



## SYSTEMIC ECONOMIC INSTRUMENTS FOR ENERGY, CLIMATE AND GLOBAL SECURITY

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**Abstract:** Energy security, climate stability, sustainable development, economic growth and national security are codependent goals; either all will be achieved or none. This global security goal-set will remain elusive with prevailing 'patchwork' policy-making. Irreversible failure with one or more of the goals may be avoidable with a non-reductionist approach to global complexity, using systems thinking and systemic interventions at leverage points, of which two are proposed. (1). Weapons spending can be deducted from Gross Domestic Product to define a 'Gross Peaceful Product' with which nations could align goals for growth and security. (2). Other global security goals can be approached by a preventive insurance scheme. Significant producers would pay an obligatory premium on all products (including fuels) according to the risk that they become waste in the air, land or water. Premiums would be invested in the capacity of nature, industry and society to reduce that risk. This market-based 'precycling insurance' would make many prescriptive instruments redundant. In particular, emissions capping debates need no longer delay international climate agreements.

**Keywords:** Codependence, climate, economic growth, energy security, systems thinking, market-based instrument, policy, Gross Peaceful Product, precycling, precycling insurance, global security, sustainable development, circular economics, conflict.

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## 1. A Global Security Goal-Set

### 1.1. CODEPENDENT GOALS

The narrow view of 'energy security', of a nation securing enough energy, has in the past been achievable as a largely freestanding issue. In future no nation can be assured of energy security without successfully navigating a broader view of global security that encompasses sustainable development, economic growth, national security and climate stability. Securing enough energy has become codependent upon securing other goals, including goals which appear to be in conflict with each other. In future none of these goals will be achievable anywhere without effective collaboration on a global scale.

The codependence of the above goal-set can be illustrated by considering any subset of the goals. What if one of the global security goals cannot be met? Failure to achieve energy security means the lights go out, with rapidly escalating impacts on societal sustainability and economic growth. Failure with sustainable development means that trends in wealth inequality, loss of nature and energy demand for example, are not reversed, making national security, energy security and climate stability unachievable. Failure with economic growth means recession, which is incompatible with the large investments needed for sustainable development and climate stability. Failure with national security means, at best, absence of the international co-operation needed to advance all goals. Failure with climate stabilisation sooner or later means 'game over' for civilisation and all its aspirations. Each of these goals requires policy-making that can cope with issues that are interdependent to the point of being indivisible. Either all the above goals will be met together or none will be met at all.

### 1.2. PATCHWORK POLICY-MAKING

Political statements often recognise the interdependence of goals but governments appear unprepared for codependence in policy or practice. The G8 leaders declared (G8 Summit, 2007), "Complementary national, regional and global policy frameworks...must address not only climate change but also energy security, economic growth, and sustainable development objectives in an integrated approach", yet their 38 page declaration omitted any further mention of this integrated approach. This G8 policy 'jigsaw puzzle' has no picture on the box and no guarantee that the pieces will fit together. Neglect of codependence may underpin the fragmented patchwork policies that allow many unsustainable trends to continue worsening decades after they are identified.

### 1.3. DECOYS TOWARDS FRAGMENTED SOLUTIONS

Continuing unsustainability is popularly viewed as a 'conspiracy' between weak-willed politicians and powerful vested interests, as reflected by globally declining trust in both business and political leaders and declining hope for the future (Gallup International, 2007). A less obvious explanation would be that attention from codependence and 'joined-up' solutions is diverted by a set of widely-held 'decoy' attitudes. Such decoy attitudes include:

- 'It's not my job.' Business, government departments and other institutions specialise within remits that cover only patches of the goal-set. Anything outside the remit is someone else's responsibility.
- 'Divide and conquer.' There is a belief that complex problems can be made 'manageable' by separately planning for separate goals. The separated competing issues can then be 'balanced', 'prioritised' and 'targeted'. 'Links' can be explored.

- 'It's not realistic.' Persistent unsustainable development paradoxically lends support both to defeatist views and the illusion that whatever is done will suffice. Ambitious solutions are 'idealistic' and small improvements are 'practical'.
- 'It's us or them.' The above decoys support a strategy of looking after one's own (family, organisation, region, nation or allies), at the expense of concern for all people (and nature). Security is sought within financial, geographical or organisational 'bubbles' where some goals are met for some people.

#### 1.4. PROBLEMS CAN BE SEEN AS THEY ARE

The reductionist view of a world definable into compartments, each controllable by the power and expertise of specialists is so psychologically attractive, even addictive (Glendinning, 1995), as to institute habits of perception. Yet global problems might be soluble only by seeing them as they are, not how they are accustomed to being seen. This requires new habits.

Some notes are offered on an approach for handling the complexity of codependence along with two prospective economic instruments. The first instrument supports the creation of global cycles of reduced fear of conflict and reduced spending on weapons. The second instrument adapts the current waste-dependent economic paradigm so that capitalism and economic growth cultivate the remainder of the goal-set. With these and other interventions, society may have a chance to rapidly meet global goals, reducing the risk that any combination of problems becomes irreversible.

## 2. Approaching Global Security

### 2.1. TRY HARDER OR THINK HARDER?

Policies based upon decoy attitudes rather than codependence have a common feature; they don't really work. In the past some goals have been met for some people at the expense of disturbances elsewhere and in the future. Many such disturbances have no boundaries (including pollution, conflict, disease, climatic instability, financial market volatility and displaced populations) and there are now no spacial or temporal hiding places. "As the gap between the nature of our problems and the ability to understand them grows, we face increasing perils on a multitude of fronts (Richmond, 1993)." In excess of US\$1 trillion annual global military spending is not making a safer world. Over 15 years of political negotiations to cut greenhouse gas emissions has not prevented steadily rising global emissions and accelerating climate instability. The decades-long flood of data and expert recommendations for action has led to a trickle of implementation. Is it enough to know what needs changing? What use are slow solutions for fast problems?

### 2.2. THINKING ABOUT WHOLE SYSTEMS

The replacement of decoy attitudes is basically a change of mind. The incentive to change could not be greater; the opportunity to sustain all life, including human civilization. Although patchwork policy-making is deeply entrenched, an alternative approach can be demonstrated. The practice of perceiving the world as a whole exists as a cultural thread throughout human history. It was shaped into a 'systems theory' by Ludwig von Bertalanffy (1950) and others in the 1950s. Churchman (1979) described a 'systems approach' where "...no problem can be solved simply on its own basis. Every problem has an 'environment', to which it is inextricably linked."

We live in a world of systems which link every dimension of human experience with the physical and living environment. The complexity of the global system is infinite yet curiously this complexity is not necessarily an obstacle to policy-making for global security. Living systems (both ecology and civilisation) require and generate complexity, from which emerges a capacity for self-organisation, resilience and self-correction. Today's troubled society dwells in complexity, pursuing certainty amongst the details of each problem rather than in the systemic causes.

### 2.3. BLINDED BY THE GLARE OF ONCOMING ISSUES

If goals can no longer be met singly, and change means changing the 'system', then there is the question of where to intervene. Systems thinking distinguishes between symptomatic effects, direct causes and underlying 'leverage points'. Donella Meadows (1999) defined leverage points as "places within a complex system (a corporation, an economy, a living body, a city, an ecosystem) where a small shift in one thing can produce big changes in everything". Society typically sees a problem as an existing or predicted symptomatic effect, such as a less stable climate, polluted water, illnesses, terrorist acts, rising population or recession. Each problem is considered to have a distinct set of direct causes. For example climate instability is 'caused' by greenhouse gas emissions, which are 'caused' by burning fossil fuels. Everyone advises everyone else to reduce their emissions, and large portions of the population believe that stabilising emissions would stabilise the climate (Sterman and Sweeney, 2007) despite cuts well above 50% being needed to allow stabilisation after a time lag of decades (and if runaway change has not been triggered). Climate would not be stabilised by small emissions cuts hence the level of emissions does not appear to be a leverage point for change. This would explain why the international climate debate has not led to emissions cuts. The world seeks its lost climatic stability under the lamp-post of direct causes rather than in the shadows of leverage points.

### 2.4. GLOBAL LEVERAGE POINTS

Human intelligence is well adapted to finding leverage points within the complexity of everyday life or technical problems. Ingenious solutions are routinely found for obstacles and bottlenecks. By contrast the decoy attitudes outlined above make global leverage points more challenging. If global leverage points were obvious they would have been taken up long ago. Whereas symptomatic problems are increasingly glaring and most of the direct causes are tangible, the global whole is beyond the reach of individual senses. People can understand the world only indirectly, as a mental model. Modeling of parts, symptoms or direct causes is analytical surgery which cuts connections at imposed boundaries. Models of global systems have the advantage of boundaries with a physical reality. Global leverage points offer the tantalising prospects of taking action on the scale of the problems and of cascading change. Meadows provided a list of places to look for leverage points, with the most powerful being feedback loops, information flows, system 'game rules', self-evolution, system goals and paradigms (shared beliefs). The last two places are probably not directly negotiable though they may be reshaped by events, new language, feedback of information or new game rules.

Possible leverage points may be indicated by one or more of the opportunities to:

- Address multiple issues together
- Scale-up or spread measures globally
- Resolve apparent conflicts between goals
- Support synergy between local (individual or group) goals and global goals

- Build-in a capacity for self-correction
- Prevent additional worsening of problems
- Use local knowledge and innovation in place of prescriptive controls
- Recruit spare matter, energy, skills or wealth.

## 2.5. CAN THE WORLD SEE ITSELF AS A WHOLE?

If global systemic change is necessary then there is a need for people everywhere to discuss how to do it. The prospects for meeting global goals rise in proportion to the vigour of this dialogue. Dialogues across issues, across institutions and across populations can introduce new perspectives, question decoy attitudes, share visions of the future and build the quality of proposals until they may become usable. Although almost all education instills a habit of working within separated topics, people have an innate ability to join-up ideas and develop multiple future scenarios (Calvin, 1989). Dialogues could encompass the widest range of perspectives and intentionally reduce barriers to participation on both formal and informal fora. Some leverage points, such as local initiatives that spread (e.g. Transition Towns) or imaginative forms of philanthropy (e.g. microcredit), are being led by individuals. Other conceivable leverage points are in the collective hands of governments, which could choose to join or lead dialogues. Multinational organisations are also well placed should they choose authentic dialogue<sup>1</sup>. Alternatively public dialogues may be initiated by any institution just by asking questions. *Is there any alternative to a future of limits and rules? What happened to sustainable development. Can a world in conflict solve anything?*

## 2.6. WHICH GOVERNMENTS WILL LEAD IN FUTURE?

Systems thinking presents a dilemma for governments, being incompatible with some institutional habits including (in the UK at least) “shared assumptions between politicians and civil servants that command and control is the correct way to exercise power” (Chapman, 2002). However, centralised command and control is restrained by democratic legitimacy and economic competitiveness. More controls risk less public support (fewer votes) and weaker, more constrained markets (less tax revenue). With climate instability for example the use of conventional controls (such as bans, rationing or punitive taxes) at a scale sufficient to halve or eliminate net emissions would strongly affect both public support and markets. Other conventional centralised ‘solutions’ such as mixed waste incineration, nuclear power and military interventions are similarly constrained. Governments wishing to face intensifying challenges and to retain authority have the option of exploring non-conventional institutional responses. Those governments which have been prominent in the past may not choose to lead in future.

The following sections are not a recipe for success but a sample of the policies available to all nations. Although other types of leverage points exist, both of the proposed interventions reflect the importance of economics in determining outcomes. Current economic ‘rules’ define a game which could end without winners.

## **3. ‘Gross Peaceful Product’ – Economic Growth, National Security and Global Security**

### 3.1. RESORTING TO CONFLICT

No-one is surprised at violence in the news. State and sectarian military adventures,

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<sup>1</sup> See for example Global Sustainability Dialogue. Shell, 2007. [www.blindspot.org.uk](http://www.blindspot.org.uk)

terrorist attacks, thuggery and knife-carrying by kids all illustrate a cultural dependence upon combative solutions to problems. Violent international crises have continued occurring at a rate somewhat higher than before World War II and violence continues to grow as the predominant crisis management technique for international conflicts (Cuellar, 2004). As oil dependence collides with climate change, predicted scenarios include “political instability where societal demands exceed the capacity of governments to cope” (CNA Corporation, 2007) and “constant battles for diminishing resources” through which “warfare would define human life” (Schwartz and Randall, 2003). A key indicator for cultural dependence upon the use of force is the money spent on weapons. This was recognised in Chapter 26 of the United Nations Charter (1945) where member nations agreed “to promote the establishment and maintenance of international peace and security with the least diversion for armaments of the world’s human and economic resources”. Less weapons spending would mean fewer weapons available for use and potentially greater investment in non-combative tactics for all aspects of security.

### 3.2. SHOULD GDP SUPPORT CONFLICT OR SECURITY?

The competing approaches to security were recited in a July 2007 speech by British cabinet minister Douglas Alexander (2007) in Washington DC, “In the 20th century a country’s might was too often measured in what they could destroy. In the 21st century strength should be measured by what we can build together.” Yet despite all efforts to agree disarmament and to promote the wider aspects of security, global military spending is estimated to have risen by 37% in real terms since 1997 to US\$1,204 billion in 2006 (Stalenheim et al., 2007). Weapons spending and combative problem-solving has not responded to good intentions and localised efforts. Progress with peace and security now depends upon global systemic intervention.

An apparent leverage point is the contribution of weapons spending to economic growth. The growth of Gross Domestic Product (GDP) is seen as an indicator of national success and status, despite increasing weapons spending more accurately indicating poorer prospects. A correction of GDP for security may be easier to implement than broad GDP correction, which is intended to measure concepts of ‘well-being’ or ‘progress’. Broad GDP correction struggles to estimate the unpredictable economic costs of ecological and societal damage, whereas a security correction to GDP need not estimate nor predict damage from weapons. Broad GDP correction can be seen as a threat by politicians accustomed to the way GDP masks problems (see Section 4.9) and is little use for guiding other decision-makers throughout the economy. In general the achievement of well-being or progress requires the economics to be corrected (see Section 4), not the indicators. However in the special case of security, those most concerned with economic growth comparisons (political leaders) also decide the bulk of spending on weapons.

### 3.3. A SYSTEMIC INCENTIVE FOR NON-COMBATIVE SECURITY SOLUTIONS

A corrected measure of economic activity, called Gross Peaceful Product (GPP), could be introduced as a replacement for GDP. Weapons-related spending would be deducted from GDP to define GPP. Economic growth would be calculated from GPP not GDP. Nations which foster weapons research and exports would have lower GPP than if they fostered more productive industries. Nations with a high dependence upon combative solutions would have lower GPP than if they prioritised non-combative solutions. Although spending on imports does not show up in GDP or GPP, nations importing large

amounts of weapons would still have lower GPP due to domestic spending on procurement, training, storage, maintenance and decommissioning. In addition, all the funds used to import weapons are unavailable for investments which could boost GPP. Reductions in weapons-related spending would boost economic growth by releasing public funds to either lower the tax burden or boost government spending on productive activities.

### 3.4. CYCLES OF LESS WEAPONS SPENDING AND MORE SECURITY

Given that governments aspire to maximise economic growth, the current method of calculating GDP provides an incentive for politicians to spend more on weapons. GPP would reverse this incentive by rewarding the minimisation of weapons spending with higher growth figures. Although GPP does not constrain governments in spending what they believe is needed on weapons, the potential loss of economic growth opens such decisions to greater scrutiny. GPP would stimulate the debates about the relative contributions of combative and non-combative security measures. If security now means global security then there is plenty to discuss. Nations could implement GPP as a diplomatic statement of intent to build a more secure world, as a badge of peace. Even without global adoption, GPP would set a new benchmark for judging the economic growth of all nations in which higher GPP and higher economic growth more accurately indicates future prospects.

A cycle of disarmament and reduced cultural reliance on force may be established due to:

- Other nations perceiving a reduced threat
- Reduced demand for weapons research and sales
- Weapons becoming less prolific
- Lower incidence of conflict
- More widespread and imaginative efforts with global security
- Young men seeing governments practice what they preach about nonviolence.

### 3.5. ENERGY AND TERRORISM

GPP would not guarantee any country adopting a terrorist-resistant (decentralised) energy infrastructure nor would it block military adventures in oil-rich regions of the world. However it would create circumstances to progressively minimise conflict as a factor in energy security and to liberate vast flows of funds from weapons budgets. The argument that taking better care of communities and nature is unaffordable would fade. If GPP succeeds to emphasise non-combative routes to security then terrorist recruiters would lose part of their supporting motives. Other motives such as resource insecurity and 'decadent' materialism can be addressed by the following market-based instrument.

## **4. Preventive Insurance Against Unsustainability – 'Precycling Insurance'**

### 4.1. FIXING THE CLIMATE MEANS FIXING THE ECONOMY

The security of both climate and energy supply would benefit from a reversal of historically rising global energy demand. Energy demand is shackled to society's material metabolism (since movement of matter requires energy). This is driven by an economic paradigm that records a faster metabolism as greater economic growth. So a 'successful' economy moves more products (including fuels) faster and further before they add to waste levels and are replaced by new products. This 'linear' economic

paradigm, defined by its systematic accumulation of waste in ecosystems, underpins modern economics. All nations find themselves competing at linear economics.

Energy demand could theoretically be reduced by mandatory emissions limits although this involves a switch from market choice to centralised control that may never be agreeable worldwide. Energy demand could alternatively be cut by phasing out the linear economic paradigm. This is relevant for energy, climate and the other global security goals as explained by Karl-Henrik Robért (1991), "Environmental degradation has many aspects but they are all related to one systemic error – linear processing of natural resources. The processing capacity of natural cycles is now exceeded by both the quantity and composition of our garbage. After steadily decreasing during the past billions of years of evolution, toxic substances are again accumulating in the biosphere – reverse evolution. ...In short, linear resource processing leads to continuous uncontrolled deterioration of socio-economic and public health conditions. It follows from the laws of thermodynamics that continuous linear processing of resources is compatible with neither wealth nor with life. ...The conclusion is unavoidable that we must transform our societies so that they function in harmony with the biosphere."

#### 4.2. A GLOBAL SYSTEMS VIEW OF WASTE

Waste is a term with a range of understandings that tend to be used interchangeably. Just two of these need be distinguished here; waste for disposal and ecosystem waste. Waste for disposal is an unwanted output from a process, such as waste water, exhausts and rubbish. Ecosystem waste is dispersed matter in ecosystems (land, air or waters) which cannot be reintegrated by biological or geological cycles (being either non-biodegradable or in excess of natural processing capacity). Waste 'strategies' devote themselves to the narrow concern of waste disposal, *how do we get rid of all that junk?* Mixed-waste incineration is commonly used to 'manage' mixed rubbish, which gives the illusion of disappearing into the air. However all disposed waste becomes either new resources (for people or nature) or ecosystem waste. Due to conservation of matter, wastes in ecosystems rise as natural resources diminish. Climate instability is the highest profile example of the multitude of problems caused by converting natural resources into ecosystem wastes. A systems approach with ecosystem waste as an indicator of sustainability has been described by Azar et al. (1996). Ecosystem waste can be built-in as a factor in market economics, offering a potential leverage point not just for waste disposal problems but for all sustainability issues.

#### 4.3. THE RISK OF RISING WASTE IN ECOSYSTEMS

Conventional insurance works for localised risks. The value of an insured house is protected by a payout in case of damage such as by fire. However, global damage, such as an unstable climate, accumulation of heavy metals or species extinctions, can be irreversible so any insurance would need to work preventively. Today's pattern of using resources is predominantly linear, from nature to products to ecosystem wastes. A leverage point at which to apply premiums would be on the risk of a product ending up as ecosystem waste – the 'waste risk'. The vast majority of the technosphere could be covered, since chemicals, fuels, equipment, houses, roads and most other human works take part in the economy of products. Even product components and most natural resources are products.

Every producer should already know if their product will add to waste levels in ecosystems. *Is our product recyclable or biodegradable? Have we contributed towards sufficient industrial and ecological processing so that our product can become a new resource in the market or in ecosystems?* Waste risk is not harder to calculate than risks



for conventional insurance. Due to complexity it is not possible to account for externalities (ecological and social costs which are neglected by markets) by measuring, predicting and allocating every ecological, social and economic impact. However waste risk serves as a proxy measure of a product's contribution to unsustainability. This is comparable to the way that risk factors for calculating car insurance premiums serve as a proxy for unpredictable automotive losses. Waste risk provides a sufficient basis for ending the historical neglect of externalities by markets.

#### 4.4. CIRCULAR ECONOMICS – JOINING UP THE RESOURCE LOOP

How could the premiums from a preventive form of insurance be used to reduce the risk of products becoming ecosystem waste? Support is needed for an array of actions that build capacity to make resources instead of wastes. These actions establish a circular pattern of resource use, or 'circular economics', as devised by Kenneth Boulding (1966). Boulding's circular economy takes part in a "cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy." The goal of circular economics may be seen in national policies, for example in China's 11th five year plan for 2006–2010<sup>2</sup>. Attempts to communicate circular economics to the public are typically reduced to simplistic messages ("recycle more") although the recent short film "The Story of Stuff" (Leonard, 2007)<sup>3</sup> introduces it engagingly.

Sustainable development and circular economics may be implemented in practice by 'precycling' (O'Rorke, 1988) which is action taken to prepare for current resources to become future resources. Precycling builds economic, social and ecological capacity to prevent ecosystem waste. Premiums charged to significant producers by insurers in proportion to waste risk would fund precycling. This generalises the 'recycling insurance' enacted by the European Waste Electronics Directive (WEEE, 2002), which funds recycling to cut the risk of particular products becoming waste. A generalised 'precycling insurance' (Greyson, 2007) could encompass all products, all ways of preventing waste, and all sustainable development challenges. Waste for disposal would be processed into new resources, with the cost included in product prices, rather than in taxes and disposal charges.

#### 4.5. BUILDING CAPACITY TO MAKE RESOURCES NOT WASTES

Ecosystem waste can be prevented in four ways, which between them allow any future product to be 'precycled'. They cover the same range of opportunities as Karl-Henrik Robèrt's 'system conditions' for sustainable development (Ny et al., 2006). Precycling is action to:

1. Cut dependence on substances from the Earth's crust that accumulate as ecosystem waste (minerals such as fossil fuels, heavy metals, radioactive compounds and phosphate).
2. Give products (any part of the built 'technosphere') a future as a resource for nature or people. Efficiency allows 'saved' materials (including fuels) not to become waste. Materials that cannot be recycled or biodegraded can be replaced. The economy can be prepared to handle all other materials cyclically.
3. Expand the diversity and range of ecological habitats (including croplands and protection of existing natural productivity). This raises the capacity to process

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<sup>2</sup> Cleaner Production in China. National Development and Reform Commission, 2006. [www.chinacp.com/eng/cppolicystrategy/circular\\_economy.html](http://www.chinacp.com/eng/cppolicystrategy/circular_economy.html)

<sup>3</sup> See: Leonard A. The Story of Stuff. Short film. Free Range Studios 2007. [www.storyofstuff.com](http://www.storyofstuff.com)

- non-solid emissions into clean ecosystems and new natural resources.
4. Meet more people's material and non-material needs. Meeting human needs, as distinct from human 'wants' (Max-Neef et al., 1991), does not inherently require ecosystem waste. Failing to meet needs, via either poverty or materialism, perpetuates waste.

#### 4.6. INSURING AGAINST UNSUSTAINABLE DEVELOPMENT

Precycling insurance fulfills an overall aim of insurance which is to avoid being financially 'wiped-out' by things going wrong. Although this is a new form of insurance, it follows existing concepts of insurance which include both preventive and obligatory aspects. Fire insurance began in 1680 with preventive investment in fire brigades (Wright, 1982), not payments for damage. Today insurance is still partly preventive, with premiums lowered for example when security measures are installed. Third party liability insurance is typically obligatory for vehicles and workplaces, with insurance premiums handled by insurance markets, not government. Precycling would be obligatory for significant producers but also entirely non-prescriptive and producers could choose how and even whether to cut waste risk since global waste risk can be cut both by producer investments and via investments of the premiums. Producers seeking to avoid premiums would invest in giving their products negligible waste risk. This provides the incentive for products to be 'precycled' with a 'cradle-to-cradle' (McDonough and Braungart, 2002) lifecycle. Those who choose to continue making 'prewasted' products would pay a premium and find their products less competitive in a market where alternatives are rapidly developed. Precycling insurance would provide strong signals also to investors and customers about which products and businesses have a future.

#### 4.7. PRINCIPLES FOR INVESTING PREMIUMS

The investment of precycling insurance premiums would bridge the gap between what is being done and what is needed. Many precycling actions cost little or nothing so small per-item premiums could add up to support large-scale changes. If precycled product prices become lower than prices for prewasted products then swift change may be expected. Premiums could be invested either directly by precycling insurers or through intermediaries according to principles which can be foreseen as follows. Investments should:

1. • Work preventively, for example primarily aiming to stabilise the climate, not to accommodate worsening weather nor to recover from disasters.
2. • Aim high, for example by expanding productive diverse ecosystems and designing urban areas that contribute positively to the ecology of their region (Birkeland, 2007).
3. • Add to people's options for living and working, for example by supporting new research, trends, jobs, processes, products, collaborations and hope.
4. • Support people's enthusiasm and engagement, for example by local and sectoral dialogues about the future, including monitoring and proposing investments.
5. • Fit together into plans for the future, for example using the Natural Step process (Holmberg and Robèrt, 2000) graphically, to chart what can be done over time.

#### 4.8. MARKET RENEWAL NOT MARKET CONSTRAINT

Unresolved global-scale problems are expensive. Prescriptive complicated

governmental constraints on economic activity are expensive. Both these expenses undermine economic stability and growth prospects yet both may be avoided by allowing the market to fulfill its responsibility for internalising externalities. This is a chance for capitalism to be seen not as a villain to be tied down but as a hero, dashing to save the day. In a renewed market the self-interest of customers and investors would stimulate change faster than any possible attempts to constrain the economy.

Governments would legislate, regulate and oversee precycling insurance schemes, but unlike taxes, they would not handle the funds. This division of responsibilities should enable transactions to be accountable to the public, building a level of trust not achievable with any expansion of taxes. Much of the existing patchwork of regulations, fees and taxes could be phased out, with benefits to innovation and growth.

Governments would be freed to focus on clearing up past problems, disaster relief, international cooperation, wealth redistribution and other roles beyond the reach of markets. A level playing field for all significant producers could be achieved with global introduction of precycling insurance, with insurers accredited by government, certified systems for investing premiums and web-based information open to public scrutiny. Coordinated international implementation could avoid accounting burdens with cross-border trade. Administrative burdens and regulation would be minimised while prospects for achieving the global security goal-set would be maximised.

#### 4.9. GROWTH OF WHAT?

Many countries have been experiencing relatively stable and positive growth of national income, or Gross Domestic Product (GDP), in recent years. Part of this GDP is spending on the side-effects of linear economics such as; regular upgrading of defences against terrorism, fraud, theft, floods, winds, heat and drought; surveillance, policing and prisons; treatments of polluted water and land, physical and mental illness; involuntary migration and poverty; advertising, sales and servicing of debt; clearance of ecosystems and extraction of diminishing resources; development, stockpiling, use and consequences of weaponry; disposal and replacement of unrecyclable products and infrastructure; over-regulation and costs of compliance; and higher taxes arising from all the other side-effects. From a GDP perspective this can look like a growth bonanza. GDP delivers 'success' irrespective of policies or events, which may explain its long-term appeal to politicians. The inventor of national income statistics, Simon Kuznets (1934), commenced the critique of GDP in 1934 by reporting to the US Congress that GDP was not designed to measure success, "The welfare of a nation can scarcely be inferred from a measurement of national income...". Kuznets' advice to watch what was growing remains relevant. With unproductive activity and economic inactivity growing, global economic growth faces a historically unprecedented end-point. Stern (2007) estimates a 5–20% penalty to GDP in case of failure with the climate stability goal. When combined with failure with other global goals, the potential penalty is harsher and the possibility of continuing growth is removed. Growth based upon linear economics appears to have no future.

Politicians may be relieved to hear that so long as current problems are reversible over time growth can continue – but not growth as usual. GDP (or more usefully, GPP as in Section 3 above) which preserves the resources on which it depends may expand with no theoretical limit to the quantity of final services that can be produced from a given physical resource input (Ayres, 1998). Growth can be generated not from a faster metabolism rushing to consume more physical resources but from activity which meets needs, prevents rising concentrations of wastes and generates new resources within industrial, ecological and geological cycles. Continuing economic growth may be underpinned by activities which adapt society to a circular economic model. Precycling

insurance premiums and their investments would both add to growth. The long-awaited global sustainable development 'revolution' would proceed rapidly, adding to growth. Losses to growth, such as less spending on products that become waste in ecosystems would be compensated by gains to growth from a vast expansion of diverse productive activity (see Section 4.5).

The outcomes of linear economics, including rising demand for diminishing resources, provide no defense against unstable and escalating prices. Speculative market activity can worsen this volatility. Precycling insurance would counteract this price instability, cut the overall costs of meeting people's needs and establish the lowest possible long-term prices for all products and services. An economy which protects resources in cycles has prospects for long-term growth, employment, stability and well-being that are unavailable in an economy which creates scarcity and damage by losing resources as wastes.

#### 4.10. A FUTURE FOR GROWTH

A portion of all fuels can be precycled by greater efficiency in resources, energy use and meeting of needs. Materials which are not needed do not require energy inputs. Energy which need not be produced does not make waste. Needs which are met do not require materialism. According to Friedrich Schmidt-Bleek (2004) "The resource productivity in western countries has to be increased by at least a Factor 10, compared to today. A dematerialisation of this magnitude will also dampen the energy demand by up to 80%, opening completely new vistas for de-carbonization and for supplying sufficient energy to the 2 billion poor of this world." Energy security may be assured not by supplying more but by needing less. The consumerist ambition of high energy-demand living standards can be superseded by low energy-demand quality of life. This cultural change may emerge, not by exhortation, but in response to suitable financial signals including precycling insurance.

#### 4.11. ALL FUELS CAN BE PRECYCLED

The use of fossil, nuclear or mixed-waste derived fuels all adds unavoidably to waste levels in ecosystems yet all can be precycled by substitution. For fossil fuels the option of carbon capture and storage may become available in future if the carbon remains safely stored over geological time-scales, storage does not release further fossil fuels and the noncarbon elements also do not accumulate as ecosystem waste. Some nuclear power equipment and fuels can be returned as new resources only over geological timescales so these can be precycled only by substitution. Precycling insurance would fund the prevention, reuse or recycling of all wastes for disposal, including two mixed fractions suitable for plasma gasification (for carbon-based materials) or construction (for non-carbon based materials). Mixed wastes would not be available for incineration. Precycling insurance would raise the production costs of waste-based fuel products and subsidise the precycling of fuels. This would direct spending and investment in energy businesses away from waste-based fuels.

The focus on products rather than emissions allows the same economic instrument to apply to both fuels and energy equipment. Energy itself is not included since all energy comes either from fuel products or from sources outside ecosystems (geothermal, tidal, solar). Precycling insurance can account for the nuclear power station as well as the fissile fuel, the oil tanker as well as the oil, and all the equipment used for renewable energy. Premiums for biomass and processed biofuels would include the waste risk of fuels used in processing. Premiums would be invested in ensuring that biofuels do not cause loss of diverse ecosystems nor food production.

#### 4.12. CLIMATE TALKS WITHOUT EMISSIONS CAPS

The tendency of linear economics to omit the costs of preventing problems has led to numerous worsening global problems, including climate change. International political climate talks over the past 15 years have not considered the role of linear economics nor of systemic economic instruments. Instead talks have pursued global agreement on mandatory emissions limits (or 'caps'). Such agreement remains elusive; the enforcement of any future agreement would be even more elusive. Many politicians understandably worry that an agreement designed to limit emissions from the economy would also limit the growth of that economy. Politicians might also worry that a patchwork of regulatory and economic policies would create unfairness between people, businesses and nations that would potentially inhibit economic growth, climate stability and other global security goals. Top-down controls such as emissions rationing have yet to be fully considered and may prove to be unusable due to lack of public support. International climate talks could usefully consider whether emissions might be cut further and faster by agreement on a new global economic model, rather than agreement on emissions limits. Linear economics should not be constrained, it should be rapidly replaced by circular economics which would operate without rising waste levels in the atmosphere or elsewhere.

### **5. Conclusion – Prepare for the Unexpected**

#### 5.1. UNSUSTAINABILITY WILL END ONE WAY...

A transition from linear to circular economics, a sufficient global effort at climate stability and the advancement of global security can be attempted using the systemic economic instruments outlined above. The proposed instruments are no panacea. Despite many aspects of human progress, a legacy of numerous problematic trends impede progress. These trends may all be reversible though whatever is now done, further difficulties will arise for decades due to time lags in complex systems. Some trends will benefit from further instruments at other leverage points. The codependence of energy security, climate stability, sustainable development, economic growth and national security suggests a role for both Gross Peaceful Product and precycling insurance. If only GPP is applied then conflicts over declining oil reserves, affordable food, clean water and productive land may worsen. If only precycling insurance is applied then vital public funds could continue to be diverted into stockpiling of weapons. If both GPP and precycling insurance are applied then it may be possible to experience economics which more fully engages the human potential for ingenuity and shared endeavour. The pace of change may be surprising.

#### 5.2. ...OR ANOTHER

Possible approaches to the complexity of codependent goals may be disregarded by policy-makers who remain comfortable with prevailing attitudes. Society's attention may be otherwise occupied. The default option of progressively tougher patchwork policies invites an outcome where no goals are met amidst emerging combinations of ecological, financial and societal disruptions. Again, the pace of change may be surprising.

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