe operating limits as a precursor to deeper systemic regime shift. The first such measures considered are those for phasing out the use of fossil fuels.

Phasing Out Fossil Fuel Use

In 2005 Sweden committed to becoming an oil-free country by 2020 and established a Commission to recommend on the best ways to break their oil dependence. They proposed targets to reduce oil use in transport by 40-50%, industry by 25-40%, to zero for heating (already reduced by 70% since the 1973 oil crisis) and to achieve overall energy efficiency gains of 20%. In 2007 Germany committed to the phasing out of coal mining by 2018 by removing annual subsidies of \$US 3.2bn (Speigel Online, 30/01/09), and in Ontario, Canada legislation has been passed to phase out coal use in electricity generation by 2014.

Another measure used in the 1973 oil crisis is energy rationing. This is an equitable way of reducing energy consumption to whatever physical level is deemed necessary.

Policy measures:

- Australia should establish targets for the phasing out of fossil fuels, with targets for each type of fossil fuel reflecting their respective impacts;
- Australia should introduce low levels of rationing for petrol and water with associated public education programs to condition the Australian public to the concept of rationing

Renewable Energy Initiatives

Since 1997, the European Union states have been working towards a target of 12% renewable energy by 2010. Spain has adopted a target of generating 30% of its electricity needs from renewable energy sources by 2010, with half of that amount coming from wind power. In 2006, 20% of the total electricity demand was already produced with renewable energy sources, and in January 2009 the total electricity demand produced with renewable energy sources reached the 34.8%. Within Spain, some regions are aiming to reach 100% in a few years with Castile and León and Galicia already producing 70% of their total electricity demand from renewable energy sources in 2006. In 2005 Spain became the first country in the world to require the installation of photovoltaic electricity generation in new buildings, and the second in the world (after Israel) to require the installation of solar hot water systems. Public perception of wind and solar power has been reported as positive with both technologies being perceived as benign and beneficial, although resistance to wind turbines was reported to be growing in areas where they proliferate (Frolova, Perez and Liberal, 2008)

Germany surpassed the EU 12% target in 2007 when the renewable energy share reached 14%. In 2007, Germany announced that its target would rise to 27% by 2020. In the United States, in 2006, California required electric utilities and providers to source 20% of their energy from eligible renewable energy resources by 2010. In 2008, this was increased to

33% renewables by 2020. The example of Spain in particular, demonstrates the capacity to transition rapidly to renewable energy production.

Policy measures:

- Australia should commit to producing 100% of electricity from renewable sources by 2020 as called for by Climate Action Groups at the National Climate Action Summit, 31/01/09 to 01/02/09;
- Australia should aim to have solar hot water installed in every dwelling and premises by 2012 and provide subsidies for these installations.

Gross Feed in Tariffs

The rapid uptake of renewable energy production in Germany and its ability to raise its target to 27% by 2020 is largely due to adopting a gross feed in tariff (GFIT) policy. This pays for all the energy produced in contrast to net feed in tariff which only pays for the surplus energy fed into the grid. A GFIT that is in place for a defined period (say 15 or 20 years) is the most effective way of encouraging the uptake of photovoltaic systems because the annual income generated by the system can be calculated with certainty. The ACT has introduced Australia's first GFIT scheme paying 3.88 times the transition franchise tariff retail price with the scheme applying for a period of 20 years. According to German Greens MP Hans-Josef Fell, this approach has been more effective than emissions trading in Germany:

While laws for renewable energies saved more than 100 million tons of CO₂ annually, emissions trading contributed no significant amount with only 9 million tons. But emissions trading resulted in 5 to 10 billion euro of unjustified additional profit for German energy companies (Fell, accessed 23/03/09).

Policy measures:

- Australia should implement a nationally consistent gross feed in tariff to encourage the rapid adoption of domestic photovoltaic systems;
- The Australian government should commission CSIRO to fast track the research and development of compact parabolic dish Stirling engine electricity generation units (which promise to be the most technically efficient means of small scale generation) for rooftop installation.

Emissions Trading or Tax?

Emissions trading and carbon taxes have received a lot of attention in recent years, being seen as the primary policy measures to deal with climate change. From a theoretical standpoint, emissions trading based on a cap and trade system is far superior. As Hamilton (2009) explains:

Emissions trading fixes the amount of pollution and then allows the market to set the price of an emissions permit. This gives priority to environmental certainty over business certainty. The price will bounce around but businesses are used to managing uncertainty through hedging.

Against this, a carbon tax fixes the price of pollution through the tax rate and leaves it to the market to decide the amount of pollution. Business has certainty but the environment pays for it. If Australia has a legally binding emissions cap, as we now do under the Kyoto Protocol and will have again under a Copenhagen agreement, then the government will be compelled to adjust the tax rate frequently and by large amounts as it tries to hit the target.

From the perspective of the theme of this paper - the disconnection between physical and economic reality - a cap is best because it sets the cap and that's it. On the other hand, trying to adjust prices to meet the cap may not work because of the disconnection between price and physical reality. At best, it will lead, as Hamilton suggests, to an ever-changing (and perhaps increasing) tax chasing the cap.

Although cap and trade is the better of the two approaches, carbon emissions' trading has not worked well in Europe and would not be effective if conducted in the manner the Australian government is proposing. To work properly, all the permits must be auctioned in a tight regime, have currency for one year and not be transferable between years. Each year new permits amounting to a lower cap need to be auctioned. In Europe, the limited success of emissions trading is due to many permits being given away and being used to make windfall profits. Similarly, the proposed Australian system is far too lax with permits to be given away with some tradability between years.

Policy measure:

- Australia should introduce a true cap and trade system for carbon emissions where all permits are auctioned, are currency for one year and including a pool of permits for household installations that reduce emissions.

It is important to note that prices, taxes, removal of perverse incentives and other conventional economic measures can still provide powerful signals that help change behaviour in the right direction. Equally, suasion should also strongly considered, the power of which is evidenced in south east Queensland's response to the recent water crisis where the target of 140 litres of water per person per day (from over 300) was bettered, achieving 117 litres per day. The success of this may have been due to the equity of the approach leading to a high level of ownership and buy-in. It is interesting to contemplate if such a result could have been achieved through the price mechanism. Even if it was, the expenditures would have been significantly higher, whereas in this situation, costs were lower as people were consuming less. On this note of the possible power of equity in facilitating behavioural change, the discussion now turns to the issue of equity.

Step 2: Equitable Distribution to Ensure Intra-generational Equity

In a world of extremely tight limits, redistribution of access to resources becomes critical. The second resource allocation stage suggested by ecological economists is that of equitable distribution, required to meet the intragenerational equity criterion for sustainability. As discussed earlier, a root of the inequity and poverty problem is the capacity of the wealthier members of global society to grow virtual wealth through the magic of compound interest. Redesign of the financial system will greatly reduce the capacity for large disparities in purchasing power to emerge as discussed earlier.

Reducing Income and the Working Week

Since western levels of consumption will need to be very significantly reduced in a sustainable society, income earning working hours can also be significantly reduced to bring purchasing power into alignment with significantly lower levels of consumption, thereby also favourably improving the life - work balance. The financial reforms sustainability demands (i.e. no compounding interest) can also greatly reduce mortgage obligations further making possible reduced working hours. In the context of reduced working hours, work will need to be equitably distributed to all. Initially, it may be possible to introduce a 4 day working week (as was introduced in France in 2002) with a longer term view of moving to 3 day and possibly even 2 day (income earning) working weeks as the norm if the throughput constraints require it. However, in the short term, it is possible that the necessary emergency response to the sustainability emergency (e.g. a Global Marshall Plan) may require a significant work contribution from all members of the population, perhaps in the form of compulsory national service for all able citizens.

A policy to establish annual income floors and caps to reduce income differentials to a maximum of say four times would significantly improve equity within a country. The legitimising rationale for this might be the recognition that nobody should have the right to consume more their fair share of the very scarce remaining natural capital of the planet. This is consistent with the widely accepted view that rationing is a legitimate way of dealing with extreme scarcities.

In the initial phase of transition, the simplest approach to improving equity (at least within countries) might be through introducing a genuinely progressive taxation system.

Domestic policy measures:

- Reduction of working hours, initially to a four day week;
- Equitable sharing of work;
- Reduction of income differentials through setting of wage caps and floors; and
- Introducing a more progressive income tax system.

International equity will almost certainly require some forms of redistribution from wealthy countries towards poorer countries. International trade will have to be reformed away from the current, so-called 'free trade' model through which an imbalance in investment capacity between poor and wealthy countries leads to a net export of wealth from the poorer to richer countries. By way of explanation, if a rich country invests ten times as much into a poor country as the poor country does into the rich country, and assuming the same rate of return on investment, then ten times as much income will flow from the poor to the rich country than in the opposite direction.

It also needs to be recognised that trade currently allows rich countries to live far beyond their fair share of the global ecological footprint, effectively living of the ecological footprint of poorer countries. International governance will almost certainly be needed to ensure that the planet's sustainable flow of resources is distributed equitably to all parts of the globe in the spirit of cooperation that the survival of human civilisation will most likely demand.

International trade policy measures:

- Introduction of a Tobin tax to make currency speculation unviable with the proceeds directed to placing poor economies on a sustainable footing;

- Reconstitution of the IMF and the World Bank to channel funding from wealthier countries to assist placing poor economies on a sustainable footing;
- Australia should only trade with poorer countries on the basis of fair trade principles.

Step 3: Efficient Allocation of Resources

The third consideration proposed by ecological economists is the efficient allocation of the resources that constitute the annual material and energy budget after the throughput constraint and equitable distribution conditions are in place. They propose that this efficient allocation of resources be achieved through the interaction of market forces.

However, as we saw previously, the interaction of market forces can at best give efficiency with respect to virtual wealth (i.e. money) rather than the physical or ecological efficiency that sustainability demands. If the market cannot do the job, then the responsibility for achieving technical or ecological efficiency must be borne by our systems of government.

The requirement would be for government to conduct physical technical efficiency analyses for the spectrum of products and their associated modes of production. Highest priority would be given to meeting basic needs of food, shelter and energy and then working progressively up Maslow's (1943) hierarchy of needs. The initial focus would be the industrial system of production.

The proposed framework of physical accounts referred to earlier would provide the informational basis for these and similar analyses to identify the most appropriate technologies for achieving maximum reductions in throughput and ecological impact. Through the use of input-output tables it will be possible to untangle the complex interconnections of embodied matter, embodied energy and embodied water to identify or design the most efficient approaches in terms of these factors collectively (or synergistically). Once the most efficient modes of production are identified, permits could be issued by the government for production of energy, materials, goods and services by the specified modes of production

This section has proposed a technical efficiency alternative to the 'invisible hand' of the market to allocate the constrained resources throughput to it can maximise the welfare of society in Maslovian terms. This is not to dismiss the important role of the market and money as a distribution mechanism to get goods and services to the consumer, or rather, the citizen. Within this context, the market system can be a useful tool through which citizens can acquire their needs from the now sustainable industrial production system.

Some may take ideological exception to the idea of the system of governance allocating resources in this way. As a rejoinder, they should note that the current spectrum of products (the production of which is rendering the planet incapable of supporting humanity) is produced by a system where the plutocracy (wealthy) decide what is to be produced and how it is to be produced. What differentiates the two approaches is their respective objectives. The plutocracy seeks to increase their virtual wealth behind the convenient mythological cloak that pursuing their self interest will maximise the welfare of society thanks to the agency of the 'invisible hand'. The objective of the democracy is to maximise the well-being of all members of society.

Policy measure:

- The Australian government should establish a Technical Efficiency Commission to help select the most technically efficient means of meeting needs

Having considered the framework suggested by ecological economics, the remainder of this section will examine some additional measures that can assist in facilitating the transition to sustainability in a technical sense.

PROGRESS INDICATORS

The question of measuring progress received some significant attention at the World Economic Forum in Davos this year. One session turned the idea of GDP on its head, questioning whether it is the best way to measure a society's progress. Former World Bank economist and Nobel Laureate Joseph Stiglitz told the Forum that there is a growing consensus that GDP does not measure the right things. French President Nicholas Sarkozy has asked Stiglitz to chair the Commission on the Measurement of Economic Performance and Social Progress, which will report soon on an alternative measure to GDP.

Indicators of the right kind can play an important role as a tool both for signalling the need for change and for measuring progress towards change. In keeping with the theme of the paper, the preference is for physical indicators rather than monetary ones. The first one considered is the ecological footprint which is a purely physical indicator.

The ecological footprint is a physically based measure of the demand of humans on the planet's ecosystems. The Living Planet Report provides an account of both the methodology and a range of impacts. The Global Footprint Network has produced quite a range of indices including national accounts showing which countries have an ecological surplus and which are in ecological debt. The objective of the Network is to make ecological limits central to decision-making, in order to end ecological overshoot and create a society where all people can live well, within the means of one planet. The ecological footprint is versatile and can be used to calculate the footprint of the individual or of a nation. It is educationally powerful as the concept is easily grasped and it effectively conveys the true magnitude of the ecological problem.

There are various Genuine Progress indicators proposed as alternatives to GDP which add the costs and benefits of economic activity to indicate the gross level of activity. Because of this, GDP growth cannot give a meaningful indication of improvements in the welfare of society. Like GDP, they are based on monetary accounts. However, because they identify the economic costs and benefits of the economy and subtract costs from benefits, they can give an indication of improving or declining welfare. The general trend in these indicators for most countries is to show increasing welfare until the 1970s or 1980s with subsequent decline since then. This tends to be in keeping with the ecological footprint of humanity exceeding one planet around 1980.

A very recent indicator is the Happy Planet Index (HPI) which is another non-monetary indicator. It is a measure of "the ecological efficiency of delivering human well-being" (NEF, 2009). As such it is an ideal indicator of what really matters in the quest for sustainability. $HPI = \text{Life Expectancy} \times \text{Life Satisfaction} / \text{Ecological Footprint}$ and the countries with the highest HPI are in the Central Americas.

Policy measure:

- The Australian Bureau of Statistics should be charged with compiling these indicators and raising public awareness of them and what they are telling us.

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THE CENTRAL ROLE OF GOVERNANCE

A quarter century of economic liberalisation has resulted in a strong deference to the market and an atrophying of the role of government in guiding human affairs. The earlier discussion on the systems conceptual framework (Giampietro, 1994) indicated the central importance of governance in constraining individually rational behaviours that are socially and ecologically irrational if everyone pursues them, otherwise social, and ultimately, ecological integrity will unravel. In recent times with the emphasis on the rights of the individual within the freedom of the market, this central integrity maintaining role of government has been lost sight of.

Policy measure:

- NGOs should call upon the government to govern in the face of the failures of the market to deal with either sustainability of the global financial crisis.

LEGAL REFORMS

The foundations of our economic and political system lie in the legal system. A brief examination of the role of the legal system in the sustainability crisis is now presented. Guth (2008) observes that the legal and economic structures adopted to promote the Industrial Revolution were grounded in assumptions of endless economic growth. While these assumptions were reasonable in an “empty” world “with comparatively few people living low-impact lives surrounded by seemingly boundless resources and pollution sinks”, they are invalid in our now “full” world that has overshoot the planet’s carrying capacity by over 25% Guth (2008).

Guth (2008) identifies the legal system as the primary driver of unsustainability:

But this much is clear: exceeding the ecologically sustainable assimilative capacity of the Earth is the inevitable result of the economic path the common law has set us on.

Under the legal system individuals and corporations have the right to pursue profits through development on the assumption that this leads to the net benefit of society. Guth (2008) points out that the only grounds to reject a development are where a cost-benefit analysis demonstrates the costs of the project outweigh the benefits. Due to the economic convention of discounting the future, where benefits generally accrue in the short term and costs in the longer term it is mathematically unlikely that costs will outweigh benefits as they are much more heavily discounted. Another problem is that under law, consideration is limited to the merits of the single project and it is not possible to take account of the cumulative impacts of a large number of developments in a region or catchment.

Guth (2008) proposes a tort of ecological degradation as a way of transforming the legal system to deal with the new realities of a full world. His proposed tort places liability for ecological degradation on the individual and gives standing to any member of the community to bring an action for ecological degradation.

Policy measure:

- The Australian government should institute a royal commission to investigate the incompatibility of the legal system with the new ecological reality and seek recommendations on how the law can be realigned with this new reality.

REDESIGNING THE WAY WE LIVE

A key requirement of regime shift will be the redesign of cities to make them highly ecologically efficient. A grassroots initiative that is taking off internationally is the Transition Towns movement (Hopkins, 2008). This is a citizen's based response to climate change and peak oil. The local initiatives that Transition Towns groups develop such as energy descent plans should be enabled and resourced by the system of government. The Transition Towns approach has the additional benefit of helping to rebuild a sense of community spirit.

Policy measure:

- The Australian government should make resources available to communities to build resilience into their communities along the lines spelled out by the Transition Towns movement.

PART 3: SOCIALLY ENABLING THE NEEDED TECHNICAL SOLUTION

PATHWAY TO A CIVILISATION WORTHY OF OUR HUMANITY

The policies proposed so far will appear to many of us as politically impossible. However, when confronted with this sense of political impossibility it is helpful to recall Daly's (2005) often quoted statement:

In choosing between tackling a political impossibility and a biophysical impossibility, I would judge the latter to be the more impossible and take my chances with the former.

Overcoming the politically impossible is a survival imperative because what we are doing is biophysically impossible in anything other than the very short term. The sustainability emergency, and now the global financial crisis are actually a unique opportunity for the human spirit to break free and create a civilisation that reflects the better side of human nature. To repeat the insight of Meadows, Meadows and Randers (1992):

The sustainability revolution will have to be, above all, a societal transformation that permits the best of human nature rather than the worst to be expressed and nurtured ... [but] it is difficult to speak of or to practice love, friendship, generosity, understanding or solidarity within a system whose rules, goals, and information streams are geared for lesser human qualities ... collapse cannot be avoided if people do not learn to view themselves and others with compassion (pp. 233-234).

Deep Dialogue as a first step in the Process of Social Change

The first step towards transformation is to start getting the kinds of ideas expressed in this paper to become a focus of national dialogue and discussion. These ideas have been around for a long time but the social reality of a worldview is that it is continually reinforced by those who share it and opposing ideas are dismissed as ridiculous or impossible or naïve.

The only way in which we can begin to break free of the current worldview is to talk about the old stories and how they no longer make sense and to talk about the new ideas which

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become more and more obvious as 'commonsense' the more we talk about them. The new stories will be even more meaningful if they also explain why the old stories no longer work and therefore break their spell.

The process of spell breaking has already begun. Alan Greenspan's previously mentioned admission to Congress that his (and economists) view of reality is all wrong is a notable example. The highly conservative Thomas Friedman, author of the Lexus and the Olive Tree recently commented in an opinion piece:

Let's today step out of the normal boundaries of analysis of our economic crisis and ask a radical question: What if the crisis of 2008 represents something much more fundamental than a deep recession? What if it's telling us that the whole growth model we created over the last 50 years is simply unsustainable economically and ecologically and that 2008 was when we hit the wall – when Mother Nature and the market both said: 'No more.'

The reality is that any stories that make sense and meaning of the world will attract the human mind. The key is to have these kinds of stories in circulation in order that they can catch on. If people of credibility in the mind of the public (including even celebrities) are talking about these ideas then they can quickly become contagious and create a bandwagon effect. This is how a paradigm shift can be brought about.

Processes of Social Mobilisation

There is little doubt that if quite radical and rapid transformation is required there will be significant resistance from those with a strong vested interest in maintaining the status quo. The only power likely to be able to overcome this is that of a global people's movement aligned in intent and action. Papers on how such a movement may be crystallised such as that of Kriegman (2006) discuss the roles of vision, distributed leadership, and self-organisation based on shared memes (i.e. ideas). Society-wide processes of deep dialogue are also likely candidates for re-engaging the citizenry in politics, thereby making possible the reclamation of democracy and politics from narrow vested interests. Such processes will enhance ownership of ideas co-learned through group process and will also serve to empower those participating. Models of participatory and deliberative democracy should also be investigated. Other possible avenues of mobilisation to explore are GetUp (www.getup.org.au) in the Australian context and Avaaz (www.avaaz.org) internationally.

What you can do to help drive the Transformation

The most powerful thing the individual can do is to share these ideas with everyone they know and to actively participate and engage in politics. Speak out and make yourself heard. These ideas will resonate with many people. Remember Eckersley previously telling us research showed 26% of Americans were 'cultural creatives' described as "people who have made a comprehensive shift in their worldview, values and way of life" in 2000. It is difficult to imagine that this percentage hasn't increased in the interim. Paul Hawken (2008) in *Blessed Unrest: How the Largest Social Movement in History Is Restoring Grace, Justice, and Beauty to the World* tells of the millions of groups and organisations around the world seeking a sustainable world. It was recently commented that if Hawken's list of organisations was typed in 8.5 font with single spacing between the words it would make a line over 27 kilometres long. The reality is that the new worldview is already highly latent and may require little more than legitimating.

The Role of the ACF (and concerned organisations) in Roundtables and National processes of Dialogue and Action

The challenge is to get the process initiated and rolling. A positive initiative in this direction would be for the Australian Conservation Foundation and other likeminded organisations to begin this process. The first step could involve a series of roundtables with leading thinkers and opinion leaders to work toward a shared analysis of both the problem, and the pathways to its resolution. This could form the basis for a program to fast-track literacy amongst leaders and the citizenry in the systems view of reality and the hope it provides. If the latency hypothesis above is valid and it resonates, making much better sense of reality then it should easily be adopted. Even if it does not, the powers of advertising could be turned to this task in the name of survival.

In parallel with this process, and led by the participants of the roundtables, a national dialogue process to engage the citizenry in the new way of thinking would assist in the rapid adoption and internalisation of the proposed approach. The necessary transformation could be made politically attractive through the vision of a more leisure oriented society with minimal mortgage obligations.

Such a movement will provide the political legitimacy politicians will be seeking to move in this direction. Society wide processes for bringing about such a wholesale transformation in social values should be examined based on the social psychology and social transformation literature. Ongoing society-wide processes of deep dialogue such as those of Freire (1970) and Kahane (2004), are likely candidates for helping society to socially and psychologically embrace the kind of transformation required. Processes that help to overcome 'groupthink' should also be closely examined.

There is no time to lose so lets get started!

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