Shifting South Africa to the Next Economy

Green Growth – Towards a Green Economy, Rich with Green Jobs

Version: September 2010

Introduction

Anyone grappling with how a future economy should or could look like, will have come across many apparent disconnects – the first would be the correct assumption that we appear to be "locked in" to a system, which does not, at first glance, lend itself to change.

This document begins to show how these changes can indeed be made, and will lead to a future economy that is both sustainable (environmentally, socially and economically) and assists in the delivery of support to the broader masses in South Africa.

The second part of the document lists literally hundreds of various Green occupations, at all skills levels, that not only build on our current skillset, but also can reverse the job losses – many job losses are in fields that are desperately needed in a Sustainable Economy.

The Chinese are well on their way to what they call a "Circular Economy" – which, locally, is called a Zero Waste Economy. It would be a positive step in our country's development if we emulated this, keeping in mind local conditions and cultures.

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Context:

What on Earth is going on? To provide some background and context to this document, it was felt that an indication of the trends in the field would be of use. Some indicators have been chosen from news from around the world…

Sub-Saharan Africa:

"Sub-Saharan Africa could provide more than 170 gigawatts of additional power-generation capacity - more than double the region's current installations - through 3,200 "low-carbon" energy projects ….Together these projects could avoid some 740 million tons of carbon dioxide-equivalent reductions each year. The total capital costs are estimated to be at least $157 billion, the report said. "The pipeline of similar projects in other regions shows us that such projects are often economically viable when carbon revenues are added," said World Bank senior energy specialist Massamba Thioye, who co-authored the report, in a statement."

Global:

The global market for environmental products and services is projected to double from the current $1.37 trillion per year to $2.74 trillion by 2020, according to a 2008 report co-sponsored by the UN Environment Programme and several international labor organizations.

"Think 1.8 million jobs in the environmental sector with 8% of GDP accounting for Green technologies… jobs in the renewable energy sector increased from 94 000 (2000) to 278 000 (2008). The world trade volume in environmental goods has increased by an average of 9.5% a year since the early 1990's. The estimated worldwide turnover by 2020 is EURO2.8 trillion, and Germany expects to double it's jobs in the environmental sector to 3 million by 2020." M&G

EU:

"Jobs in low-carbon sectors are already outstripping those in Europe's traditional polluting industries in Europe, but the EU is missing the boat as regards harnessing the economic crisis to kick-start the transition to a low-carbon, competitive economy, a WWF study published yesterday (16 June 2009) shows. The conservation NGO's estimates show that renewable energy, green transport and energy-efficient goods and services employ at least 3.4 million people in Europe. This compares favourably with 2.8 million jobs in mining, electricity, gas, cement, iron, steel and other polluting industries, it reads. Renewable energies employ 400,000 people, but the potential for growth is significant, the study points out. Although around 70% of renewables technology rests in the hands of European companies, only a small number of countries, with Germany and Spain in the lead, account for the bulk of jobs in Europe. The largest share of green jobs, around 2.1 million, is in sustainable transport. "

United Kingdom:

"Green jobs are growing more than twice as fast as other employment, according to a report released today by the Pew Charitable Trusts. Driving the expansion is consumer demand, venture capital and federal and state policy reforms, said Pew in a release. "A clean energy economy," said Pew, "generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources." June 10, 2009

The green-collar sector is a huge growth industry. Worldwide, businesses invested $117.2 billion in alternative energy in 2007, according to New Energy Finance, a U.K. research company. Over 3,400 U.S. companies are in the solar energy business, including manufacturers, installers, distributors, developers and suppliers.

“The pursuit of so-called "green jobs"-employment that contributes to protecting the environment and reducing humanity's carbon footprint-will be a key economic driver of the 21st century. "Climate-proofing" the global economy will involve large-scale investments in new technologies, equipment, buildings, and infrastructure, which will provide a major stimulus for much-needed new employment and an opportunity for retaining and transforming existing jobs.

The number of green jobs is on the rise.

The renewable energy sector has seen rapid expansion in recent years, with current employment in renewables and supplier industries estimated at a conservative 2.3 million worldwide. The wind power industry employs some 300,000 people, the solar photovoltaics (PV) sector an estimated 170,000, and the solar thermal industry more than 600,000.More than 1 million jobs are found in the biofuels industry growing and processing a variety of feedstocks into ethanol and biodiesel. Construction jobs can be greened by ensuring that new buildings meet high performance standards. And retrofitting existing buildings to make them more energy-efficient has huge job potential for construction workers, architects, energy auditors, engineers, and others. The weatherization of some 200,000 apartments in Germany created 25,000 new jobs and helped retain 116,000 existing jobs in 2002-04. The transportation industry is a cornerstone of modern economies, but it also has the fastest-rising carbon emissions of any sector. Relatively green auto manufacturing jobs- those in manufacturing the most-efficient cars currently available-today number no more than about 250,000 out of roughly 8 million in the auto sector worldwide.” Worldwatch: Green Jobs: working for people and the environment

Global Roundup:

The global market volume for environmental products and services currently runs to about $1,370 billion (€1,000 billion), according to German-based Roland Berger Strategy Consultants, with a projected $2,740 billion (€2,200 billion) by 2020.

Globally, some 300,000 workers are employed in wind power and perhaps 170,000 in solar photovoltaics (PV). More than 600,000 people are employed in the solar thermal sector—by far most of them in China. Almost 1.2 million workers are estimated to be employed in generating biomass-derived energy (mostly biofuels) in just four leading countries: Brazil, the United States, Germany, and China. Overall, the number of people presently employed in the renewable energy sector runs to about 2.3 million. Given the gaps in employment information, this is no doubt a conservative figure.

The most impressive building project to date is the German Alliance for Work and the Environment, a retrofitting program serving 342,000 apartments as of March 2006. From 2001–2004, this project was responsible for creating 25,000 jobs and saving an existing 116,000. In 2006, an estimated 145,000 additional FTE (full-time equivalent) jobs were attributed to this building retrofit program as a result of increased levels of public-private spending. Additionally, many studies have begun to assess the number of potential jobs that would be created through energy-efficiency measures including investment, standards, and mandates.

The entire Cape’s electricity or energy requirement (Eastern Cape, Western Cape, including Namibia) is approximately 5 000MW. The largest wind turbine produces 2MW and 2 500 wind

turbines would be required to supply the entire Cape. Such a plant would take about 4 years to build on a 900km2 piece of land *(could be on existing farms)* at an estimated cost of R100bn..... Equally, a base load solar energy power station generating approximately 2 000MW would require CAPEX of about R100bn to R120bn, although it would take up to four years from construction to commissioning, its cost structure would be somewhat similar to that of a nuclear power plant.

CLOSING REMARKS – JOHANNESBURG, GAUTENG HEARINGS

P M Makwana, Interim Chairman & Chief Executive, Eskom

GALLAGHER ESTATE, 22 JANUARY 2010

China, which has the largest amount of waste, has a mix of formal and informal collectors. About 1.3 million people are employed in the formal waste collection system and an additional 2.5 million informal workers or scrap collectors. But beyond waste and scrap collection activities, China has a far larger number of people involved in all aspects of recycling, reuse, and remanufacturing—as many as 10 million according to one estimate. In Cairo, there are an estimated 70,000 or so Zabaleen—independent garbage pickers and recyclers—in addition to formal-sector garbage-collecting companies that are far less focused on recycling than on waste disposal.

Already 800 million people are engaged in growing food in urban areas. The employment benefits of sustainable urban agriculture are potentially enormous.

Source: Green Jobs: Towards decent work in a sustainable, low-carbon world

Latest Research: South Africa

A recent (Jan 2010) report from international research organisation the Global Climate Network (GCN) has indicated that some 36 400 new direct jobs and 109 100 indirect jobs could be created in the renewable energy sector in South Africa by 2020.

Transiting to a Future Sustainable, Zero Waste Economy.

Summary:

There are probably as many paths to a Green Economy as there are people, but one way in which this may be achieved, many agree, is being followed by some UN projects. Some of the key issues reiterated time and again, include the following:

1. Promotion of Sustainable Consumption and Production (Demand-side Management)
2. Greening Business and Markets
3. Development of Sustainable Infrastructure
4. Green Tax and Budget Reform
5. Eco-efficiency Indicators

Sustainable Livelihoods Approach: The Social Link to Green Growth

It is often forgotten that a Green Economy is very people friendly, and delivers on more social mandates than almost any other approach – and not only will the Green South African economy continue this trend, it will also help us address various challenges, from Climate Change to the creation of Decent Jobs; from local food security to safe and clean energy sources; the re-integration of (for example) lost manufacturing jobs, greatly in demand in a Green Economy – the list could go on…

Many projects emphasize the Sustainable Livelihoods approach, a rights-based approach that recognizes the poor as a key stakeholder in the development process. To this end, Green economies encourage the use of participatory assessments, designed to include the concerns of vulnerable women and men in the policy planning and implementation cycle. Adopting this approach allows Green economies to work towards win-win solutions: addressing the environment in ways which enhance opportunities for the poor to participate more fully in society, improving their quality of life.

Greening economies: what are the basic principles?

- Quality of the economy
- Eco-efficiency of the economy
- Environmental and social sustainability vis-à-vis environmental performance

Key Interventions towards a Socially Just Green Economy:

1) Sustainable Consumption and Production – these patterns are basic drivers of any economy and play an important role in shaping the sustainability of economies. Developing regulatory frameworks, coupled with better pricing signals for raw materials and their sustainable alternatives, and penalising disposal or destruction of materials in a de-materialised economy (as required by the South African National Framework for Sustainable Development), can create the conditions for more sustainable processes.

Clean and eco-effective production is supported by
(i) green investment;
(ii) eco-innovation;
(iii) eco – design;
(iv) ambitious and regularly updated product standards and labelling programmes;
(v) increasing market access for environmental goods and services;
(vi) environmentally sound public procurement rules and practices;
(vii) environment management systems and standards.
(viii) local and localised production and consumption

2) Greening Business and Markets
This requires initiatives from both the private sector and policy makers. Sustainability is an essential component of the long term business objectives of private sector firms, both by the promotion of eco-efficient production activities and by marketing sustainable products and services. Social entrepeneurship targets poor communities in the local economy to nurture green business solutions for poverty reduction and sustainable livelihoods.

Corporate responsibility and accountability, including
(i) by creating full transparency about the sustainability performance of business;
(ii) equitable and informed dialogue between enterprises and the communities in which they operate;
(iii) financial institutions to incorporate sustainable development standards into their decisionmaking processes;
(iv) workplace-based partnerships and programmes
(v) review and regulation of advertising in order to prevent unsubstantiated and/or misleading environmental claims.
(vi) acceptance that some products and processes will have to be phased out

3) Sustainable Infrastructure
Many countries are locked into unsustainable resource consumption patterns, due in large part to the way infrastructure has been designed to deliver services. The development of an eco-efficient infrastructure – economically efficient, environmentally sustainable systems that provide citizens with safe and reliable access to shelter, energy, transportation, water, proper sanitation and re-integration of unavoidable wastes back into the economy – is becoming increasingly critical.

4) Green Tax and Budget Reform
While SA has begun this process, this policy instrument comprises a wide spectrum of fiscal pricing measures that have the potential to simultaneously increase revenue and foster Green Growth. More

specifically, it entails: 1) shifting the tax burden from traditional areas of taxation, such as income savings and capital gains, to environmentally relevant products and activities like fossil fuels and waste, both of which are highly subsidised, often by the impacts on the poor and marginalised; and 2) redirecting subsidies from environmentally perverse activities, towards activities that promote Green Growth. This reform is done with the aim of achieving revenue neutrality: a net zero increase in the level of taxation on the economy.

Ecological fiscal reform containing
(i) removal of environmentally harmful and other perverse subsidies;
(ii) use of eco-taxes and other penalties to internalise external costs;
(iii) broader use of price mechanisms that support policy integration;
(iv) selective use of positive post-compliance incentives;
(v) development of new and common measures of accounting including environmental impacts within the current system of accounts.

5) Eco-efficiency Indicators
Eco-efficiency, or minimizing environmental pressure while maximizing economic benefit, is a key sustainability principle. A country's economy can be thought of as a huge resource-processing plant. Raw materials, including energy and water, go into the economy as inputs to various production or consumption processes. At the other end, the result is goods, services and waste. The transformation process is intended to result in some human benefit. Maximizing the efficiency of resource use and minimizing pollution during the entire transformation process across economic sectors is critical to achieving sustainable development or economic benefit. However, it must be clear that products and services cannot have an automatic "right to exist", and must fall within agreed sustainability parameters.

In 2000, the World Resources Institute undertook a study of material flows across five economies, tracing the inputs of raw materials (minerals, other raw materials and energy) to determine the amounts that were used to create durable material wealth (material in manufactured goods and infrastructure that
would exist for more than a few years) and the amounts that ended up as waste. It was found that certain economies seemed more predisposed than others to create higher proportions of waste. In one case, for every unit of material wealth created, three times the amount of waste was created. In others, the ratio was closer to 1 to 1.2.

However, Life Cycle analyses confirms that for every kilogram of product, anywhere between 35 and 70 kilograms of waste are generated.

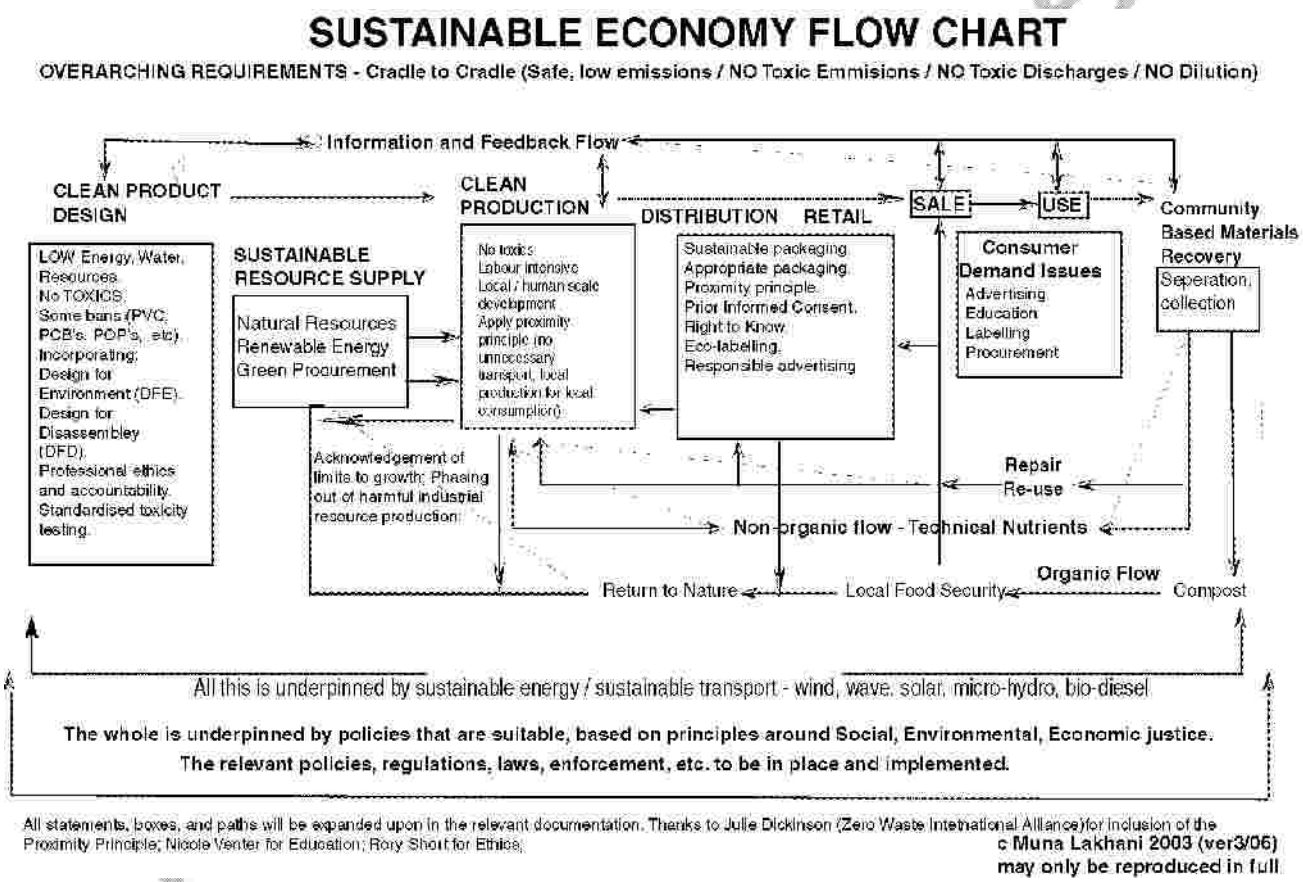
Chinese reduction plans by 2020:
(Compared to 2000 levels):
Energy intensity (energy used per unit GDP) by 50 to 60 per cent
Water intensity (water used per unit of GDP) by 80 per cent
Sulphur dioxide (SO2) intensity (SO2 emissions per unit of GDP) by 75 per cent
Carbon dioxide (CO2) intensity (CO2 emissions per unit of GDP) by 60 per cent

These plans take some key steps in defining eco-efficiency indicators that can be used to monitor trends in economic development. It is also beginning to explore how such indicators can be applied to assess the environmental sustainability of infrastructure.

Some key questions addressed by these projects are described below:

- How is eco-efficiency measured?
- What indicators can countries use to measure eco-efficiency?
- Is infrastructure becoming more or less eco-efficient?
- Is infrastructure delivering more services per unit of environmental impact?
- Does the fiscal system adequately facilitate improvement in the quality of consumption, with lower disposal and greater durability?
- Are production and consumption patterns becoming more eco-efficient?
- Are eco-efficiency standards based on sustainable materials and sustainable energy, with low water usage?
- Are businesses actively engaging in practices that lead to more eco-efficient production and consumption, and greatly reduced toxicity and pollution?

Sustainable Economy Flow Chart



Detail:

Through its focus on the greening of economic growth, international work recognizes that different patterns of economic growth lead to different outcomes for ecological integrity and therefore for human well-being. The idea that the "quality" of economic growth differs depending on policy choices, and that all countries - including developing countries - can choose their development path, must be a basic principle underlying the work done in greening economies. Quality of economic development, in the context of sustainable development, may mean different things various countries and regions. In South Africa, as in Asia and the Pacific, overall, there has been a coincidence of rapidly expanding economies, poverty and substantial future consumption pressures, however, the natural resource base in Africa is wider than SE Asia. Thus, a focus on meeting human needs and improving well-being with the lowest possible ecological cost is more relevant in Asia and Pacific

than in any other global region, but given the degradation and skewed land ownership patterns in South Africa, the same is relevant here.

Developing policies to promote and measure the eco-efficiency of economies is therefore a key way to meet the most important challenge to sustainable development in this region reducing the pressure on the natural resource base while continuing to meet human needs. And how is eco-efficiency achieved in practice? There needs to be an emphasis on the difference between policies and institutions that work to improve environmental performance, and those that contribute in a meaningful way to improving environmental sustainability. A focus only on improving environmental performance (that is, the end result, and mainly pollution control) results in end-of-pipe solutions – this is the current approach in South Africa. At the same time, there is a need to take action to address the environmental sustainability of the economy where the biggest eco-efficiency gains can be achieved. The green economy approach provides the tools for this.

Many make the mistake of thinking that eco-efficiency has to do with birds and trees and bees and animals – however, eco-efficiency has massive potential positive impacts on human health, wealth and well-being. In short, sustainable and people-driven eco-efficiency translates into more benefit for more people, from fewer resources.

Reviews of progress on achieving the Millennium Development Goals justify a growing uneasiness with prevailing economic growth patterns, evidenced in the media and by some research. Of course, the recent and ongoing "financial meltdown" is impacting across the globe, and those economies that are most eco-efficient, tend to be the ones surviving the problem best, as they are able to provide for their needs at a local level. Only a few countries have managed to increase incomes at all levels of society. In most countries, the gap between rich and poor is growing, with South Africa unfortunately leading the pack (as measured by the GINI coefficient). However, income inequality is only part of the picture. Gender-based inequalities in access to health care and rural-urban inequalities in relation to access to water and sanitation are also highlighted by these reviews. Despite economic growth since the advent of democracy, the results have not delivered substantial benefit to the poor and previously marginalised in the way it was originally hoped for.

One key reason is that the "growth at all costs" approach has come home to roost, as the famous "trickle down" theory and others, have confirmed that the growth only approach does not lead top significant improvement in the lives of the poor, and instead, has been responsible for the growth of the incomes of the rich.

The degradation of the natural resource base exacerbates the situation and makes it more difficult to advance towards achieving Goal 1 (eradicate extreme poverty and hunger) in a way that benefits all persons in society. There is continuing evidence of reduced natural capital in the form of declining air quality in many cities across the region, land degradation and desertification, shrinking natural forest cover and increasing water stress. The limitations of and continuing threat to natural capital compromise the ability of Governments to meet the still substantial needs for economic benefit

Most importantly, current and projected patterns of consumption and production point to mounting future environmental and social pressures, pressures that not even the improvements in pollution control that sometimes accompany economic growth will be able to relieve.

"Grow now, clean up later", is no longer an option. Improving the ecological quality of economic growth requires greater focus.

Fiscal policy and pricing is the "software" of our economies and societies. Are fiscal policy and pricing "programmed" for the kind of economic and social development that maximizes human well-being and minimizes environmental impact, or do they promote economic growth at all costs? Do fiscal policy and pricing reward and facilitate investments made in natural capital commensurate with the ecosystem goods and services that this natural capital is expected to provide?

Are current patterns of infrastructure development locking countries into resource-intensive, socially excluding lifestyles for decades into the future, or is there sufficient effort to develop infrastructure in a way that maximizes service delivery and reduces environmental impact? Is balanced consumption being promoted as a means to improve human well-being, or as an end in itself? How can sustainable production and consumption choices be created to meet the demand of the growing numbers of conscientious consumers, ignoring for the moment in the need to supply same to all? Are businesses able to transform their practices quickly enough to restore, rather than destroy, natural capital, and lead to positive social impacts? How can policy and implementation allow business to achieve this?

While there are some key ethical and moral issues attached to these questions, they serve to indicate (at the very least) the direction that the economy is or should be heading in.

Table 1 : Environmental sustainability vis-à-vis environmental performance

	Environmental performance approaches	Environmental sustainability approaches
Planning and policy perspectives	Short- to medium-term perspectives	Long-term perspectives
Intervention in systems that impact on the natural environment	Focus on improvements to existing modalities of consumption and production and end-of-pipe solutions	Seek fundamental changes to patterns of socio-economic activity (consumption and production) to make them more eco-efficient Seek to improve decision-making processes that impact on the use of natural resources
Scope of responsibility	Mainly implemented by government agencies and private sector units responsible for environmental management	Require the involvement and support of all government agencies, the private sector and the wider society
Measures and indicators	Use traditional measures and indicators of environmental quality – e.g. extent of forest area, concentrations of pollutants	Seek to determine the impact of patterns of natural resource use by focusing on the linkages between the use of environmental goods and services and anthropogenic activity: for example, eco-efficiency of use of ecosystem goods and services (e.g. total material flows per unit of GDP, and pollution produced per unit of production)

Source: ESCAP (2006). State of the Environment in Asia and the Pacific 2005 (New York, United Nations).

Can current economic and pricing systems (the software of the economy) and the physical expressions of economic growth manifested in the trade in goods and services as well as patterns of infrastructure development (the hardware of the economy) produce new environmental and social outcomes?

It is unlikely, even with the best pollution and waste control measures in the world.

Where economic growth is determined by market forces, and market forces do not take into account environmental costs, environmental and social (human health) protection is doomed. Climate change is the most prominent symptom of such market failure. Eco-tax reform (ETR) uses fiscal policy measures to steer economic burdens away from economically beneficial activities (such as employment) towards environmentally harmful activities (such as the generation of pollution). With this approach, decision-making at every level, by the

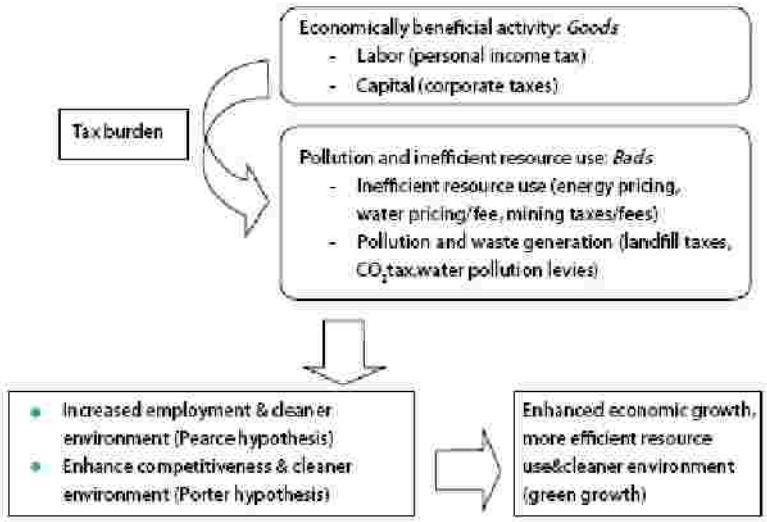
individual in society up to the highest national Government forum, is steered towards minimizing the negative social and environmental impacts of economic development.

Sustainable infrastructure development is a critical focus of green economies. While infrastructure expands, it locks economies into specific patterns of resource use (such as energy) for decades into the future. In South Africa, as in Asia and the Pacific, where there is rapid urbanization and significant shortfalls in almost every kind of infrastructure, investments in infrastructure may be turned into investments in environmental sustainability and an opportunity to build more sustainable economies. This has yet to be seen in South Africa, as the pattern (as evidenced by the 2010 mass construction programme) is still locked into unsustainable infrastructure.

Another aspect of the hardware of an economy is the production and consumption of goods and services. The rate at which these goods and services are produced, and how they use environmental resources and services (as raw materials in their production, as inputs to their operation, or as waste sinks) are critical sources of environmental pressure. These pressures are growing with the rise of the consumer classes in many economies. The greening of business and sustainable consumption remain the core prerequisites for meeting both
human welfare and environmental protection needs.

Eco-tax reform

ETR, also known as green tax and budget reform, is a powerful policy tool for building more effective, efficient, socially beneficial and environmentally sustainable fiscal systems and economies. Its key principles are the internalization of environmental and negative social costs in the market and revenue neutrality, that is, green taxes should not pose an additional burden.
How can the promise of ETR be turned into a reality for more countries?



In his 2003, research paper, A. Verbruggen compared electricity prices and electricity intensities (electricity used across each economy, per unit of GDP earned) and revealed a neat curve. At the top end of the curve lay the countries with high energy prices and low electricity use per unit of GDP (electricity intensity), typically high-income countries. At the low end of the curve lay the countries with very high electricity intensities and very low electricity prices. In the middle of this curve lay a few surprises: countries such as the United States of America showed higher electricity intensities than expected for expected for their stage of development. Every unit of GDP earned by the United States of America required twice as much electricity as those of countries such as Denmark and Sweden. The distribution represents the evidence that higher energy prices encouraged the development of energy-efficient economic structures without precipitating economic disaster. The economies of countries that had the highest energy prices were, in fact, among the most stable in the world. In addition, they were known for their achievements in socio-economic development, as measured by the human development index.

Energy pricing that steers business and the consumer towards more efficient energy use patterns is a standard instrument in environmental tax reform. When environmental taxes are applied in a revenue-neutral approach to ETR, they become a powerful tool in changing the sustainability of the local economy. Differential pricing is a mechanism that has been utilised in South Africa, but the bulk users have been paying the low prices, with small users paying more – the model of a stepped tariff (with unlimited steps, as opposed to the current model) will address these issues, as well as ensure that the social upliftment is further supported in this way.

Sustainable infrastructure

Green building design can reduce energy and water use by human settlements by more than 30 per cent over the lifetime of the structure; this does not take into account the potential savings from applying eco-efficiency concepts to all types of infrastructure development.

Infrastructure development – "hard-wiring" consumption patterns.

Infrastructure development patterns are the most important, but least recognized, determinants of the consumption patterns of a country. As cities grow upwards and outwards, highways lengthen and water, energy and sanitation services are expanded to people who do not yet have the basic requirements for a good quality of life, the region's growing populations are locked into energy and water consumption patterns determined by the infrastructure through which these services are delivered.

The spectres of climate change and growing resource scarcity suggest that policymakers and planners who are now accountable for only the capital costs of a building, a transportation system or a new urban centre when it is constructed should also be accountable for the social, resource-use, pollution and environmental costs over the lifetime of the infrastructure, far into the future.

Currently, in South Africa, basic services are becoming less affordable, especially by the poor, the exact opposite of what is required. Infrastructure design and incorrect pricing and subsidy are responsible for this state of affairs.

Sustainable infrastructure development – eco-efficiency as a basic principle

Buildings are already responsible for about 75 per cent of GHG gas (mainly CO2) emissions. Addressing this source is therefore important to climate change mitigation. Climate change adaptation entails improving energy and water efficiency in response to the projection of scarcity of these resources and the resulting impacts. Such impacts include the heat island effects, in which urban temperatures rise due to the thermal properties of the built infrastructure and energy use.

People transporting themselves (and needed materials) to the building can use more energy than the building itself does. Therefore, building location and materials decisions are equally, if not more, important to sustainable infrastructure development than building design. There are tremendous opportunities to improve the performance of built environments in developing countries that are in the process of improving, renewing and extending their infrastructure.

Improving sustainability in infrastructure development requires explicit attention to eco-efficiency, achieving more with less consumption of resources (energy, water, land and raw materials) and

production of pollution (such as CO2, SO2, nitrogen oxides) over both the construction and usage phases of infrastructure. Concepts and tools such as material intensity per unit of service and material flow analysis can help determine resource consumption in the delivery of infrastructure services in order to measure eco-efficiency. These concepts help focus infrastructure decisions on eco-efficiency criteria and achieve the necessary paradigm shift in thinking and practice.

Sustainable infrastructure should:

- *minimize resource use and ecological impacts throughout the life cycle;*
- *preserve ecosystem integrity;*
- *not aggravate adverse global phenomena as climate change and ozone depletion;*
- *deliver economically viable goods and services;*
- *maximize long-run economic growth for the benefit of all;*
- *be financially viable;*
- *be managed and operated in a sustainable way;*
- *be socially inclusive;*
- *contribute to reducing poverty;*
- *contribute to meeting the MDGs;*
- *be appropriate for the stage of development and context; and*
- *be accepted and supported by the general population*

Source: Report of the ESCAP Expert Group Meeting on Sustainable Infrastructure Development in Asia and the Pacific, 11-13 June 2007, Bangkok, Thailand

Maximizing service delivery while minimizing environmental impact

This requires a closer look at whether infrastructure development objectives are expressed in terms of the problem that they are intended to solve (the lack of accessibility and affordability / ability to use) or in terms of the solution that finds the greatest support in the most powerful sectors of society. Are the right questions being asked when infrastructure development decisions are made? For example: “How can we enable all or most people to move to the places they need to get to in a timely way?” rather than “Is there enough space for the cars?”

A focus on sustainable infrastructure is therefore not only about reducing environmental impacts; it is equally about maximizing service delivery to all people in a way that enhances economic and social and economic performance. It is therefore more likely to result in infrastructure development patterns that are people-focused rather than narrow and solution-focused.

Infrastructure development in the ancient city of Bangalore, India has been described as typical of unsustainable infrastructure development, with road-widening and other infrastructure projects resulting in a city that is quickly losing its charm and marginalizing poor pedestrians and bicyclists.

Further along in its growth path, the city of Seoul has reversed this process to restore the Cheonggyecheon River by removing an overhead highway. Although the project cost as much as US$386 million and resulted in social conflict and the displacement of businesses, it is creating an oasis in the city, which has had economic benefits for both small and large enterprises.

Forward-thinking planners are now proposing that accessibility, rather than mobility, needs to be the goal of transportation infrastructure. The dimensions of accessibility include:
Socio-economic accessibility: Are infrastructure solutions affordable for all or most groups?
Socio-cultural accessibility: Are mobility solutions provided in a culturally appropriate way?
Can all persons of various socio-cultural backgrounds (differentiated, for example by gender) equally access the services? Do the solutions reflect prevailing lifestyles?

Institutional accessibility: Are the solutions geared towards facilitating access to key institutions in society (for example government offices, schools, hospitals)?
Physical accessibility : Are mobility solutions accessible to those with physical limitation, for example?

Decentralized service delivery: economic, environmental and social benefits

Approaching infrastructure development from an accessibility-first perspective provides opportunities for socially inclusive infrastructure development, potential for community involvement in service delivery and thereby broader-based economies that meets needs more efficiently. Communities can themselves become investors in infrastructure development.

Decentralized infrastructure-service delivery, through, for example, through off-grid or micro-grid renewable energy services, small piped-water networks or local feeder bus systems is often promoted as a more environmentally sustainable and socially empowering approach to infrastructure development. Social empowerment facilitates investments from multiple stakeholders and provides livelihood opportunities.

Other benefits include a reduced vulnerability to natural disasters. Mr. David Ness further points out that low technology infrastructure solutions at a local community level, such as the three-wheeled electric vehicles in Kathmandu or solar PV applications in rural areas, present the opportunity for the use of business models that couple increased eco-efficiency with economic and social benefits. For example, solar PV systems may be provided as part of a service by the producer (that is, rental rather than sale) and designed for end-of-life take-back, disassembly, reuse and recycling (creating greater product stewardship).

Another example of the multiple benefits of decentralized service provision can be found in the water sector. For developing countries in particular, the need to expand access to water and energy services in the most cost-effective and efficient way has become urgent. The work of ESCAP in Sri Lanka has shown the potential pro-poor public-private partnership (5-P) models have to (a) expand access to water services, (b) reduce unaccounted for water and (c) be adapted to specific socio cultural and socio-economic situations.

Under this 5-P project, private companies, in partnership with state utilities, provide underserved markets with water, overcoming both the lack of resources faced by public utilities, and the socio-economic and socio cultural barriers (such as secure land tenure or proof of ownership) faced by poor or otherwise marginalized water users in accessing services from more centralized services.
In the energy sector, another ESCAP 5-P project in Indonesia has forged a business partnership between a rural community and a hydropower company. The partnership includes sharing the income from the sales of electricity to the national grid, as well as increased access to electricity for the rural community.
The project is being replicated in other countries.

However, a key potential concern is that the services may be rendered too expensive for the poor. A model for South Africa should be limited to community and state partnerships, to avoid the current privatising of services that is leading to lack of access and affordability of services, and widespread social unrest.

The examples above underline the principle that, in any service delivery system, physical infrastructure is complemented, strengthened and supported when users can be active investors. There is a definite need for social, fiscal and other policies that support entrepreneurs and communities who invest in improving their environmental performance and who cover underserved and often unprofitable areas.

Such policy changes must approach infrastructure development in the context of the wider economy in society. Institutional and legislative support is needed to develop and maximize the synergies between infrastructure development and economic and social systems, particularly in the case of decentralized models of infrastructure development. For example, the Asian Development Bank notes that, to maximize the performance of small piped-water networks, small network service providers should be legalized.

Participants at the 2007 Expert Group Meeting on Sustainable Infrastructure Development in Asia and the Pacific argued that the decentralization of responsibilities without a corresponding decentralization of authority and resources could be "counterproductive and dangerous". Decentralising service provision, they said, did not eliminate the need for central oversight with respect to performance, safety and access standards, and coordination and planning.

Sustainable infrastructure and water-resources management

A combination of engineered and natural water capture, storage and treatment systems, may prove more cost-effective, less energy intensive and more socially acceptable than the engineered water supply systems that have become the norm in the western world.

Urban development planning that explicitly takes into account the possibility of water capture can go a long way towards facilitating water recycling. In the context of climate change, where the variability of rainfall is expected to increase, flood mitigation (for example through rainwater harvesting, especially in urban centres) becomes an important infrastructure function. Rainwater harvesting for certain new buildings is now law in the Republic of Korea and in Bangalore, India.

Siting wastewater treatment plants close to the sources of both the water to be recycled and the water to be used increases the economic feasibility of water recycling. Urban stormwater run-off and treated wastewater irrigates public greenery and supplies horticultural and agricultural enterprises in Australia.
In the country's dry city of Adelaide, 19 per cent of water demand is met by recycled water.

Sustainable Energy – the future

Given the nature of global energy issues currently, the focus on Climate Change is both a positive and a negative. The negative is easily disposed of: Climate Change is a symptom, and focussing on symptoms seldom leads to sustainable solutions, much like the discussion above on end-of-pipe approaches to waste and pollution.

Key areas require changes, which will assist the move to genuinely sustainable solutions in the provision of energy services to all. The most critical is the related to asking the right infrastructure questions, as for transport or water above. Inevitably, the current approach of massively centralised energy generation, and (generally) long distance distribution, will prove less and less sustainable over time.

Some key principles for sustainable energy provision include:

1) decentralised generation through (ideally) locally manufactured Renewable technologies
2) localised distribution
3) various scales of generation (large scale – greater than 100MW; medium scale between 10MW and 100MW; and small scale below 10MW)
4) energy efficiency built into all infrastructure and product / service design
5) introduction of policy that promotes products and services that consume the lowest energy per unit.

A key intervention in making energy infrastructure decisions includes analysing the full Life Cycle of the service, from extraction to final re-integration into the economy, or as "waste" – which has its own opportunity cost. Such costs are almost never taken into account, hence the skewed pricing of goods and services that subsidises the polluter. Even on a straight financial approach, the tables below show that sustainable energy options are far superior in every measure, when honest accounting is applied.

Job Creation from Different Energy Sources

Job Creation from different energy sources[i]			**(all jobs per Mega Watt generated**			
Unsustainable Sources	**Fuel**	**Manufacturing**	**Installation**	**Operation and maintenance**	**Other**	**Total**
Coal current	0.8			0.9		**1.7 jobs per MW**
Coal - future	0.8		1.3	0.9		**3 jobs per MW**
Nuclear				0.5		**0.5 jobs per MW**
Pebble Bed Reactor			0.4	0.9		**1.3 jobs per MW**
Gas			1	0.1		**1.2 jobs per MW**
Renewable Sources						
Solar thermal		1.7	4	0.2		**5.9 jobs per MW**
Solar photovoltaic		18.8	12.1	2.5	2	**35.4 jobs per MW**
Wind		3.2	0.5	1	0.1	**4.8 jobs per MW**
Biomass				1		**4.9 jobs per MW**[ii]

Seen above, is some indication of the potential for delivering on the social and political mandates, while actually spending less money. Further, the transition to sustainable energy will not only result in more decent work, but also builds on skills we already have, but are unable to use – manufacturing, where we have had massive job losses.

Further, the opportunity for communities to enter the current monopolised energy market grows exponentially with sustainable energy. The positive health and environmental impacts are too obvious to mention.

The simplest calculations confirm the sustainable direction is better for energy provision and the social and health benefits, while not quantified, make the future green scenario even more attractive.

Micro energy.

A much ignored, yet exciting, energy solution is Micro Energy. Micro energy refers to the vastly distributed generation of energy at a small scale, from household level upwards, through community owned capacity, and begins to reach the notional "minimum" as contained in current South African energy policy with regard to REFIT (Renewable Eneregy Feed in Tariffs). It is argued that two-way meters and similar changes need to be made to the legislation to help enable micro-power deployment, such that a significant contribution is made to the national energy demand. This approach will also from a strong base for genuine and long-term energy security for our country.

Micro energy or micro power have many benefits:

Eight Hidden Benefits of Micropower

1) Modularity - By adding or removing units, micropower system size can be adjusted to match demand.
2) Short lead time - Small-scale power can be planned, sited, and built more quickly than larger systems, reducing the risks of overshooting demand, longer construction periods, and technological obsolescence.
3) Fuel diversity - Micropower's more diverse, renewables-based and reduced mix of energy sources lessens exposure to fossil price volatility fuel price fluctuations.
4) Load-growth Some types of small-scale power, such as cogeneration and end-use efficiency, expand with load matching growing loads; the flow of other resources, like solar and wind, can correlate closely with electricity demand.
5) Reliability - Small plants are unlikely to all fail simultaneously; resilience they have shorter outages, are easier to repair, and are more geographically dispersed.
6) Avoided plant - Small-scale power can displace construction of new plants and grid construction- reduce grid losses, and delay or avoid adding new grid capacity or connections.
7) Local - Micropower provides local choice and control, community choice and the option of relying on local fuels and spurring community economic development.
8) Avoided emissions - Small-scale power generally emits lower amounts of particulates, sulfur dioxide and nitrogen oxides, heavy metals and carbon dioxide, and has a lower cumulative environmental impact on land and water supply and quality.

based on Lovins and Lehmann, op. cit. note 7.

These issues are confirmed by further research, which provides the following:

1. Reduction in energy dependence, move towards self-reliance in sources.
2. Boost to manufacturing industries for components both local and regional.
3. Promotion in specialised services in Engineering and consulting in the use of renewable energies at local level.
4. Development of R&D in companies and local education centres.
5. Reduced environmental impact of electricity production.
6. Increased level of services to the local community.

7. Employment creation – research, design, equipment production, installation, maintenance and exploitation.
8. Reduced cost of electricity – deferred capital investment. The R/kWh of generation may be higher but the R/kWh of supply may be lower.
9. Reduced transmission/distribution losses.
10. Reduced capital risk.
11. Reduced risk of stranded capital.
12. Potentially, stability of the system is improved as supply and demand scenarios are reduced.
13. Impact of electricity production at local community level – everyone will be able to see the energy being produced. The likely impact of this is behavioural change in consumption pattern of electricity usage.
14. Centralised, large-scale production of electricity then distributed through a national grid was designed in the 1950's when the supply, cost and environmental impact of fuel presented no problems.
    Perhaps then, the model for electricity generation and supply for the 21st century is in small, localised generation through hybrid renewable energy systems. The problems of transportation of fuel are diminished. Some of the quality problems associated with intermittent supply can be mitigated in hybrid systems e.g. it is likely to be sunny when the wind is not blowing.
15. Elimination of fuel poverty where areas that are rich in renewable resource are penalised for not being in an area of high population density. The potential is there to actually complete the task in areas rich in renewable resource.

Eight Barriers to Micropower

• Higher initial capital costs
• Ownership rules
• Customers not rewarded for relieving peak load
• Impacts on local reliability ignored
• Unfair standby charges, exit fees, transition costs
• Burdensome interconnection requirements
• Discriminatory permitting, fire, building, and other codes
• Inequitable emissions policies

Source: 10 based on Iannucci, op. cit. note 12; Thomas Ackermann, Royal Institute of Technology, "Distributed Power in a Deregulated Market Environment," Working Paper, First Draft, Stockholm, Sweden, June 1999; Myers and Kent, op. cit. note 12; European Commission (EC), Non-Nuclear Energy Programme, Joule 3, *The Value of Renewable Electricity*, Final Report, Coordinated by the Science Policy Research Unit, University of Sussex, U.K., June 1998.

Ten Micropower Market Accelerators

• Simplified interconnection standards
• Modest or unpredictable growth in electricity demand
• Aggressive gas, energy service, and micropower vendors
• More efficient electricity pricing schemes
• Saturation of electric transmission and distribution systems
• Siting difficulties for new central generation plants and transmission and distribution lines
• Streamlined, standardized permitting procedures
• Electricity customer dissatisfaction with central power
• Technological improvement

• Demand for green energy

Source:
based on ibid.; Andrew Evans, "Buying and Selling Green: Deregulation and Green Power Marketing," *Renewable Energy World*, January/February 2000; Cler, Lenssen, and Manz, op. cit. note 37; "BP Amoco to Invest in Internet Energy Concern," *New York Times*, 4 May 2000.

The greening of business : changing growth paradigms

We are fortunate that environmentally sustainable business strategies and techniques translate into short- and long-term global business competitiveness, speaking to particularly Green goods and services. This is a very "convenient truth", a welcome antidote to the many "inconvenient truths" of the present unsustainability of business-as-usual practices that steadily erode the productive capacity of nations.

The sustainability race is one to the top that prevents rapid economic expansion from being a "race to the bottom". The social networks (that is, social capital) that facilitate sustainable business health are rapidly growing and are continually enhanced by public and private institutions such as NGO partnership and sustainability-oriented public programmes. There has never been a better time for public policy managers to bring the magic of sustainable business prosperity to their stakeholders.

Business sustainability strategies becoming mainstream

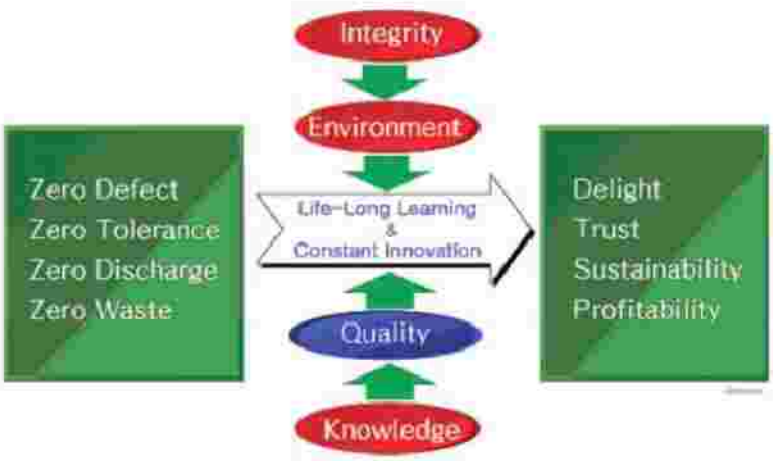
Nearly all of the most successful businesses in every sector of the global marketplace have adopted sustainability strategies. While many, if not most, of these companies have a less than sound environmental or social history, the very fact that even theoretically unsustainable business sees the need for sustainability, should give us pause for reflection.

These companies demonstrate that sustainability is a successful marketplace strategy today, even with the many governmental policy and marketplace barriers that need to be addressed. However, it is clear that, so long as market prices do not reflect the full social and environmental costs of production and operations, sustainable products will face competitive challenges.

All organizations (for-profit businesses, non-profit enterprises and government operations) face similar challenges in implementing sustainability strategies. These challenges can be summarized as follows:

Integrating sustainability (long-term social and environmental responsibility) with revenue/profit goals and short-term financial challenges
Making "sustainability performance" everybody's job
Allocating capital for both short-term (often "baby-step" and/or symbolic) successes and long-term sustainability performance investments

Figure 6: Sustainable business mechanism



Source: Yuhan-Kimberly, Republic of Korea, presentation at the ESCAP Third Green Growth Policy Dialogue: the Greening of Business and the Environment as a Business Opportunity, Bangkok, 5 to 7 June 2007.

Creating an organizational culture that embraces and reinforces sustainability values – usually within a socio-economic environment that has not done so

Convincing shareholders and other important stakeholders, including employees, that sustainability strategies are critical for the organization's future and are based on sound scientific/economic assessments of the future rather than a passing fad

Expanding sustainability strategies beyond operations under the organization's direct control to the entire value chain

Creating sustainability management systems that add more value than their costs of development and implementation (often including third-party auditors)

The role of Government

How can public policy leaders and implementing (regulatory) officials support enterprises, which are the engine of the region's economy in overcoming these hurdles?

The first step is to fully understand and embrace sustainability strategies as a source of short-term and enduring competitiveness for enterprises, communities and nations. **?** The second is to prioritize fiscal policy and financial innovations, education and other interventions that provide public support and real incentives for sustainable consumption of green goods and services (market stimulation). Third, fiscal policy and financial innovations must provide enterprises with direct support and incentives in making whole-system changes that increase the eco-efficiency of services or product delivery across the entire life cycle.

For example, tax breaks for process analysis and improvements should be more readily receivable than tax breaks for end-of-pipe pollution control. Fiscal policy must maximize incentives for sustainably designed and manufactured products, including the elimination or reduction of research/development cost write-offs unless the costs are for a more sustainable product than what presently exists in the marketplace.

In developing countries in Asia and the Pacific, enterprises need substantial support in making such improvements, and fiscal policy must be supported through special programmes, such as those provided by clean production centres established by United Nations organizations in several countries.

A key strategy for Governments in greening businesses is to collaborate with both civil society and businesses, and, when possible, engage the entire society.

Corporate ratings disclosure programmes that use simplified ratings of pollution control efforts to publicize corporate environmental performance have successfully motivated enterprise-led improvements in several countries, and have increased public awareness of environmental protection issues. It is recommended that materials, energy and water usage also feature in future local systems.

Social entrepreneurship

In addition, public policy leaders can create favourable policy environments for social entrepreneurship, which is especially important in rural and impoverished communities. Social enterprises can fill the gap between private sector interests (often short-term interests) and Government programmes, and are capable of improving local green economies in a substantial way.

Social entrepreneurs are described by the Schwab Foundation for Social Entrepreneurship as combining the characteristics of successful businessman Richard Branson (of Virgin Group Ltd) with those of the legendary Catholic saint and charity worker Mother Teresa. The Foundation's website states that a social entrepreneur is "a pragmatic visionary who achieves large-scale, systemic and sustainable social change through a new invention, a different approach, a more rigorous application of known technologies or strategies, or a combination of these...with an emphasis on those who are marginalized or poor". While there are valid arguments about and around Social Entrepeneurship, this must not be confused with the ability of communities to become sustainable in and of themselves – this is not an abrogation of Government responsibility, but a way in which people can be productive for their own benefit, be it in energy, food and the like.

Conclusion:

The work to date confirms that a Green Economy, a Zero Waste, Circular Economy (as described by the Chinese) has the potential to deliver on government's social mandate, while encouraging the movement of the economy towards a genuinely sustainable base.

(see Green Jobs – below)

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Green Jobs in a Green Economy

"People well versed in environmental topics, or productive in developing methods that lighten the environmental footprint, will be highly sought, key players in the development of the new economy—and well rewarded."

Mario Mettich, communications manager for environmental health and safety at Con Edison.

Context:

While this document is intended to be read in conjunction with "Greening Growth – Towards a Green Economy, Rich with Green Jobs", it is still useful as a general resource, to show how broad and deep a range of jobs a genuinely green economy can deliver.

Muna Lakhani

Institute for Zero Waste in Africa – www.izwa.org.za

Defining Green Jobs

The latest assessment report by the Intergovernmental Panel on Climate Change (IPCC) and the widely-noted Stern Review on the Economics of Climate Change have lent new urgency to countering the challenge of global warming—a calamitous development in its own right and a phenomenon that further aggravates existing environmental challenges. There is now a virtual avalanche of reports by international agencies, governments, business, labor unions, environmental groups, and consultancies on the technical and economic implications of climate change as well as the consequences of mitigation and adaptation strategies. Many declaim a future of green jobs—but few present specifics. This is no accident. There are still huge gaps in our knowledge and available data, especially as they pertain to the developing world.

Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World assembles evidence— quantitative, anecdotal, and conceptual—for currently existing green jobs in key economic sectors (renewable energy, buildings and construction, transportation, basic industry, agriculture, and forestry) and presents estimates for future green employment. The pace of green job creation is likely to accelerate in the years ahead. A global transition to a low-carbon and sustainable economy can create large numbers of green jobs across many sectors of the economy, and indeed can become an engine of development. Current green job creation is taking place in both the rich countries and in some of the major developing economies. We define green jobs as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution. From a broad conceptual perspective, employment will be affected in at least four ways as the economy is oriented toward greater sustainability:

? ? First, in some cases, additional jobs will be created—as in the manufacturing of pollution-control devices added to existing production equipment.

? ? Second, some employment will be substituted—as in shifting from fossil fuels to renewables, or from truck manufacturing to rail car manufacturing, or from landfilling and waste incineration to recycling.

? ? Third, certain jobs may be eliminated without direct replacement—as when packaging materials are discouraged or banned and their production is discontinued.

? ? Fourth, it would appear that many existing jobs (especially such as plumbers, electricians, metal workers, and construction workers) will simply be transformed and redefined as day-to-day skill sets, work methods, and profiles are greened.

Green jobs span a wide array of skills, educational backgrounds, and occupational profiles. This is especially true with regard to so-called indirect jobs—those in supplier industries. Even for new industries like wind and solar power, supply chains consist largely of very traditional industries. For instance, large amounts of steel are incorporated into a wind turbine tower.

Technological and systemic choices offer varying degrees of environmental benefit and different types of green employment. Pollution prevention has different implications than pollution control, as does climate mitigation compared with adaptation, efficient buildings vis-à-vis retrofits, or public transit versus fuel-efficient automobiles. These choices suggest that there are “shades of green” in employment: some are more far-reaching and transformational than others.

Greater efficiency in the use of energy, water, and materials is a core objective.

The critical question is where to draw the line between efficient and inefficient practices. A low threshold will define a greater number of jobs as green, but may yield an illusion of progress. In light of the need to dramatically reduce humanity’s environmental footprint, the bar needs to be set high: best available technology and best practices internationally will need to be replicated and adopted as much as possible. And, given technological progress and the urgent need for improvement, the dividing line between efficient and

inefficient must rise over time. Seen in this context, “green jobs” is a relative and highly dynamic concept. A successful strategy to green the economy involves environmental and social full-cost pricing of energy and materials inputs, in order to discourage unsustainable patterns of production and consumption. In general, such a strategy is diametrically opposite to one where companies compete on price, not quality; externalize social and environmental costs; and seek out the cheapest inputs of materials and labour.

A green economy is an economy that values nature and people and creates decent, well-paying jobs. Green jobs need to be decent work, i.e. good jobs which offer adequate wages, safe working conditions, job security, reasonable career prospects, and worker rights. People’s livelihoods and sense of dignity are bound up tightly with their jobs. A job that is exploitative, harmful, fails to pay a living wage, and thus condemns workers to a life of poverty can hardly be hailed as green. There are today millions of jobs in sectors that are nominally in support of environmental goals—such as the electronics recycling industry in Asia, or biofuel feedstock plantations in Latin America, for instance—but whose day-to-day reality is characterized by extremely poor practices, exposing workers to hazardous substances or denying them the freedom of association. As the move toward a low-carbon and more sustainable economy gathers momentum, growing numbers of green jobs will be created. Although winners are likely to far outnumber losers, some workers may be hurt in the economic restructuring toward sustainability.

Companies and regions that become leaders in green innovation, design, and technology development are more likely to retain and create new green jobs. But workers and communities dependent on mining, fossil fuels, and smokestack industries—or on companies that are slow to rise to the environmental challenge—will confront a substantial challenge to diversify their economies.

Public policy can and should seek to minimize disparities among putative winners and losers that arise in the transition to a green economy, and avoid these distinctions becoming permanent features.

Drivers

What are the key drivers of green employment? Green innovation helps businesses stay at the cutting edge, retaining existing jobs and creating new ones. While some companies have barely progressed past green sloganeering—or worse, “greenwashing”—a growing number have announced ambitious goals to reduce their carbon footprint or make their operations “carbon neutral.” The global market volume for environmental products and services currently runs to about $1,370 billion (€1,000 billion), according to German-based Roland Berger Strategy Consultants, with a projected $2,740 billion (€2,200 billion) by 2020. Forward-thinking government policies remain indispensable. They are important for providing funding of green projects; overall goal- and standard-setting beyond the time horizons typical in the business world; providing infrastructure that private enterprises cannot or will not create; and creating and maintaining a level playing field for all actors. Key policies include:

? ? Subsidies. Phase out subsidies for environmentally harmful industries, and shift a portion or all of those funds to renewable energy, efficiency technologies, clean production methods, and public transit.

? ? Carbon Markets. Fix the current shortcomings inherent in carbon trading and Kyoto Protocol related innovations like the Clean Development Mechanism so that they can become reliable and adequate funding sources for green projects and employment.

? ? Tax Reform. Scale up eco-taxes, such as those adopted by a number of European countries, and replicate them as widely as possible. Eco-tax revenues can be used to lighten the tax burden falling on labour while discouraging polluting and carbon-intensive economic activities.

? ? Targets and Mandates. Ensure that regulatory tools are used to the fullest extent in the drive to develop greener technologies, products, and services—and thus green employment. This includes land-use policies, building codes, energy-efficiency standards (for appliances, vehicles, etc.), and targets for renewable energy production.

? ? Energy Alternatives. Adopt innovative policies to overcome barriers to renewable energy development, including feed-in laws that secure access to the electrical grid at guaranteed prices.

? ? Product Takeback. Adopt “extended producer responsibility” laws (requiring companies to take back products at the end of their useful life) for all types of products.

? ? Eco-Labeling. Adopt eco-labels for all consumer products to ensure that consumers have access to information needed for responsible purchasing decisions (and hence encouraging manufacturers to design and market more eco-friendly products).

? ? R&D Budgets. Reduce support for nuclear power and fossil fuels and provide greater funding for renewable energy and efficiency technologies.

? ? International Aid. Reorient the priorities of national and multilateral development assistance agencies as well as export credit agencies away from fossil fuels and large-scale hydropower projects toward greener alternatives.

Modern economies mobilize enormous quantities of fuels, metals, minerals, lumber, and agricultural raw materials. Although some changes have been made in past decades to reduce the world economy’s environmental impact, these gains are insufficient and may simply be overwhelmed by continued economic growth.

In view of the gathering environmental crisis, and especially the spectre of climate change, there is an urgent need to make economies far more sustainable and thus to re-examine the prevailing production and consumption model. Concepts such as dematerialization, remanufacturing, “zerowaste” closed-loop systems, durability, and replacing product purchases with efficient services (such as “performance contracting”) have been discussed for some time and tested in some instances, but by and large have yet to be translated into reality.

Green Jobs identified for South Africa:

The various sectors of the DEA 5 year Strategy suggest that the following Green Jobs should be developed and increased as soon as possible, as they are identified growth areas in the local economy.

Waste Sector
Industrial design (low materials, low energy low water low toxics use)
Design for environment
Design for disassembly

Sustainable Materials Research
Materials production
Sustainable energy (organic waste biodigestion)
Green procurement expert
Design for proximity

Sustainable transport packaging
Sustainable consumer packaging
Eco-labelling experts
Responsible advertising
Sustainable materials use for advertising
Sustainability edicators
Community based materials recovery and value adding experts
Community and business on-site organics management
Technical nutrient flow experts
Organic flow experts
Composting experts – windrow; vermi; anaerobic;
Compost packaging and marketing
Green chemists
Labour intensive product designer
Pollution monitoring
Pollution avoidance experts
Sustainable transport
Design for repair
Design for re-use
Design for recyclability
Value adding designer
Collectors and recyclers

Air Quality
Air Quality Field technicians
Statisticians
Climate and Air Quality Modelling technicians

Geographical Information System (GIS) opearators
Educators and Community liason officers
Monitoring and enforcement officers
Licensing staff
Laboratory Staff
Renewable energy specialists
Inspectors
Natural air monitoring systems experts

Integrated Environmental Management
Specialists in related fields (heritage, water, botany/biodiversity etc)
Environmental Impact Assessment Practitioner
Strategic Impact Assessment Practitioner
Social Impact Assessment Practitioner
Government officials
Transport planners
Town and Regional Planners
Inspectors
Environmental Control Officers
Monitoring and enforcement staff
Life cycle analysts
Life Cycle Economic Analysts
Public participation specialists
Lawyers and legal staff
Engineers
Green Architects
Designers
Project Managers

Green jobs with immediate application to South Africa

Alien invasive species removal – there are several economically valuable alien invasive species that must be removed or dealt with in our waters and on land.

Attorney – we need more attorneys experienced in environmental law in order to implement not only the LMRA and ICMA but also our international obligations.

Biodegradable Materials – the use of biodegradable products must be encouraged. South Africa must shift away from soaps and detergents that contain phosphates and nitrates as these are having massive impacts on the receiving environments, estuaries and coastal zones, with anoxic zones, die-offs, etc. The use of fossil fuel sourced fertilisers must be phased out as soon as possible for this reason, amongst others. There is therefore massive job creation potential in this sector.

Biologist (Conservation) – in order to deal with the issues related to green jobs, we need as many conservation biologists, versed in coastal, marine, water, land and air issues as possible.

Bio-Mimicry Engineer/Biologist – as above.

Career Consultant – career consultants need to be made aware of the potentials for job creation in this sector and to direct work seekers to this lucrative field.

Chief Sustainability Officer (Chief Environmental Officer/ Chief Green Officer) –Industries that impact on the environment need to have suitably qualified personnel to deal responsibly with their respective industrial challenges in order to shift to sustainable production.

Climate Risk Analyst – this is an immediately relevant job creation driver for this sector.

Climatologist/Environmental Meteorologist – as above.

Commercial/Industrial Designer – design of extractive systems in order to minimise impacts and maximise sustainability is essential. Same applies for industries that impact the environment as well as towns and municipalities, in order to deal with water, waste, etc.

Community Affairs Manager – it is essential to involve communities in management of the environment in order to make the benefits of sustainable use apparent.

Composting – historically the harvesting of marine species, such kelp (E. maxima) and other seaweeds (chlorella) have been very important for the nutrient mix they provide. The landfilling of seaweed and other organic as is presently practiced in the country must be banned and this material must be composted.

Conservation Scientist – as with biologist, etc.

Consultants – consultants well versed in sustainable use of environmental resources will be in increasing demand. They require broad knowledge bases but can come from specialised backgrounds.

Corporate green / sustainable management – there are significant potential areas of involvement in the environment, covered in more detail below.

Corporate Social Responsibility Professionals – corporate extractive use of the environment must be sustainably managed, not just to pay lip service but to ensure the continued viability of these important resources.

Corporate Waste Compliance Coordinator – historically, land, air and rivers and oceans have been treated as waste receptacles. While this has changed to a certain extent, there is still a long way to go and many jobs can be created in this sector through proper application of skills and resources.

Database specialists – management of ecosystems will require comprehensive database management and capture of key facts.

Ecological Economist – as related to both corporate and coastal management from planning of towns and cities, this job will be important in justifying the potentials and sustainability's of the sector.

Ecologist – as per biologists, environmental management, etc.

Economists (Environmental) – as per ecological economist, corporate social responsibility, consultants, etc.

Eco-tourism – this is already a major draw card, with whale watching, shark diving, diving, fishing, pelagic birding trips, sailing, surfing, kayaking and many other aspects of marine and coastal eco-tourism with massive forward potential.

Eco-Tourism Jobs – Given the already huge size of this sector and the potential to grow it, this sector provides jobs across the board from unskilled to highly skilled alike and must be encouraged and supported in an environmentally, socially and economically sustainable manner.

Educators (Ecological) – in order to maximise the sustainable use of this sector, it is essential to have sufficiently trained ecological educators and trainers.

Emissions Managers – as above, dealing with emissions that effect air, water and soil, such as from sewage works, chemical build-ups etc. The negative health impacts are currently unacceptable.

Emissions monitoring – given the huge emissions from most enterprises, and the lack of emissions monitoring in general, this is an area that requires attention.

Energy efficiency – all aspects of the economy can benefit from additional energy efficiency and we stand to create significant jobs in engineering and other fields from this market.

Energy Engineer – in order to maximise the almost unlimited potential of harvesting of energy, this is a job with significant upward potential.

Energy retrofits to increase energy efficiency and conservation – this to industries as it does to communities and how they interact with the environment regarding energy use, and its impacts.

Enforcement – this is a well established role in this sector but one that needs to be expanded significantly, from a largely ad hoc role to a continuous, integrated monitoring and enforcement role. This can be funded largely by user/ polluter pays fees but it needs to go further than this, as with monitoring effluent, waste and air discharges, scientific enforcement, planning enforcement, etc. There is significant scope for employment for both skilled (lawyers, administrators) as well as less skilled (monitors, law enforcement) to least skilled (community oversight, etc). The importance of this sector cannot be overestimated and has historically been underestimated.

Engineer/Biologist (Renewable Fuels/ Bio-Mimicry) – as above re biologists. There is significant potential to clean polluted environmental and to remove atmospheric carbon through natural processes in various sectors, without considering the dangerous potentials of ecosystem engineering.

Engineers (Environmental / Pollution Control) – as above with biologists, scientists, etc, dealing with emissions, pollution incidents, etc. Given the emphasis on pollution control in both local and international legislation this is a seriously neglected field of expertise.

Engineers and Developers (Sustainable Energy) – as above re sustainable energy.

Entrepreneur (Green) – This relates to many fields of human endeavour, in fact almost every field of employment has some aspect of green entrepreneurship related to its implementation.

Environmental Consulting – as above related to economists, consultants, corporate responsibility, etc.

Environmental Engineer –as noted elsewhere this is a sector intimately connected to good environmental governance.

Environmental Health and Safety (EHS) Technicians – given that working in mines, factories and at sea, are amongst the highest risk jobs on earth, this is a neglected field of employment.

Environmental Science – as above.

Environmental Technology – as above.

Environmental engineering – there are numerous potential jobs within this field.

Fair Trade – there is huge potential here that provides decent jobs and sustainable jobs.

Farm, Ranch, and Agricultural Manager Specializing in Organic Production – relates to point before on fair trade – all agriculture, mariculture and aquaculture should be organic but unfortunately few are. The potential of this market cannot be underestimated both for financial reasons but also for sustainability reasons. Most present agriculture, mariculture and aquaculture is utterly unsustainable and this must be addressed in an integrated and holistic manner.

Farmer – as above but taking the concept of farmers to the coastal and marine environments, as we shall have to do in future.

Financial analyst/adviser specializing in socially responsible investing – this relates to good CSI and while a few industries have made strides in this field, there remains room for improvement.

Food Waste Recycling – the fact that around one third of the worlds fishing catch is discarded at sea, and that large quantities of food all along the value chain are also discarded, is a fact that cannot be permitted any longer. Waste from food systems cannot be allowed to continue, at any level.

Green Business Manager – related to many fields of sustainable use of the environment, such as waste management, green chemistry, energy, organic agriculture, good fishing practice, sustainable mariculture, etc. Significant potential in this sector.

Green Cleaning – given the noxious products used to clean homes, factories and buildings, this is a hugely neglected area of potential employment and job creation, using green chemistry principles. The job creation potential here is significant.

Green marketing, PR, Film and Video – marketing of the environment sector has huge potential and already has created many jobs. This needs expanding upon.

Green technology investment, financial management –industry needs to further green itself so there is a lot of opportunity there.

Green training – all those working need to be trained to operate in responsible and interactive manners in order to maintain health and ecosystems.

Green transportation – given the low energy inputs needed to transport large loads over significant distances, we should encourage increased use of waterways, rail and sustainably powered transport in a responsible manner.

Green Travel and Hospitality – as touched on elsewhere, this sector has grown appreciably over the past decade with massive further potential. This sector must however be wisely managed in order to ensure ecological, social and economic sustainability.

Green waste composting on a large scale – no waste must be allowed from any source. All of these resources must be wisely used, and have the potential to contribute to local food security.

Green, sustainable, and environmental entrepreneurship – Through accreditation there is significant potential to increase the value of our various products but this needs both a top down and bottom up

approach in order to succeed. The market for new green goods and services is rapidly expanding worldwide.

Groundwater, rainwater and greywater Recovery – Through the use of properly managed systems groundwater depletion must be halted. This will immediately alleviate the water scarce condition of South Africa.

Hazardous materials clean-up – this is an essential field of employment for this sector, as most of the worlds hazardous materials are transported by sea and road, and we have one of the most dangerous coastlines and roads. We must implement a user pays principle as a matter of urgency.

Heating, air conditioning and refrigeration mechanic and installer – this is important for the efficient use of resources. For example, the use of RSW (refrigerated salt water) as a cooling mechanism is long established, as have other technologies. The use of dangerous refrigerants must be halted.

Hydrologist / Environmental scientist – this is a critical set of job skills for this sector and people must be trained in these important fields for obvious reasons.

Indigenous Plant Restoration – restoration of coastal and indigenous zones is critical, especially given land overuse, bad building practices, etc. and the unsustainable use of resources. Significant job creation potential for skilled and unskilled workers alike, with the added benefit of resources for communities and business alike..

Industrial Designer (Sustainable) – Significant potential for this field in improving ecological efficiencies, materials and toxicity reduction, etc.

Land preservation – critical to this sector with the threats of climate instability, sea level rises, etc. People need to be encouraged to enter suitable disciplines for this field of management.

Land Use Planner – as above.

Landscape Architect (Green) – as above, as well as related to indigenous plant and riverine and coastal restoration.

Landscaping – as above.

Lawyer (Environmental) – We require a good pool of skill sets in environmental law, from both local and international perspectives, in order to deal with the threats and risks to our environment.

Lobbyist – well informed lobbyists are essential to inform politicians of issues and their roles, and can be drawn from most of the employment options here but generally need to be of an interdisciplinary bent.

Management – this sector needs many specialised management skill sets. Estuary management, coastal zones, marine zones, urban areas and rural areas, etc. Significant potential for suitably skilled personnel.

Manufacturing jobs related to large scale production of appropriate technologies (i.e. solar, wind, current generation, etc)

Marine Renewable Energy – as dealt with above.

Materials reuse – As with any other sector there are specialised recycling options both within industry as well as the domestic and government sectors and significant potential exists here.

Monitoring – the monitoring and evaluation of the environment and social / health impacts is a wide field.

Natural/Non-Toxic Cleaners – dealt with above in biodegradable materials and green chemistry.

Ocean energy - (wave, tidal race, tidal, OTEC, off shore wind) – given that wind energy operates most efficiently over flat topography and oceans, the marine and coastal zone is has already proven ideal siting for wind energy sites.
Current generators installed in the Agulhas current have significant potential given the average 3 knot speed of this current throughout the year. This source alone, if tapped could provide all of our energy needs, making the wild coast the centre of our national energy programme, creating jobs and enabling development and upliftment.
Due to our limited tidal ranges, tidal energy technology presently remains largely unsuitable to South Africa.
Wave energy is an ideal source of energy given the high energy coastline of South Africa, with several indigenous designs already mooted.

Organic Food and Farming Production Specialists – as dealt with above in organic production, green production, fair trade, etc.

Organic Gardening - this is important for food security, reduced dependence on fossil inputs, reduced health impacts and improved nutrition, requires lower water abstraction and less chemicals etc. Significant employment potential across all sectors, skilled and semi-skilled.

Organic/Low or No VOC Paint – Given the noxious paints generally used, this is a field of research that holds significant potential, see green chemistry.

Parks and open space expansion and maintenance –this could include edible landscaping, labout intensive indigenous plant opportunities, and many more, so there is significant employment opportunity in this sector.

Peri-urban and urban agriculture – as related to organic agriculture, Permaculture, etc.

Permaculture, Biodyanmic farming, organic farming, ecological agriculture, etc. – Aquaculture, marine ranching and other related fields of farming hold significant potential for growth. This is already an established industry but needs to become more ecologically integrated in order to increase jobs, sustainability and potentials.

Pest Control Technician – The importance of this task cannot be underestimated. Given our extremely poor monitoring of this vector this must be corrected. There are many effective environmentally non damaging means to deal with pests.

Plastic Recycling – as per other sectors, but given the high amounts of plastics dumped at sea, it is essential to have a total ban on dumping at sea from any local fishing vessel, coaster or through any other vector. While there are concerns about the toxicity of plastics, some method exist that are safer than others.

Policy & Advocacy – through promoting sustainable use of our resources we stand to gain both locally and internationally but this requires focussed, well thought through agendas.

Pollution Control Engineer – as above, in plastic recycling, pollution must be halted at source and not dealt with after the fact.

Pollution Control Technician – see above.

Public/Private Alternative Energy Engineers – see renewable energy, green energy, marine renewables, etc

Recycling – see plastics, etc.

Recycling and reuse – see plastics, etc.

Refuse Processors (into value added products) – as per other sectors, significant job creation potentials exist.

Renewable Energy Manager – see Ocean energy, green energy specialists, etc.

Renewable Fuels Engineer/Biologist – the environment has significant potential as a fuel source, both through extractive and non-extractive means.

Renewable Resource – The environment holds renewable resources that hold significant potential for job creation if managed properly.

Science Teacher – inculcating the correct ethos about management of resources should begin at school. This must be integrated into the school curriculum in as many spheres as possible.

Scientific researchers – There are virtually limitless spheres of research in the environmental spheres, from fisheries research to climate change, clean production, sustainable consumption, etc.

Scientist (Environmental) – see related fields, biologists, etc.

Scientist and Hydrologist – Hydrological science managers are essential in managing resources and this is a speciality that is not receiving sufficient attention at national level.

Social responsibility officers – it is essential to get buy-in from society at large if sustainable management of the environment is to occur. Suitably trained people must communicate this effectively to coastal communities in an objective manner.

Solid and Liquid Hazardous Waste Avoidance Recycling – again, sector must be effectively empowered in order to deal with this challenge and threat.

Steel Recycling –an established industry, despite all recycled steel being exported.

Stormwater Management – this is a major problem in how we abuse our land, river, marine and coastal areas, with vast amounts of terrestrial pollution entering sensitive ecosystems. This is a neglected field of work that must be dealt with.

Sustainability Analyst – Again, essential to the sector, in order to justify the requirements and demands for sustainably.

Sustainability Coordinator – as above, but to co-ordinate actions.

Sustainability Director – as above.

Sustainability Officer – as above.

Sustainability Specialists – as above.

Sustainability Systems Developer – as above.

Toxicologist – especially important to this sector given the risks of both pollution but also natural sources of toxins in the marine environment, both from fish, plankton (red tide, blue green algae) as well as chemical pollution.

Urban and Regional Planner – wise urban and regional planning is essential to the good maintenance of systems and resources and planners must be suitably trained to deal with the challenges to these systems in order to have integrated planning in place.

Urban Replanners – as above but important to have those who are capable of re-examining the shortcomings of poor design and rectifying same.

Waste Disposal Manager – as with pollution control, recycling, etc.

Waste Management – as above.

Wastewater Water Operator – Given the sensitivity of the environment to poor wastewater quality, as well as their associated negative health impacts, we need to prioritise the training of well versed operators who understand good management principles.

Water Conservation – from rainwater harvesting to drip irrigation, much work needs to be done in a water-scarce country like South Africa.

Water Conservation – essential to the management of human needs and the environment.

Water Recovery – as above.

Wildlife Biologist – extremely relevant to this sector as the management of marine species hinges upon the presence of sufficient properly trained wildlife biologists.

Wind Construction Project Manager – important for energy security, as wind is unimpeded across the sea and coastal zones are usually windier than inland areas in South Africa.

Wind Energy Developers – as above.

Wind Energy Developers and Construction Professionals – as above, important to integrate design into contexts.

Wind Power – as above.

Zero Waste – all activities must shift toward a zero waste approach. There must be no disposal; rather materials must be re-integrated into the economy. There is massive potential for job creation in this field, not just in picking up litter which does not solve the problem, but rather to re-design products and processes.

Key Niche Markets:

Green Design and Production: Zero Waste Design

Green Globetrotters: Travel and Hospitality
Sustainability Stewards: Planning and Land Use
Complementary Care: Health and Medicine
Power Pushers: Energy and Renewables
Planet Protectors: Legal Careers
Green Geeks: Information Technology (IT)
Eco Educators: Green Learning
Better Builders: Design and Construction
Improving Industry: Corporate Social Responsibility
Organic Occupations: Food and Farming

Additional Key Markets:

Life Cycle Analysts

Full cost accountants

More Detailed Niche Markets:

ENERGY EFFICIENCY

ALTERNATIVE ENERGY
Wind
Geothermal
Solar
Ocean energy (wave, tidal race, tidal, OTEC, off shore wind)
Biodigesters
AIR QUALITY MONITORING
ALTERNATIVE FUELS
ALTERNATIVE/NATURAL BUILDING
GREEN BUILDING / REMODELING
GREEN AND COOL ROOFS
CERTIFICATION AUDITS
COMMUNITY GARDEN MANAGEMENT
CORPORATE GREEN/SUSTAINABLE MANAGEMENT
ECO-TOURISM
EMISSIONS MONITORING
ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL SCIENCE
ENVIRONMENTAL TECHNOLOGY
GREEN CLEANING
GREEN HEALTH CARE
GREEN JOB PLACEMENT
GREEN MARKETING, PR, FILM AND VIDEO
GREEN TECHNOLOGY INVESTMENT / FINANCIAL MANAGEMENT
GREEN TRAINING
GREEN TRANSPORTATION
GREEN URBAN INFRASTRUCTURE
GREEN, SUSTAINABLE AND ENVIRONMENTAL ENTREPRENEURSHIP
IRRIGATION MANAGEMENT

LIGHTING RETROFITS
ORGANIC AGRICULTURE
ORGANIC FOOD PROCESSING
PERMACULTURE,BIODYNAMIC FARMING
POLICY & ADVOCACY
REFURBISH COMPUTERS
STORM WATER MANAGEMENT
URBAN FORESTRY
WATER CONSERVATION
WEATHERIZATION
ZERO WASTE

More Green Jobs !

Agricultural Inspector
Agriculture or forestry supervisors.
Architect
Architect (Environmental /Sustainable Design)
Asphalt Recycling
Attorney
Bicycle / Scooter Technicians
Bicycle Recycling
Bike based delivery services
Biodegradable Materials
Biodiesel manufacture from waste vegetable oils
Biologist (Conservation)
Bio-Mimicry Engineer/Biologist
Building Material Recycling
Building Operations Management
Car and truck mechanic jobs, production jobs, and gas-station jobs related to biodiesel
Car Manufacturing (Green)
Cardboard Recycling
Career Consultant
Certified Organic
Chemist
Chemist (Environmental)
Chief Sustainability Officer (Chief Environmental Officer/ Chief Green Officer)
Climate Risk Analyst
Climatologist/Environmental Meteorologist
Commercial/Industrial Designer
Community Affairs Manager
Complementary Health and Medical Care
Composting
Computer Recycling
Conservation Scientist
Construction (Energy Efficiency - Green Building
Construction Manager
Consultants
Corporate Social Responsibility Professionals
Corporate Waste Compliance Coordinator
Database specialists.
Eco-Friendly Furniture Builder
Ecological Economist
Ecologist
Economists (Environmental)
Eco-Tourism Jobs
Educators (Ecological)
Efficient Heating
Electricians.
Electronics Recycling
Emissions Managers
Emissions testing
Energy Efficiency Builder
Energy Engineer
Energy Manager (Renewable)
Energy retrofits to increase energy efficiency and conservation
Engineer/Biologist (Renewable Fuels/ Bio-Mimicry)
Engineers (Environmental / Pollution Control)
Engineers and Developers (Sustainable Energy)
Entrepreneur (Green)
Environmental Consulting
Environmental Engineer
Environmental Engineer
Environmental Health and Safety (EHS) Technicians
Fair Trade
Farm, Ranch, and Agricultural Manager Specializing in Organic Production
Farmer
Fashion Designer (Green)
Financial analyst/adviser specializing in

socially responsible investing
Financial Analyst/Adviser Specializing in Socially Responsible Investing
Food Scientist
Food Waste Recycling
Foot Massager
Fuel-Cell Entrepreneur
Fund-Raising Director
Furniture Builder (Eco-friendly)
Geothermal Cooling
Geothermal Heating
Geothermal Power
Glass Recycling
Green Business Manager
Green Car Manufacturing
Green Interior Designer
Green Landscape Architect
Green MBA and Entrepreneur
Green Roofing
Green Travel and Hospitality
Green Walls
Green waste composting on a large scale
Groundwater Recovery
Hauling and reuse of construction materials and debris (C&D)
Hazardous materials clean-up
Heating, air conditioning and refrigeration mechanic and installer
High School Ecologists
Hydrologist / Environmental scientist
Indigenous Plant Restoration
Industrial Designer (Sustainable)
Insulation
Interface Designer
Interior Designer/Building Operations Manager
iPod/ iPhone Doctors
IT Specialists (Green Software and Hardware Developers)
Lamp Recycling
Land preservation
Land Use Planner
Landscape Architect (Green)
Landscaping
Lawyer (Environmental)
Lobbyist
Management
Manufacturing jobs related to large scale production of appropriate technologies (i.e. solar
Marine Renewable Energy
Materials reuse
Mattress Recovery/Recycling
Monitoring
Natural Fiber Carpet
Natural/Non-Toxic Cleaners
Non-toxic household cleaning in residential and commercial buildings
Organic Farming Specialists
Organic Food and Farming Production Specialists
Organic Gardening
Organic/Low or No VOC Paint
Organization
Paper Recycling
Parks and open space expansion and maintenance
Peri-urban and urban agriculture
Pest Control Technician
Plastic Recycling
Pollution Control Engineer
Pollution Control Technician
Printing with non-toxic inks and dyes
Protection Technician
Public transit jobs related to driving, maintenance, and repair
Public/Private Alternative Energy Engineers
Reclaimed Building Materials
Reclaimed Cotton
Reclaimed Fibre
Reclaimed Stone
Reclaimed Wood
Recycled Coffee Grounds
Recycled Concrete
Recycled Glass
Recycled Plastic
Recycled Rubber
Recycling and reuse
Recycling Specialists
Refuse Processors (into value added products)
Renewable Energy Manager
Renewable Fuels Engineer/Biologist
Renewable Resource
Science Teacher
Scientific researchers.
Scientist (Environmental)
Scientist and Hydrologist
Senior Hydrologist
Senior Urban Planner
Siding
Small businesses producing products from recycled materials
Social responsibility officers.
Soil Recovery
Soil Recycling

Solar Heating
Solar Installation
Solar Lighting
Solar Power
Solar Water Heating
Solid and Liquid Hazardous Waste Recycling
Specialist/Scientist
Steel Recycling
Sustainability Analyst
Sustainability Coordinator
Sustainability Director
Sustainability Officer
Sustainability Specialists
Sustainability Systems Developer
Sustainable material Doors
Sustainable Wood
Sustainable-Design Architect
Tire Recycling
Toxicologist
Transportation supervisors and dispatchers.
Tree cutting and pruning
Urban and Regional Planner
Urban Gardeners
Urban Planner
Urban Replanners
Waste Disposal Manager
Waste Management
Waste Veg Oil Recycling
Wastewater Water Operator
Water Conservation
Water Recovery
Water retrofits to increase water efficiency and conservation
Whole home performance, including attic insulation, weatherization, etc.
Wildlife Biologist
Wind Construction Project Manager
Wind Energy Developers
Wind Energy Developers and Construction Professionals
Wind Power
Wind Turbine Fabricator
Wind-Energy Developer
Windows
Wood Recycling

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This document was compiled and edited by Muna Lakhani, National Co-ordinator of the Institute for Zero Waste in Africa. It is placed in the public domain in good faith – errors and omissions are regretted.

www.izwa.org.za

[i] Source: Employment Potential of Renewable Energy In South Africa - 14 November 2003 - The Sustainable Energy and Climate Change Partnership - Johannesburg

[ii] Updated information – NREL