



The Sustainable Business

Taking the first steps towards understanding, implementing and managing sustainability from a cost/profit perspective.



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Introduction

Sustainability is often confused with the term 'going green'. Broadly speaking, however, the capacity for continuance into the long-term (which is one of many sustainability definitions) is about more than the environment. Make no mistake, the environment should be of paramount concern to all of us for the simple reason that every business (and life) resource comes from it.

That being said, focusing only on the environmental aspects of sustainability is both shortsighted and partial -- not unlike claiming that good health is solely about vegetables. It is therefore important to note that sustainability embraces the legal, financial, economic, industrial, social and behavioural arenas as well as the environment. From a business viewpoint it can be argued that sustainability is about reducing expenses - including future expenses - in every conceivable form so as to facilitate longevity and competitiveness. These expenses consist of the costs of short-term thinking, the problems and costs associated with waste, the spiralling cost of raw materials and resource deficits (resulting from an increasingly affluent and growing population all of whom are competing for the world's finite supply of resources), costs created or exacerbated by poorly designed products and production processes, the costs of climate change (e.g.: property damage and crop failure), and the costs of unemployment and underemployment - to name just a few.

In the 1980s, the Brundtland Commission, a UN investigative body, defined sustainability as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

As a teacher, it is fascinating to watch student reactions when sustainable business practices are introduced in the classroom. Most are dumbfounded by the cost-savings and profits involved and want to know more. A smaller number, however, respond differently. With their lips pursed and their arms folded across their chests, they refuse to believe in what British business consultant John Elkington referred to in 1994 as the 'triple bottom line' - the financial, environmental, and human costs of doing business (wealth creation, resource efficiency, and job creation) as well as the significance and importance of each of these 'pillars', and how they influence one another. Interestingly, although most of the people who disregard sustainability readily admit that the world is facing profound problems - and that these problems are not going away anytime soon - their lack of experience, knowledge, and comfort with long-term thinking often forces them to place sustainability under the label of 'environmentalism' (or 'fad') so as to dismiss the subject out of hand. But I'm getting ahead of myself.

To understand sustainability it's essential to begin by first comprehending the big picture - i.e.: to acknowledge that sustainability is about longevity and to develop an awareness of what that encompasses before analytic thought does its (necessary) reductive work. Rather than

building up from particulars to generals (the empiricist method), one must begin with generals — an in-place, intuitive wisdom of the logic behind long term balance, proportion, and profit, what it entails, and why it is important. Once that is obtained, most people instinctively gain a better idea as to where to direct their analytic attention. Again, it is difficult to expect progress by focusing only on one area (for example the environmentalism aspects of sustainability). The problem with this (the empirical) approach is that once a few facts become clear it's tempting to believe that they possess an independence all their own and to rest in them and believe that they are the foundation of what is being sought (theologians call this 'idolatry')¹. Obviously, dividing the world into parts is something we all do to ease understanding, but in doing so something is always devalued – and what is diminished is often an awareness of and contact with that which can only function as a whole.²

Several years ago I created an alliteration using seven words (all beginning with the letter P) to describe the waste-reduction aspects of sustainability in a business application context (see the left column of FIGURE 1) and the interplay they have on one another. Alliterations are never perfect. However, the 7-P model has proven to be helpful both in and out of the classroom so it has been used to structure this guide. Briefly, the 7-P's are as follows:

Preparation – Setting the stage for change (physically and psychologically), accepting the breadth and depth of sustainability (e.g.: all the financial implications and the fact that sustainability is not about sacrifice or being independent) and understanding what the reformer is up against when trying to implement profitable, long-term practices (e.g.: apathy, ignorance, short-term thinking, and what Machiavelli called 'the incredulity of mankind, who do not believe in anything new until they have had actual experience of it.').

Preservation – encompasses two areas: internal (collecting and displaying real-time measurement) and external (keeping ahead of laws, pending legislation, trends, and developments).

Processes – sustainable belief systems, philosophies, business models and thought patterns that help match a business with customer demands, core capabilities and best practices.

People – accepting the importance of training and education and working diligently to avoid the wasting of people, specifically: employees (who seek security and motivation), stakeholders (who want a return on their investment), customers (who want safe, value-laden products), and the world community - including the two-thirds of humanity who are currently left out of the global economic loop (who desire jobs and inclusion) and who represent an economic force all their own.

Place – the buildings and places where work is performed and/or products are sold.

Product – goods and services that are free from unnecessary waste ('non-product') and toxins - and designed so that the materials, energy, and manpower that comprise them (and their packaging) are treated as investments and continuously reused.

Production – the physical, mechanical, biological, and chemical processes used to transform raw materials into products or services - and transport them.

Figure 1
The 7-P Application Model (toward sustainability)

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What happens inside the classroom often reflects what goes on outside it – and vice versa. Although the word ‘sustainability’ is still either dismissed or misinterpreted by too many businesses and business schools (many still see it as a fad), it is slowly gaining recognition as a viable subject for study. In 2004, when I first suggested adding it to the curriculum of a business programme, the president of the university made a throwing gesture with his left hand and invited me to exit his office by loudly growling, ‘GET OUT OF HERE!’ Five years later he presented me with an award for outstanding achievements in teaching. To his credit, he refused to ignore the over \$2 million my (first year) students showed local businesses they can save by adopting waste-minimisation practices. The progress I made with other university

administrators occurred in a more opportunistic way. For example, one programme coordinator resisted every attempt made to introduce sustainability as an elective course – until she took a two-year maternity leave. Three minutes was all that was needed to convince her replacement that sustainability is not only viable as a business subject, it is vital – something the school's students seemed to know intuitively. The first semester it was offered, *Managing the New Frontiers*, a basic course on waste minimisation as a first step toward sustainability, became the most popular elective in the school's history (a record it still holds). 'Most business schools only offer sustainability if students demand it,' Hunter Lovins explained in an e-mail sometime afterwards.

Although Hunter and the other reviewers and contributors associated with this publication are happy to note that more business schools are recognising certain aspects of sustainability and that a number of them are adding bits and pieces of it to their curriculums, many of us believe that few schools go far enough. Instead, what usually happens is that one or two courses highlighting a few components of sustainability are introduced and the matter is considered settled. Once again, sustainable thinking (i.e.: long-term thinking) is a viable, basic, and necessary concept that should be an integral part of every business subject (imagine, for example, if long-term thinking had been applied in the financial industry before the 2008 financial meltdown). It is frustrating to have to note that examining the inputs of a business as well as the activities that go on inside it, followed by the exiting of its products (and their marketing and distribution) is considered perfectly legitimate in academia - yet when what happens afterward is approached for study, too many people who call themselves business scientists still put their foot down (the academic equivalent of stating 'that's not my job'). For example, I have been told - and I am still being told - the following in regards to including sustainability-based thinking in business school curriculums:

- 'What does this have to do with academia?'
- 'Teaching such subjects would be against the law.'
- 'This is environmentalism, not business.'
- 'This is not worthy of study, it's a fad!'
- 'Sustainability is not scientific.'
- 'What's in it for us?' (this was uttered by the head of Corporate Social Responsibility at an esteemed university in western Europe)

It should go without saying that any institute that calls itself a business school is obliged to study *all* aspects of business – not just those it deems worthy of its attention. Scientific study is about exploring what we do not know, or what we know little about, or that which shows promise, as much as it involves the continuing study of what we already are certain about (or think we are certain about).

'A misconception about science is that science is about what we know,' explained Dr. Olivia Judson in a recent op-ed piece for the *International Herald Tribune*. She continues, 'A colleague told me that when he was studying science at school, the relentless focus on the known gave him the impression that almost everything had already been discovered. But in fact, science — as the physicist Richard Feynman once wrote — creates an 'expanding frontier of ignorance,' where

most discoveries lead to more questions. Moreover, insofar as science is a body of knowledge, that body is provisional: much of what we thought we knew in the past has turned out to be incomplete, or plain wrong. (A second) misconception about science comes from the impression that scientific discovery progresses as an orderly, logical ‘creep’; that each new discovery points more or less unambiguously to the next. But in reality, while some scientific work does involve the plodding, brick-by-brick accumulation of evidence, much of it requires leaps of imagination and daring speculation.³

Thomas Kuhn in *The Structure of Scientific Revolutions* states that scientists today all-too-often engage in ‘group think’ taught in a certain ‘school’ of theory with the result that mere facts are ignored in order to save reputations, careers, and perhaps avoid more work (which suggests that the term ‘peer-reviewed’ amounts to little more than exposure to group think).⁴ Richard Horton, editor of *The Lancet* agrees. When commenting on the techniques used by conservative thinkers to snuff out the paradigm shifting and unorthodox, he calls the opinions of peers ‘biased, unjust, unaccountable, incomplete, often insulting, usually ignorant, occasionally foolish, and frequently wrong.’⁵

Even the *Financial Times* has thrown its hat into the ring with a lead story explaining how companies are becoming increasingly vociferous with their complaints about irrelevant business school curriculums. Solipsistic academic theories based on limited sets of empirical experiences are also mentioned as a turn-off. One corporation that spends a small fortune educating its executives put it this way, ‘Business schools should spend more time listening to clients and developing course design in accordance with our requirements, not theirs’.⁶

Several years ago, when trying to make headway against those who oppose the study and teaching of sustainable business practices, I phoned Walter Stahel, a pioneer in the development of closed-loop sustainability concepts, to ask for guidance. ‘Most business school academics are economists,’ he told me, ‘which means they’ve been trained to think in two-dimensions. The reason they don’t understand sustainability is because it’s a three-dimensional issue.’

Most economists are indeed taught to collect data and express it using an X and Y axis – with the end result being something akin to the old parable about three blind men examining an elephant (‘It’s like a giant piece of felt,’ says the first blind man, holding its ear. ‘No, it’s more like a snake,’ says the second as his hands move over the animal’s trunk. ‘No, no, you’re both wrong,’ says the third, working his fingers around a leg, ‘this creature is a tree!’).

‘You can only understand the system of a rainstorm by contemplating the whole, not any individual part of the pattern,’ Peter Senge wrote in his acclaimed book *The Fifth Discipline*. ‘Business and other human endeavours are also systems. ... (and) systems thinking is a conceptual framework... (designed) to make full patterns clearer and to help us see how to change them more effectively. Mutual reflection. Open and candid conversation. Learning to let go. Awareness of how our own actions create the systemic structures that produce our problems. Developing these learning capabilities lies at the heart of profound change.’⁷

Happily, an increasing number of governments, people and responsible companies are deciding that they no longer wish to pay for the short-term thinking of others – hence an increase in the interest of sustainability and responsible business practices. From a managerial

viewpoint this can be seen as either a curse or a blessing not least of which because sustainability requires a profound comprehension of a business before even the most basic work can begin. Everything within the business (and everything that touches it and is touched by it) needs to be examined and understood, which means that everyone the business employs or touches needs to work together in collaboration. No one can consider himself or herself too busy. Added to this is the old cliché that there is no finish line; sustainability, by its very nature, is an on-going process. It must therefore be said that any introductory booklet about sustainability designed to function as a primer (like this one) cannot contain all the in-depth coverage of the necessary issues and topics that comprise its subject -- which is why waste minimisation as an all-important first step to sustainability is the main focus of this document. For a more comprehensive look at the information presented, please download the free, 377-page introductory text titled *Managing the New Frontiers* on which this guide is based. *Managing the New Frontiers* is distributed as a free PDF file by a number of universities, business organisations, and research centres with the aim of helping to strengthen business communities, increase employment, and reduce environmental degradation. It is updated at least once a year. Visit any of the following websites to obtain a free copy (an updated 2nd edition will be released in the autumn of 2011) – and please encourage your friends and colleagues to do the same.

- the **European Foundation for Management Development** (Brussels, Belgium) **www.efmd.org/publications**
- **Kozminski University** (Warsaw, Poland) **www.kozminski.edu.pl** (click on the English-language icon)
- the **University of Surrey**, Centre for Environmental Strategy (Guildford, UK) **www.ces-surrey.org.uk** (see ‘news’)
- the **Birla Institute of Management Technology** (New Delhi, India) **www.bimtech.ac.in**
- the **Product Life Institute** (Geneva, Switzerland) **www.product-life.org** (click on ‘major publications’)
- the **Global Text Project** (USA) **<http://globaltext.terry.uga.edu/>** (The GTP provides free textbooks to students – particularly those in developing countries.)

Additional Reading

Once you’ve grasped the basics of sustainability in a micro context, it is recommended that you progress to *The Performance Economy* by Walter R. Stahel to further your understanding of the subject in a macro context. *The Performance Economy* is based on 30 years of work and research in the field of sustainability. More to the point, the information it contains has been, for quite some time, put to use by a number of companies and governments to great success.⁸

PREPARATION

...the act of making ready (i.e.: putting or setting in order in advance of an act or purpose). Before beginning the sustainability process it's important to: (1) learn what it entails, (2) articulate why the pursuit of it is important, and, (3) establish the groundwork that will instil both managers and non-management employees with enthusiasm, answers, and support. Without this foundation, most attempts at sustainability are prone to confusion, suspicion, disorganisation, and dwindling motivation - as well as wasted time and efforts.

1. Fundamentals

When General Electric made the decision in 2004 to become 'greener', many company managers were not impressed. By the end of 2008, however, 'green' practices had delivered US\$100 million in cost savings to the company's bottom line while yielding a portfolio of 80 new products and services that generated \$17 billion in annual revenues (greenhouse gas emissions were reduced by 30% in the process). Going green 'has been 10 times better than I ever imagined,' says the company's CEO Jeffery Immelt.¹

For the most part, what Immelt is talking about is eliminating waste (also known as non-product) in all its forms and becoming more innovative in the process - a discovery that reflects the company's Six Sigma mantra from the 1980s. Taken as a first step toward sustainability, waste minimisation has a lot going for it. It not only increases quality, facilitates innovation, and lowers resource and disposal costs, it also reduces pollutants and the expense of pollution (which is why environmentalists are so enamoured with the subject). Electricity consumption provides a good example. The American EPA estimates that a typical data centre consumes 10 to 100 times more energy per square metre than the average office building. Yet a 2,300 square-metre data centre spending \$2.6 million annually for power can still enjoy electricity savings of more than 20% per year simply by reducing its energy demands (approximately \$1.2 million over a four-year period)². A recent IBM study dug even deeper, concluding that less than 4% of the energy going into a modern server farm actually processes data. 40% is needed to cool the room where the servers are located, another 40% is used to cool the interior of the machines, and over 16% is used to keep the servers idling in case a sudden increase in processing occurs.³ This means that 96% of the costs of operating a server area are used to perform activities that are unrelated to data processing. Moreover, the extra electricity needed results in more coal being burned (coal is the most common fuel used to produce electricity), which produces more pollution, which results in health and cleanup costs being added to the mix, and so on. The problem is exacerbated when one takes into account that up to and over 50% of all the energy a business consumes is wasted. Put more succinctly, the more a business wastes the more it has to purchase.

For a growing business, an energy-intensive business, or a business suffering through the difficulties of a recession this is clearly not a sustainable path. The good news is that many business energy costs can be reduced with long-term sustainable solutions that are so simple they defy belief. For example, Yahoo saves 60% of its electricity costs by opening the doors and windows where its servers are located and letting the hot air out. Intel states that similar efficient air-cooling can cut the power costs of a 10 megawatt data centre by \$3 million thereby eliminating hundreds of thousands of tons of greenhouse gases and their costly damage.⁴ Suddenly, becoming more sustainable (or going green or whatever it's called - as long as an acknowledgement is made that 'green' is just one component of sustainability) doesn't seem like such a far-fetched idea after all.

10 Reasons for a Business to Become Sustainable

Volatile energy prices

Between 2004 and 2008, oil prices rose from below \$20 to over \$145 a barrel. As the world's population increases and becomes more affluent, the cost of oil escalates accordingly. Insulated

windows and walls, and efficient machines and equipment are obvious ways to fight higher fuel costs, but there are other solutions as well that involve little more than changes in behaviour. Firms like UPS are teaching their drivers to reduce left-hand turns, pack trucks tighter with more packages and drive fuel-efficient trucks more efficiently. As a result the company has saved millions of dollars in petrol and maintenance.⁵ Investing in more sustainable energy sources (wind, solar, and hydrogen) goes further. For example, the Sierra Nevada Brewing Company in Chico, California purchased solar panels that produce 203 kilowatts of electricity to supplement a previous purchase of four 250-kilowatt fuel cells.⁵ Thanks to rebates, tax credits, and other financial incentives, a 100% return-on-investment is expected in six to seven years - after which time the company will have few in-house energy costs. More to the point, the company has now protected itself from the numerous power-cuts and brownouts that plague its region. Switching shipments and deliveries from trucks to trains is another move that slashed the business's dependence on oil and saves around \$2 million a year⁵ - '...- money that can be (and is) used to fund additional cost-saving projects..

Increases in raw material costs.

Raw materials are increasing in price for the same reason as oil prices (currently, 20% of the world's population uses 80% of the planet's resources). This is somewhat bizarre when one takes into account the enormous number of goods that consumers throw away daily, which still contain all the materials, labour, and energy that went into making them (in the USA, for example, 2.5 million plastic bottles are discarded every hour¹). One sustainable solution is 'extended product life', which turns waste into assets via reuse, remanufacturing, and recycling. For example, Stewart's Ice Cream Shops in the USA has been using refillable bottles (over 12 million annually) in its over 200 shops for more than four decades thereby saving millions of dollars a year.⁵ Elsewhere, Caterpillar, the world's largest manufacturer of construction equipment, delivered years of record profits due to a manufacturing business model that makes high-quality components, collects them after they've been used, cleans them up, and re-incorporates them into new products at a cost 30%-60% less than making them from scratch.⁵ Many of these parts are made once and sold three times (think of the profit margins involved). Meanwhile, Interface Inc., the world's largest manufacturer of commercial carpets has, for 14 years, been using old carpets to make new carpets instead of sourcing petroleum as a raw material. As a result, profits have doubled, employment has almost doubled, and the company's stock price increased 550% over a five year period.⁵

Increases in waste and disposal costs.

Simply put, there aren't enough landfill sites to dump the world's increasing amounts of garbage (approximately 2 kilos per person per day and rising⁶) so prices rise accordingly. For example, in the USA, between 1985 and 1995, the average cost of disposing one ton of garbage into landfill rose 425%⁷. The bottom line is that throwing stuff away costs money - and the bigger the business, the greater the costs. The Sierra Nevada Brewing Company (mentioned above) saved \$1 million in landfill fees and \$2 million in waste haulage fees by finding ways to reuse or recycle what it used to throw away⁵. Meanwhile, Wal-Mart has issued an edict to its distributors demanding that they reduce their packaging by 5%. As a result, the retail giant

expects to save \$3.4 billion a year in waste disposal costs⁵. Another example is 3M. After sifting through its waste bins to discover what was being thrown away, the 3M employees developed a profitable and recyclable new product made entirely from waste.⁵ Now that's sustainability!

Changes in waste legislation

Banning wasteful incandescent light bulbs to help lower national energy demands and reduce CO₂ emissions is merely the beginning. Paper, plastic and other recyclable materials are increasingly being turned away from landfill sites to avoid waste and encourage recycling. Similar waste legislation examples include the USA's Toxics Release Inventory, which some claim was America's first intelligent step toward waste legislation, take back laws that make manufacturers legally responsible for their products after they've been sold to encourage reuse and remanufacturing technologies – and directives such as WEEE (Waste Electric and Electronic Equipment), which took effect in 2005 (designed to mitigate the incineration and dumping of electronic waste) and RoHS (the Restriction of Hazardous Substances), a 2006 law that bans electronic equipment containing certain levels of cadmium, lead, mercury, and other toxic substances. Further regulations include the 2007 EUP directive (Energy Using Products), which requires producers to design and track products according to closed-loop waste reduction practices, and the REACH authorisation (the directive on Registration, Evaluation, and Authorisation of Chemicals), which requires manufacturers to publicly display toxicity data and to prove that the chemicals used to make products are safe.⁵ Additionally, the 2008/98/EU directive, which went into effect in December of 2009, categorises waste prevention as a first priority, resource reuse as a second priority, and makes material recovery, in almost all its forms, mandatory. Rest assured that more such legislation, all of which is designed to mitigate future waste problems and expenses, is on the way.

Increases in environmental laws.

Digging up the earth and turning it into pollution is not a sustainable business model; it's a sign of costly waste. Legislation that classifies CO₂ as a pollutant merely adds weight to this argument (think 'cap and trade'). Company administrators sometimes claim ignorance, but astute shareholders know what is at stake. In 2008, for example, the Securities and Exchange Commission was petitioned by representatives of seven American states to force companies to reveal the actions they are taking to deal with climate change. This was not due to a sudden interest in the environment, but rather a belief that investors should have the opportunity to 'avoid investing in companies that are ignoring the spiralling costs of a changing environment'.⁵ Earlier, in 2007, the CEO's of several corporations called on the American president to enact mandatory reductions in carbon emissions. The group consisted of chief executives from Alcoa, BP America, Caterpillar, Duke Energy, DuPont, the FPL Group, General Electric, PG & E, PNM Resources and others. 'We felt it was better to be in the formative stages of legislation,' said Jim Owens, CEO and Chairman of Caterpillar, '(otherwise we) could cost (ourselves) out of the market.' By banding together to avoid a patchwork of costly and conflicting regional regulations, far-sighted CEO's are trying to work with lawmakers to set goals and targets that allow businesses time to make changes and implement solutions that will improve the environment and energy efficiency, protect the economy and national trade, and deliver a one-two punch to

waste-filled competitors and products.⁵ Added to this is the belief of many scientists that toxin build-up in air, soil, and water is more costly and damaging than climate change – which is one reason why environmental crimes committed by negligent company directors can now result in fines of over \$1million and jail time of up to ten years.

Changes in customer demands and expectations.

‘Don’t go into business to sell what you want to sell,’ I regularly tell my students, ‘go into business to sell what customers want to buy – and that includes where they want it, how they want it, when they want it, and why they want it.’ Recently, a major telecom manufacturer stated that in 2007, there were 50 request for proposal bids (out of 400) asking for information on the company’s sustainability initiatives. In 2008, the number was 125, and in 2009 it is on track to be over 200.⁸ It does not take a rocket scientist to deduce that B2B customers and B2C customers want lower costs, fewer toxins, less guilt, more incentives, and less packaging associated with the products they buy. Even retailers are watching over their supply chains (where most of their environmental footprint is located) in order to reduce unnecessary expenses that result from wasteful practices. Energy and material price rises are bad enough, but when they are added to supply chains they do even more damage. Firms such as Planet Metrics collect information on raw material sourcing, production methods, delivery systems, and energy use – indeed all aspects of a product’s life cycle – to provide a clearer picture of what might happen if oil prices increase, or water becomes scarce, or a law changes, or a higher price is placed on CO₂, and so forth³. In other words, it’s possible for major buyers to now know ahead of time which of the products they purchase are more likely to experience cost increases (or get hit by new legislation) – as well as the names of alternative (lower cost) suppliers. If that is not enough to scare the hell out of a wasteful business, I don’t know what is.

Competitive advantage.

During the 2001-2003 recession, global carpet giant Interface faced a 36% worldwide slump in carpet sales. Nevertheless the company gained market share during this period because of its commitment to low-cost sustainable operations.⁹ More recently, the Tennant floor maintenance company introduced a commercial floor cleaner that electrically charges tap water to behave like a heavy-duty cleaner.¹⁰ The safe, toxin-free result cleans floors better than anything else on the market, thereby enabling customers to forego the expenses of purchasing cleaning solvents and the cost and time of training employees how to use them. In addition, valuable storage space that once held toxic cleaners is now a thing of the past for Tennant’s customers. The message could not be clearer. Companies that sit on the sustainability sideline may discover that when they finally decide to take action their competitors have already passed them by.

Transparency issues.

The more secretive a business is the more likely it is to be shunned by customers. Companies like outdoor clothing manufacturer Patagonia use transparency to their advantage by making it easy for customers to follow products online from conception to the sourcing of materials to manufacture and delivery.¹¹ Clorox and SC Johnson take a similar route by posting online lists of every ingredient in their products. Business writer and environmental speaker Andrew

Winston says it best: transparency comes in two flavours. Voluntary (information donated by the company) or involuntary (information donated by a consumer watchdog group or disgruntled customers).³ Guess which one is best for your business?

The acquisition, retention and motivation of talented employees.

To be sure, money is important to employees, but there are other things at least some employees think about as well. The ability to make a difference, feel a sense of accomplishment, work with pride and purpose and other intrinsic motivators can be infinitely more powerful than money. Ray Anderson, founder and former CEO of Interface carpets says that nothing galvanises his employees more than the company's commitment to sustainability.⁹ 'In the competition for the best business school graduates and other high-flyers, especially once the economy starts to recover, companies that show they were not mere fair-weather friends of sustainability will be at an advantage,' The Economist magazine wrote less than a year ago. As if to prove the point, sustainability pioneer Patagonia receives, on average, more than 1,000 CVs for every job position available. Think about how that minimises talent search and recruitment costs.

The cost of procrastination.

The longer a business takes to act the higher the cost of change and the further behind it can fall in terms of profitability, innovation and market share. Delayed action also ensures that additional costs - many of which are hidden - continue to accrue. For example, according to the American Environmental Protection Agency (EPA), building-related productivity losses and illnesses resulting from poor lighting, poor ventilation, and/or indoor pollution (a.k.a. 'sick building syndrome'), cost American businesses \$60 billion.¹² And that's just from indoor pollution. Further expenses - resulting from outdoor toxins - create unnecessary costs as well. For example, the EPA estimates that it will take \$1 trillion to clean up America's trichloroethylene residues (trichloroethylene is a toxic substance used to remove grease from metal) and that \$100 billion is spent in the USA on medical expenses related to polluted air alone. Meanwhile, a 2001 survey of nearly 600 children found that perfluorooctanoic acid - a substance found in food wrap, Teflon, and stain-resistant fabric coatings - is swirling in the blood of 96% of the children it sampled¹³ - one of dozens of toxins now found as a matter of course in human bodies¹⁴. Traces of arsenic, mercury and benzene also show up regularly alongside heavy metals such as lead, cadmium, zinc, chromium and copper. In river sediments and estuaries these substances are ubiquitous. Escalating levels of polycyclic aromatic hydrocarbons (PAH's), polychlorinated biphenyls (PCB's), and pesticides (each of which can take hundreds of years to degrade) make matters worse.¹⁵ In the interim, residues from billions of doses of prescription drugs are now found as a matter of course along shorelines and in wetlands. Swallowed to combat cancer, pain, depression, and other ailments, most medications do not harmlessly dissolve into patients and disappear. Instead, they exit the body, leak from sewage pipes, and work their way into the environment.¹⁶ Researchers in Canada found a dozen different toxic drugs in water samples taken from the St. Lawrence River in Quebec, while across the border in the USA a vast array of pharmaceuticals (including antibiotics, anti-convulsants, mood stabilisers, and sex hormones) were found in the drinking water supplies of 41 million Americans.¹⁷

Additional Costs that Result from Waste

Unemployment and underemployment (i.e.: the wasting of people) provide further examples of the cost of waste. Expenses associated with laying-off employees (or negative job growth in general) include loss of investment in human capital and skills (particularly in individuals that have been unemployed for a long time), social and economic deprivation (rises in crime, depression, divorce, family break-ups, poor health,²³ lower life expectancy, etc...), and a reduction in regional and national economic growth potential (particularly from the one-two punch of fewer tax revenues and increased government spending designed to spur growth). When poverty is added to the mix these problems only intensify.

Stuart Hart, author of *Capitalism at the Crossroads*¹⁸ and a pioneer in the field of 'Inclusive Commerce' has discovered that most business strategies focus exclusively on the 800 million or so people that makeup the industrial world while effectively ignoring the 4 billion to 5 billion people that comprise the bottom of the economic pyramid. Contrary to popular belief, the world's poorest countries have had zero or negative economic growth since the early 1980s¹⁹ and the years between 1990 and 1999 mark the slowest growing decade the world economy has seen in the past 40 years²⁰. Of particular concern are the approximately one billion people that live on \$1 a day or less, the 16,000 children that die daily from malnutrition and the fact that the number of people suffering from chronic malnutrition has almost doubled since 1970. Meanwhile, in the world's poorest regions (areas like sub-Saharan Africa) \$25,000 is spent every minute servicing the debt owed to rich countries. Today, the World Bank estimates that the developing world spends around \$13 in debt repayment for every \$1 it receives in grants.²¹ Clearly, this is not a sustainable path.

Connecting the Dots

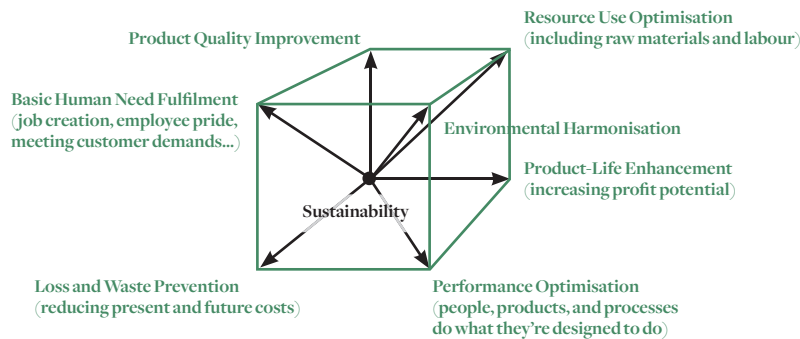
We know what happens when the world and its businesses are run in an unsustainable manner. The ten year period between 2000 and 2010 has been described as the 'most dispiriting and disillusioning decade in the post WWII era'.²² The millennium began with a dotcom bust and a Wall Street crash, both of which were overshadowed by major terrorist attacks. In the years that followed the numbers of large-scale terrorist bombings increased.. Then came the worldwide financial meltdown of 2008 brought about by irresponsible deregulation and monetary policies. Large swathes of the globe are now beset with high unemployment, huge amounts of debt, and growing unrest. An increase in catastrophic storms, floods, and droughts - and the increasing acidification of the world's oceans - merely adds to overall costs and malaise as well as a profound feeling that humanity is moving in the wrong direction. Furthermore, potable water is now at such a critical low level that wars over this crucial commodity are predicted to break out within 10 to 20 years while the Earth's resources (of which there are finite supplies) continue to be captured, abused, concentrated to industrial (toxic) levels and discarded at an alarming rate.

'We have seen the enemy,' said Walt Kelly's satirical character Pogo, 'and he is us.'

There is a better way. It is possible to abandon the costly, cancerous actions that constitute short-term thinking. It is possible to do more with less, obtain more from purchases and investments, reuse industrial inputs and outputs and minimise future problems and expenses.

To be sure, sustainable business practices will not solve all of the world's ills -- the complex, multi-dimensional configuration of sustainability ensures that there is no silver bullet that can be relied upon to hit every target. Equally as true is that no known business on Earth can call itself 100% sustainable (those that are interested are, for the most part, merely experimenting with the concept). That being said, minimising waste, thinking whole-system and acting in the long-term is a big step in the right direction. Businesses in the manufacturing, retail, financial and service sectors are benefitting in astonishing ways. If you wish to take part in this phenomenon (to paraphrase Mahatma Gandhi) you will have to be the change you want to see in your business. Translation: clean your own house first. Let your competitors spend their money on lawyers and lobbyists. Rather than make excuses and continue with delays, a growing amount of business data strongly indicates that long-term thinking is a profitable way forward.

The areas where sustainability leads



Sustainability: a 3-Dimensional issue

.....

16

2. What the reformer is up against

With large corporations saving more than \$1 billion from sustainable practices - and countless smaller businesses adding tens of thousands of dollars a year (or more) to their bottom lines by doing the same - one would think that businesses around the world would be rushing to become more sustainable. Unfortunately, this is not the case - and a major reason why this appears to be so lies within the complexity of the human brain.

The Center for Research on Environmental Decisions (CRED) is a research organisation based at Columbia University. For the past several years, scientists at CRED have been working to understand the mental processes that shape human choices, behaviours and attitudes. Understanding why people behave differently when presented with simple choices is a field of study located at the crossroads of psychology and economics, which sprang from the work of Nobel Prize-winning psychologist Daniel Kahneman and his colleague Amos Tversky, both of whom discovered that humans often carry a number of biases that greatly affect decision-making.¹ For example, we are generally more averse to losses than gains and we repeatedly use short-cuts to solve problems (a process called heuristics). Moreover, most of us have an inert dislike of delayed benefits. Placed in an everyday context, this means that given a choice we will more often take €20 now as opposed to waiting a year to collect €100.

*Between 1513 and 1532, Niccolò Machiavelli, author of **The Prince**, wrote, “There is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit from the old order, and only lukewarm defenders in those who would profit from the new order – the lukewarmness arising partly from fear of adversaries who have the laws in their favour, and partly from the incredulity of mankind who do not believe in anything new unless they have had actual experience of it.*

People are also extremely susceptible to how questions are posed. For example, would you adopt cost-free procedures that resulted in your company saving €29,000 annually - or - would you adopt cost-free procedures that cut carbon emissions by 139,000 kilos per year? The result (from turning off unneeded lights in a business one of my students examined) in both cases is the same, yet depending on who is being questioned, the answers vary considerably.

Further examples of biases that affect human decision-making processes include:

- A finite pool of worry – being able to focus on only a limited number of problems at any given time.
- Single-action bias – the belief that performing one act or task is enough to solve a complex problem.
- Focusing more on what is unknown rather than what is known – for example, endlessly debating the exact amount of money that a sustainable procedure will save (€200,000 or €500,000) rather than the fact that the procedure will save more than it costs.
- The expectation bias – making a judgement based on what the outcome is expected to be (or, as Henry Ford is credited with saying, ‘Whether you believe you can or believe you can’t, you’re absolutely right.’)
- The anchoring bias – the belief that things are as they appear to be, or, as they have been taught (in other words, an individual’s powers of estimation, frequencies, probability, and sizes are heavily influenced by his or her surroundings, background, and education [this helps explain why people are incensed by flag-burning or the kind of sex others have in private, even though these issues don’t really affect them --- yet when an issue like toxin build-up comes along, which does affect them, their reaction is negligible).²

Compounding these biases are a number of additional short-comings that influence behaviour including poor communication skills (especially those of scientists, academics, managers, and teachers), prevention avoidance (e.g.: only being able to defuse a bomb after it has exploded), and the constant misinformation spread by moneyed interests, sceptics, or out-and-out liars (a situation exasperated by a common perplexing belief that the truth is whatever anyone says loudly or fervently enough).

Mixed messages, as well as messages expressed in ways that motivate the messenger more than the receiver, create additional obstacles to long-term thinking – and a quick search through the proliferation of websites promoting green business practices provides a case in point. Many of these sites earnestly document the amount of greenhouse gas emissions a company can eliminate in a bid to become ‘greener’, but all-too-often there is little or no mention of the financial savings that will be achieved in the process. This is puzzling for the simple reason that finance is the language of business – not CO₂ emissions. Is it any wonder so many businesses are not interested in sustainability?

Manifestations

How do the above biases and shortcomings manifest themselves in academic institutions and work places? Usually in the following ways⁴:

- Lack of Awareness: Without question, ignorance is the greatest enemy of sustainability. Most people simply do not know about the cost of waste, the money that can be saved by reducing it, the numerous negative situations that can be alleviated by eliminating it and the myriad solutions that can turn it into money. Just as important, most people never consider that pollution and over-production are among the easiest signs of waste to spot. (For example 3M’s ‘Pollution Prevention Pays’ programme saved the company more than

\$1 billion over a 30-year period). Added to this is the common misconception that just because a system, machine, or product is functioning, it is operating at 100% efficiency or that traditionally low-end costs (such as water and electricity) don't amount to much and are therefore not worth examining - neither of which is true.

- Waste Acceptance: Some people believe that waste is a natural and acceptable part of business. Common variations of this theme include defeatism (saying sustainability is not worth the effort) or the belief that sustainability does not apply in (our) part of the company or in (our) industry. As harsh as it sounds, the more short-term a person's thinking is, the more likely it is that he or she will feel this way.
- The Cost Myth: 'How much is this going to cost me?' is the first question managers usually ask when the basics of sustainability are explained – and the question is often put forth in a pessimistic tone implying that the cost will be too high. Unfortunately, it misses the point. It is not the costs, but the savings and potential profits that should be considered first. Yes, in many cases some capital is required to start a sustainable process, but the point of sustainability is that it can pay for itself – with the added benefit of additional savings year after year that can be used to fund further improvements. Energy efficient light bulbs provide a good example. Efficient bulbs can cost anywhere from \$6 to \$20 (or more) per unit whereas regular light bulbs cost around 75-cents (or more) per unit. Most folks assume that 75-cent bulbs are the less expensive option, yet if one takes into account that energy efficient bulbs last years longer and can save \$30 - \$60 in electricity costs over the life of the bulb, the 'cheaper' bulb becomes the more expensive alternative. Unfortunately, too many people do not think in the long-term and end up choosing the more expensive option. This is especially true with 'stranded capital' (businesses that invest millions of dollars in inefficient equipment and machinery and cannot afford to change).
- The Dimes-not-Dollars Argument: Those who have looked into efficiency sometimes find it difficult to become enthusiastic because they assume it only leads to small-time savings. Most of the businesses my students assess, for example, initially scoff at the notion that they can save money by implementing basic efficiency procedures – until estimates show that many of them can save thousands of dollars per year just by turning their lights and computers off when not in use. In several cases we revealed that annual savings of up to and over half-a-million dollars could be obtained by incorporating a few more inexpensive (and risk-free) solutions. The moral of the story is that the savings from efficiency do not just add up – they tend to multiply. For example, to continue with the light bulb example above, the overall savings from installing energy-efficient light bulbs includes: (1) reduced electricity costs (efficient bulbs consume less electricity), (2) reduced replacement bulb costs (efficient bulbs last longer), (3) lower cooling costs (heat from inefficient light bulbs can increase a building's heat load by 30%), (4) a reduction in air-conditioning needs (with heat levels cut by 30%, a smaller, less expensive air-conditioning system is needed), (5) reduced HVAC energy requirements (smaller air-conditioning systems require less electricity), and so on.
- The Hassle Factor: Many people don't want to add more work to their day no matter how

much time or money they can save. The message to remember here is that sustainability is not about sacrifice. It is about eliminating wasteful practices and replacing them with more cost-effective alternatives that make work easier, more enjoyable and less expensive.

- Scepticism and/or Obstinacy: In a world where prices are regularly taken into account, but long-term value rarely is, sustainability is a difficult concept for many people to accept. Sceptics, for example, often think that the amount of cost-savings a business can achieve are impossible to prove (especially if no measurement is taking place). Estimations therefore become easy to dismiss with an unmovable conviction that the amount of time and money invested will be more than what is received in return. Stated differently, since much of sustainability falls into the realm of prevention, and the predicted savings from most preventative measures cannot be proven until after a practice has been implemented, predictions become easy to ignore.
- Social Loafing: Almost every business or industry has within its ranks those who reduce their efforts when they see that others are more than pulling their own weight. This practice is called social loafing and it is anathema to sustainability – particularly when the lowered input of one or two individuals has the ability to reduce the work or aspirations of an entire operation (or industry). Social loafing tends to be pervasive in under-regulated industries and/or in companies that have untrained or unsupervised employees. As a result, since employees feel that the company (or industry) that employs them does not care about costs – why should they?
- ‘Let’s Wait and See’: Businesses (or managers) that wait to see how other companies react first before they themselves take action probably suffer from a lack of education, direction, and training. Ironically, because of the virtually risk-free nature of efficiency and the rapid financial improvements it brings about, when a decision to become more efficient is finally made those that sat on the sidelines may discover that their competitors have already passed them by.
- The Solutions are Too Simple: A British efficiency consultant in France once relayed to me that almost every manager he spoke with about sustainability rolled his or her eyes when the first suggestion he made was to turn off unneeded lights (this practice alone saved one factory that my students assessed €28,800 a year). Although there is no data to suggest that complexity legitimises business solutions, many people apparently seem to need the false reassurance that they feel complexity provides. Therefore, because many sustainable solutions are simple and low-tech, they are rejected out of hand.
- ‘We’re Already Doing as Much as We Can: These self-deceiving words are usually uttered by managers and employees who: (1) mistakenly believe that they’ve done it all, or, (2) wish to avoid additional work, or, (3) are placating customers, their shareholders, or the media with false information. According to the Scottish Environmental Protection Agency, the true cost of a business’s waste is often five to 20 times more than what the business assumes. Think about that for a moment. An office manager once told my students that it was highly doubtful they could find more than \$300 in efficiency savings (‘We’re already efficient,’ she said). The students found over six times that amount in two hours. Another

group of students found over \$4,000 in savings in a restaurant, which claimed beforehand that it too was as waste-free as it could be thanks to the policies set by its head office. Managers and employees take note: proclaiming that your business is as good as it's going to get is tantamount to claiming that it has no further need of new thinking, training, input, or ideas.

- Group Think or a 'Committee Mentality' results when laziness or the smug air of superiority creeps into a business and it refuses to consider what it feels are strange or different viewpoints from others. For example, students I have trained to conduct waste evaluations have been called 'tree-huggers', 'crackpots', and a host of other names when they mention that sustainability also helps the environment by dramatically lowering greenhouse gases. This type of behaviour is mostly a hangover from the 1970s when businesses and environmentalists clashed (sometimes physically) on a regular basis.
- Additional Obstacles include: fear of change, lack of leadership, an inability to accept criticism, poor management and poor decision making – all of which will be examined later.

The Illusion of Control

Humans often have a strong desire to feel in control – so much so that acquiring a feeling of control is usually deemed essential for survival. Psychologist Bruno Bettelheim concluded (from first-hand experience) that survival in Nazi death camps depended on a person's ability to preserve areas of independent action and to maintain some control over certain aspects of one's life. Eliminate control and people experience depression, stress, and even the onset of disease.³ In an academic study of elderly nursing home residents, for example, a group of individuals was told that it could decide how their rooms were decorated and that each person had a choice over what type of plant he or she could have (the subjects were also told that they were responsible for caring for the plant). A second group had everything done for them. Eighteen months later, 15% of the subjects in the first group had died compared with 30% in the second group.⁴

Although research shows that satisfying the human need for control can create a powerful sense of purpose and direction, the irony is that too much control can generate problems. Few people enjoy the company of control freaks, for instance, and having one person in a group (or business) make every decision often results in the group being vulnerable to bad choices – particularly when it comes to money. Studies have shown, for example, that people feel more confident when they toss a set of dice rather than if someone else makes the toss for them.⁵ Most people will also value a lottery ticket more if they choose it rather than if one is chosen for them at random.⁶ A similar study revealed that well-educated subjects actually thought that they could improve their prediction of coin tosses through practice.⁷ Obviously, in all of these examples the subjects had no control over the outcomes of the acts described, yet as psychologist Leonard Mlodinow reports,³ on a deep, subconscious level they must have felt they had some control because they behaved as if they did. The conclusion is that sometimes a false sense of control can promote a false sense of well-being by allowing an individual to maintain the hope that a bad situation can be improved.

So what, you may ask, does a false sense of well-being (i.e.: the illusion of control) have to do with sustainability?

In the introduction it states that sustainability embraces the legal, financial, economic, industrial, social, behavioural, and environmental, arenas – and most of the examples provided in this publication offer proof that this is so. Now take a minute to thumb through this guide while asking yourself the following question: how much control does the business in which I work have over these issues?

Battling the Illusion of Control

Because of the enormous breadth and depth of sustainability - and because too many people believe (or want to believe) that the issues comprising sustainability are distant both in time and place - the astute manager has his or her work cut out trying to implement sustainable practices in the workplace. Over the past few years it has become fashionable to describe the kind of focused, collaboration-induced communication needed to break through these barriers as having the proper frame, explains Jon Gertner, author of the article *Why Isn't the Brain Green?*¹, however, in our haste to mix jargon into everyday conversation, frames are sometimes confused with another psychological term, 'nudges'.

Frames and nudges are powerful tools that help mitigate biases, reduce individual shortcomings and clarify mixed messages. A frame is a method used to get people to behave or think a certain way by using sophisticated messages that resonate or take advantage of cognitive biases (such as placing a message in a financial context rather than an environmental context). Nudges, on the other hand, direct the intended recipients toward a preferred action and are designed to follow frames by structuring choices so that cognitive shortcomings do not drive desired actions off course.

For example, if a business has been told that it can save €2,000,000 in costs by reducing wasted electricity (the frame), a nudge that can encourage employees to reduce those costs could take the form of an electricity monitor displayed so that every employee can see how much electricity is being used or wasted in real time. Nudges therefore appeal to the human need for short-term satisfaction as well as the desire to be rewarded for improvement. So, placed in a management context, a 'frame' is the ability to communicate a message to others in a way that they understand and a 'nudge' refers to the feedback and measurement that enables the targeted group to see if their actions are achieving desired results.

Establishing a Resonating Frame for Businesses

To date, in an on-going survey, my students have asked 127 business managers and 530 employees in eight countries (Belarus, Canada, China, Peru, Poland, Russia, the United Arab Emirates and the United States) what aspects of sustainability most interest them. Top ratings are almost always given to: the cost savings involved, profit potential, market share increases, and job security (i.e.: the financial aspects of sustainability). Environment concerns are usually ranked least important – often by margins of 8 to 1. Why then, when trying to win over businesspeople, are the aspects of sustainability that appeal most to business constantly forced to take a back seat to environmental facts and figures?

The Importance of Collaboration

Apart from frames and nudges, group collaboration (i.e.: the input of employees as well as different departments, customers, suppliers, and so on) appears to be another key component to achieving success when sustainability-based changes are introduced into a business. Why? Because when an individual is reminded that he or she is part of a group, the group tends to become the decision-making unit – and groups are often more patient than individuals, especially when considering long-term or delayed benefits. Equally as important is that armed with good information, the freedom to speak out, and strong leadership, the calibre of group work can usually be expected to exceed the sum of that which each individual could normally produce on his or her own. Experiments conducted at the CRED research centre, for example, show that giving subjects a blue sticker and telling them they are on the ‘blue-star team’ increases cooperation from 35% to 50%. Just seating the ‘team’ together at a table increases participation rates by 75%.¹⁸ These outcomes suggest that collaboration can be used to set long-term sustainable goals before individual biases and misinformation have the chance to set in – which is important because, as the next section reveals, setting clear, understandable goals and objectives that everyone can agree on is a cornerstone of the sustainability process.

3. Establishing Sustainability as an Objective

Not long ago, an administrator at a prominent UK business school pulled me aside and explained that her university had just bought a hybrid car (coloured green, of course) and had painted the words '(Our) university is going green!' on its side. 'What will the car be used for?' I asked. 'That decision hasn't been made yet,' she replied. 'Who'll be driving this car?' I responded. 'We haven't figured that out yet either,' she answered, 'but we're really serious about this sustainability thing so we're also going to knock down two of our buildings and rebuild them so they're greener.'

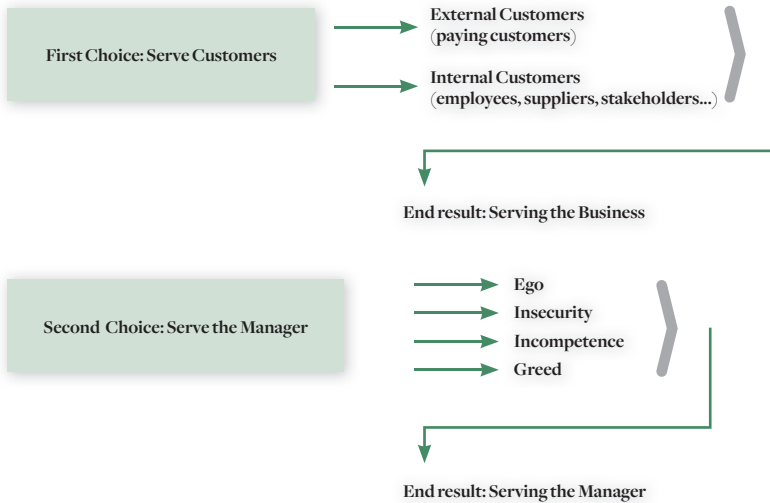
Obviously something is wrong here. Few grandparents try to connect with their teenage grandchildren by using 'gangsta' hand gestures, saying things like 'peace out', and wearing snorkel jackets and trousers that hang down around their knees. Yet too many business schools (and businesses) fail to see a similar sense of irony when they announce that they're 'going green' – with the result that their efforts end up looking like nothing more than a misplaced marketing exercise. Put another way, it is probably not in the best interest of a business or business school to tackle the subject of sustainability from its weakest point (environmentalism) – particularly when a wealth of other vitally important long-term thinking skills and abilities are well within its grasp.

The Role of the Astute Manager

For the past five years, companies considered to have good social, environmental and governance policies have outperformed the MSCI world index of stocks by 25%. Indeed, it has been shown that 72% of companies that adopt sustainable policies regularly outperform their industry peers.⁶ What this suggests is that if sustainable practices are a proven way to improve business operations they should be strongly considered – and since the role of a manager is to serve customers¹ (see FIGURE 3-1, The Two Choice of Management) perhaps the best way to implement sustainability is through service. Serving external customers (paying customers) involves finding out what they want - as well as how, when, and where they want it - and then moving heaven and earth to provide it (see section 12: Understanding the Importance of Customers). Serving internal customers (employees, colleagues, suppliers, contractors, shareholders and other stakeholders) includes finding good people, educating (training) them, and giving them what they need so that they know the needs of the business, the business knows their requirements, and the two can serve each other. Any other decision on the part of the manager merely serves the manager (in a nod to the Four Horseman of the Apocalypse, I refer to the four major managerial weaknesses depicted in FIGURE 3-1 as 'the Four Horseman of the Managerial Psyche'). For example, if an employee approaches a manager with a sustainable cost-saving idea and the manager says 'no', the manager is probably serving his or her ego (few words show that a manager has superiority over a subordinate than the word 'no'). If the manager says 'no' because he or she is not sure if the idea will work, insecurity is perhaps to blame (a manager's job is to find out how or if new ideas will work). If the manager says 'no' because implementing the idea will involve additional work (as new practices often do in their initial stages), the manager is probably serving his or her incompetence. Lastly, if the manager says 'no' because he or she is just being stubborn, or, the idea will allow someone else to shine, the manager's greed (or selfishness) is most probably being served.

Figure 3-1
Scott's "Two Choices of Management"

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Sustainability: Make It an On-Going Mission and Make It Known

A common refrain heard from employees and managers in many organisations is that they don't know the aims of the company in which they work and they have never been taught their employer's values and priorities (if they have any) - a situation that usually boils down to a lack of communication. Poor communication results in employees not performing to the utmost of their ability and the organisation as a whole not pulling in one direction. Simply put, people work better (1) when they know exactly what it is they're supposed to be doing, (2) when they've been told (and have accepted) what is expected of them, and, (3) they're provided with regular real-time feedback.²

Ensuring that Proper Goals and Objectives are Established

When establishing its sustainability objectives, Dow Chemical could boast support from the company's CEO as well as shop floor workers, clients, suppliers and environmentalists'. Excluding input from any one of these groups was seen as asking for trouble – something the Monsanto corporation discovered only too well during the 1990s. Around this time, Monsanto developed a bold new vision of providing sustainable agricultural products that could resist pests and diseases without the use of chemicals. The company's objective was to aid the environment and provide a level playing field for poor farmers around the world who could not afford the latest fertilisers and pesticides and other high-end technologies. This seemed to be an admirable objective from the viewpoint of business administrators, however, the company started developing genetically modified seeds to achieve its aims without first asking its customers what they thought about this plan. The resulting violent reaction against Monsanto and its genetically modified products shook the GM industry to the core, caused the company's stock price to collapse, forced its CEO to step down, and ended with the company being merged with

another. In other words, by giving its customers what it thought they wanted instead of asking what they actually wanted, Monsanto set off in the wrong direction and paid a heavy price for it.⁴

Four Steps to Achieving Optimal Objectives

1: Create a Vision

A vision is a clear and vivid idea of how things should be. In the UK, HSBC Holdings PLC decided to motivate its external and internal customers with a vision of reducing waste by becoming carbon neutral. Reckitt Benckiser, a British manufacturer of household goods has developed similar plans. In the USA, the Bradley Corporation, a manufacturer of commercial washroom fixtures, proclaimed a comparable vision which led to its products becoming ‘environmental solutions instead of environmental problems’.⁵ Computer maker Dell Inc. has announced that it is committed to becoming the greenest technology company on the planet. Organisations like these have discovered through research and close client relationships that a commitment to sustainability not only reduces waste, pollutants, and costs, it also promotes responsibility and respect - attributes that attract the attention of customers and help create an inspiring vision for employees to fulfill.

2: Decide on a Mission

Mission statements individualise a business by defining its purpose and uniqueness. For example, ST Microelectronics pledged to obtain a forty-fold increase in production and become virtually waste-free (in terms of greenhouse gas emissions) by 2010. Figuring out how to do this took the company from being the 12th-largest microchip manufacturer in the world to the 6th – while saving a billion dollars in the process.⁶ Meanwhile, Ben & Jerry’s Ice Cream declares as its mission a dedication ‘to make, distribute, and sell the finest all-natural ice cream... (with) a ‘continued commitment to incorporate wholesome, natural ingredients and promote business practices that respect the Earth and its environment.’

3: Break the Mission Statement Down into Achievable Objectives

Objectives are blueprints for achieving a mission that incorporate concepts of time and measurement, address financial and non-financial issues and are more concrete and action-oriented. For example, sustainable carpet manufacturer Interface jump-started its employees by setting the following objectives and then asking everyone how to achieve them:

1. To drive waste out of the company completely,
2. To emit only benign emissions,
3. To harvest old carpets into new carpets rather than use virgin raw materials,
4. To only utilise renewable energy in production processes,
5. To transport products from the factory to customers as efficiently and cleanly as possible,
6. To sensitise people and communities about sustainable practices, and,
7. To reinvent commerce itself using improved leasing services.⁷

4: Formulate Strategies to Achieve Objectives

The final stage of the objective process is to identify short-term goals for unit, departmental, or individual use, along with timelines to avoid procrastination as well as forms of measurement

to ensure that progress is being made (e.g.: the production department will reduce waste by 60% in nine months and energy consumption by 25% in three months...). Methods for achievement can include providing better employee training, replacing raw materials with recyclable materials, investing in clean energy, replacing outdated equipment and machinery with efficient alternatives, redesigning products and so on. Tapping into the workforce is essential because involving employees yields ideas and solutions and builds motivation and commitment. For example, on the 4th of May 2004, the Subaru car manufacturing factory in Lafayette, Indiana made history by becoming the first auto assembly plant in North America to become waste-free thanks to the on-going commitment and input of workers and managers. 100% of the waste steel, plastic and other materials coming out of the plant are now reused or recycled. Even paint sludge is dried to a powder and shipped to a plastics manufacturer where it ends up as parking lot bumpers and guardrails. What can't be reused - about 3% of the plant's trash - is incinerated to generate electricity.⁸ In another example, a Kozminski University student in Warsaw, Poland who was assessing a business approached a worker and asked him if he had any ideas that would improve efficiency. The worker suggested moving two machines closer together so that one person could operate them both, thereby freeing up a second worker to focus on other tasks. Hearing this, the shop foreman expressed surprise that the worker hadn't spoken up earlier. 'No one asked me earlier,' the worker replied.¹⁰

Putting It All Together: Frames, Nudges, Objectives, and Control

For a manager interested in 'selling' sustainability to colleagues, success or failure often hinges on an ability to speak the language of the people being addressed. This is the world of selling, where putting the needs and interests of customers ahead of one's own is considered by many pros to be the most winning of strategies. The key to successful selling lies in understanding customers and their motivation. Two factors are involved. The first is moving toward a goal or reward. The second is moving away from a fear or loss. According to sales guru Tony Parinello, if you can work out which one of these motivates your customers (or can figure out how both of them can), you're on your way to making a sale.⁹ Don't assume that merely talking about financial savings and profit increases will win a financially-minded audience over to sustainability. Yes, this type of information can be made interesting and intriguing, however, it doesn't always instigate action – and action (e.g.: approval, the granting of authority, and, funding) is what most managers are after. Before pitching any proposal, it is imperative that research is done beforehand to identify a specific problem the audience faces. Once that information is known a proposal can be tailored to show how it will help the audience as well as those who have the power to act. For example, if a seller is pitching first-aid kits to a factory, rather than explaining the low cost of the kits, the advanced materials the kits contain, the lives they've saved, or the design awards they've won, it would be in the seller's best interest to first find out the most common injuries suffered by employees in the factory. In a chemical factory where employees are prone to burns this information could then be used the following way in a sales pitch: 'Studies show that, thanks to our first aid kits, chemical burn scars are reduced by 63% and pain is reduced by up to 80%. Furthermore, by having our kits on your premises, your insurance premiums can be lowered by up to 14% and your company will save an additional \$2,000 per year because of the current discount we're offering. Our kits, and the support

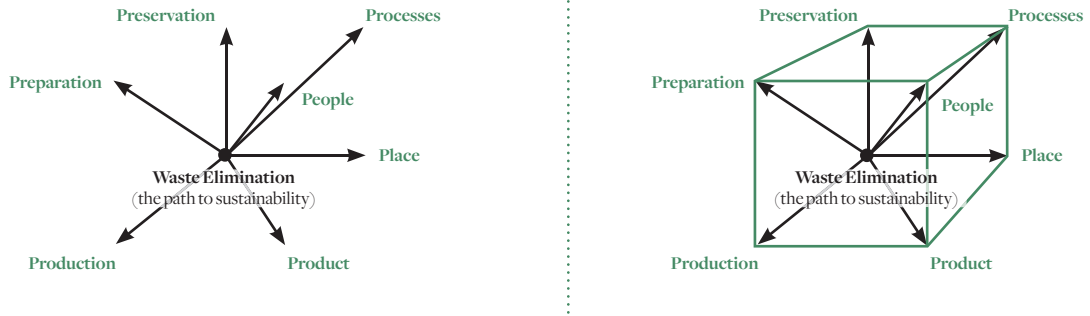
system behind them, will even help you sail through your next health and safety inspection.’

This type of approach helps the seller target three objectives. (1) It gets the customer emotionally connected to the product or idea, (2) it targets the real problems of the customer with real solutions, and, (3) it shows the customer what is at risk by not implementing the idea. In other words, in one fell swoop it shows how the customer can (a) move closer toward a goal or reward and, (b) move away from a fear or loss.⁹ In a sustainability setting this could mean explaining how the \$25,000 that can be shaved from the business’s yearly electricity bills would be used to pay the wages of a part-time worker needed in a production department. \$40,000 in fuel savings can be pitched as a perfect way to purchase new computers. If the shipping department needs a new vehicle or operations is desperate for a more advanced extrusion machine, the \$82,000 a year saved by incorporating sustainable waste recovery practices could be explained as a no-capital, non-risk way to begin paying for what is needed. Likewise, if the region, state, or country is poised to adopt new environmental legislation that might cost the company a fortune, show how taking action now will save \$125,000 and reduce carbon emissions by 30,000 tons over the next five years. Proposals presented this way are difficult to ignore.

One More Time

In 2005, employees at Hewlett Packard managed to keep 84% of the company’s trash out of landfills around the world as part of the business’s sustainability drive. At Xerox, a company that credits sustainable activities as having helped save it from financial collapse, employees reuse, remanufacture and recycle over 90% of company waste. Workers at three of Toyota’s manufacturing plants in the United States have reached a 95% recycling level - as have the employees at Fetzer Vineyards, one of America’s largest wine makers.⁸ The point here is that sustainable waste-minimisation practices mesh beautifully with the fundamentals of business: to serve the needs of customers, to reduce costs, and to streamline the business toward making a sale (not to mention the protection and creation of jobs). To be sure, the examples mentioned in this and other sections represent only a fraction of the overall sustainability picture - and it is important to note that sustainability is like quality in that one sub-par or out-of-sync component often diminishes the entire end result. Staying on track involves acknowledging the big picture by continuously honing and developing an awareness of what sustainability encompasses (understanding the interplay of every component - see FIGURE 3-2) before analytic thought, personal interests, negative experiences and biases begin their reductive work. Equally as true is that after a few goals have been achieved it is tempting to believe that these successes possess an independence all their own and to rest in them and believe that they are the foundation of what is being sought. This is the time to note that a pledge to sustainability is a pledge to on-going improvements across the board along with complete acknowledgement that there is always room for improvement.

Figure 3-2
Sustainability in your business (connecting the dots)



Waste elimination: going from fragmented, scattershot operations that foster an ‘It’s not my job’, ‘That’s not my area’, or ‘I don’t know’ attitude to a responsible mindset that promotes long-term, whole-system, 3-dimensional unity and stability

PRESERVATION

Preservation is defined as:

- the process of keeping something in existence,
- to keep up or maintain something,
- the act of protecting or safeguarding something from harm or injury,
- keeping possession of, or retaining, what currently exists.

Any way it's looked at, preservation is not about standing still. In a business context, sustainability demands that two forms of preservation take place. The first is internal and involves the collection and analysis of real-time measurement in production processes and product use. The second form is external and includes keeping ahead of laws and legislation, industry improvements, directives from customers (e.g.: 'scorecards' insisting that packaging or toxins be reduced), disruptive trends, and other forms of change.

4. Mapping the Waste-Elimination Process

Trying to eliminate waste in an organisation without first conducting some form of reconnaissance is comparable to hacking one's way through a jungle without a map.¹ Put another way (as one practitioner explained it), without in-depth knowledge of what you're looking at and what you want to do, trying to find wasteful practices is akin to wandering around in circles pointing out superficialities. For this reason, a number of efficiency experts advocate creating a process map (also known as a process flow chart) to help lay the application foundation.¹

Almost any production setup or work process in any organisational setting will benefit from being mapped including service businesses, factory assembly lines, farms, offices, schools and food production. When done correctly, a process map usually reveals astonishing facts and figures about consumption and waste, including:

- Raw materials (including the amounts of whatever is needed to collect, process, and ship them),
- Manufacturing processes (including manpower needs, material use, energy use, and waste creation),
- Packaging requirements (the amount of paper, plastic, styrofoam and other materials being consumed),
- Transportation needs (the amount of energy used to shift materials from one place to another),
- Maintenance (the chemicals, energy, and water needed to use, maintain, and/or clean whatever is being produced), and,
- Use and Disposal methods (a description of how the product is thrown away as well as the costs involved).²

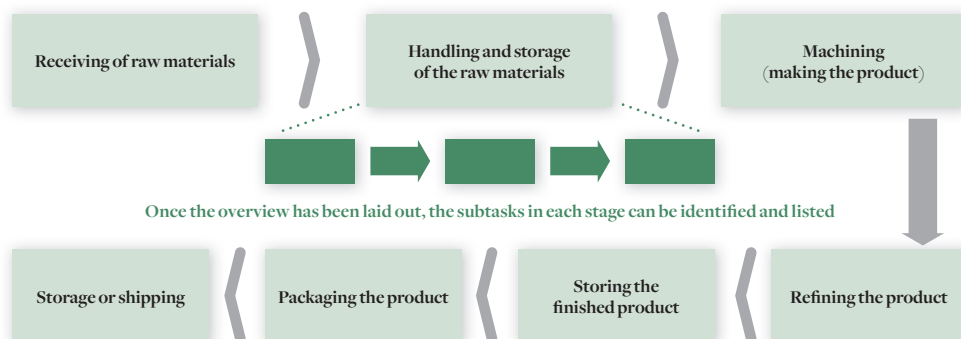
Because gathering and mapping an organisation's production activities requires effort and usually involves more than originally envisioned, obtaining the input of the many different people involved in the activities being examined is crucial. Henri Miller, a famous American painter and novelist, once said that in this age, which believes that there is a shortcut to everything, the greatest lesson to be learned is that the most difficult way is, in the long run, usually the easiest. Keep Miller's words in mind when mapping a work process.

Laying the Groundwork

Don't worry if you or your employees have no experience putting together a process map. Practice makes perfect. Experienced practitioners suggest using post-it notes to start the process. Displaying work processes on post-it notes and rearranging them on a big board makes it easy to move and add new information. Again, remember to obtain input from as many people as possible. You are bound to miss something if you go it alone. FIGURE 4.1 (below) shows how a mapping process can start:

Figure 4.1
Overview of a seven stage manufacturing process

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Analysing Every Stage of Production

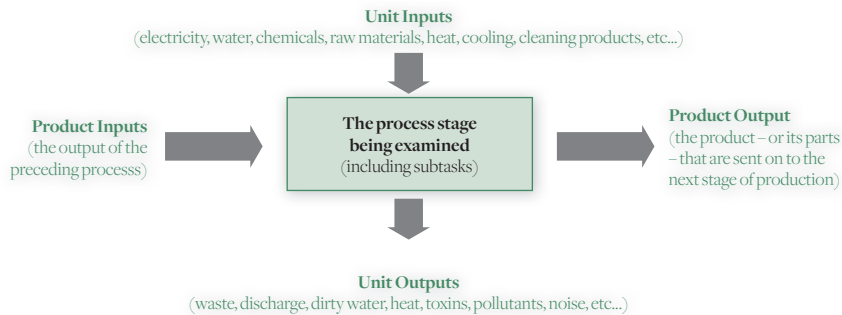
After every stage of production has been laid out, the next phase is to break the stages down into subtasks for further analysis. List and describe every activity in the order that it occurs. Examine how these activities impact one another and measure and record the amount and costs of every production unit input and output (see FIGURE 4.2). Measuring and recording all inputs and outputs includes weighing or counting (in terms of units or financial amounts) how much is consumed as well as how much is produced and discarded. Use this information to create baseline statistics against which future measurement can be judged. Nothing should be seen as trivial. For example, one of my students visited a company to conduct his waste reduction research and discovered that employees used mobile phones to communicate with one another in different parts of the plant. A quick search on the Internet revealed that the mobile phones could easily be replaced with cheaper walkie-talkies, powered by rechargeable batteries, which would drastically cut the business's phone bills. 'Everyone stopped laughing at my waste reduction suggestions after that,' the student said.

Examples of waste measurement statistics include: utility and fuel bills, the number of trash bags the business fills daily (placing similar items of garbage into separate containers makes this process easier), water consumption figures, raw material invoices, and so on.

A common way to measure (and appreciate) the amount of physical waste a department or business disposes is to 'dumpster dive' (i.e.: collect and examine what has been thrown away).³ 'Once you've seen your garbage up close its hard to ignore it,' says Shira Norman, a research consultant with YRG Sustainability. As if to prove her point, for over 12 years, the Bentley Prince Street carpet company (a division of Interface) has forced employees to record what they toss in the trash by sifting through company rubbish (a different department is selected to do this every month). Examining the company's rubbish makes it easy to determine what can be reduced, re-used, re-incorporated back into production, or sold to a recycler. The company now only orders snacks from vending machine suppliers that take back their packaging – a move that has greatly reduced the amount of rubbish in office bins.³

Figure 4.2
Production unit analysis

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Keep It Simple

The term ‘process mapping’ is not normally used by practitioners when they describe the activity of investigating and recording inputs and outputs of work processes for waste minimisation purposes. ‘We just study our utility bills and look in our garbage bins to see the amounts of waste being produced,’ one sustainability practitioner explained to me, ‘then we make a note where it comes from. We don’t make maps.’ When it was suggested that collecting waste data, determining its origins, and recording it (to make improvements) is indeed a form of process mapping, he (and several others) conceded. The message? Don’t overload your waste-reduction process map with symbols, technical jargon, or other academic markings that render it incomprehensible. Most business will find it difficult to profit from a map that only a handful of employees understand.

Calculating Carbon Footprints

Calculating a ‘carbon footprint’ (i.e.: the amount of carbon dioxide a process creates) is a trendy way to measure carbon emissions with the added benefit that, when lowered, the numbers can be used in public relations campaigns or to prove compliance with emissions legislation. Employees usually enjoy seeing how their efforts help reduce environmental degradation so displaying carbon emission reductions alongside other relevant data can help create motivation and a strong sense of achievement. For more information about carbon footprints and their calculation use the free calculators at these websites:

- www.carbonneutral.com
- www.ghgprotocol.org
- <http://actonco2.direct.gov.uk>
- www.puretrust.org.uk/Business/Calculator.aspx

Involve Everyone and Examine Everything

After the data from measurement is collected it is time to sit down with colleagues and ask some tough questions. What types of waste are being produced? How much waste is there?

Why does the waste exist? What can be done about it? Note that these questions are merely the beginning. The resulting answers (and additional questions) as well as any perceived disruptive changes should not be considered as painful obstacles, but rather the path to success. The idea is to stay ahead of the rising bar being set by formidable competitors, increasing legislation and other exterior influences. Being reactive and playing catch-up is not a viable business strategy. Your never-ending goal is to stop paying for more resources than you need and to stop producing stuff (non-product) you cannot sell. Everything your business does should be questioned. If you work in a financial institution you will need to discuss whether or not you want to buy from, invest in or lend money to, businesses that actively ignore the financial advantages of sustainability. If you are a manufacturer, what affect will rising raw material and energy costs have on your production? What will happen when oil hits \$150 a barrel - or \$200 - or \$300? What will you do if a tax is put on carbon emissions or a chemical you use? What will happen if the local landfill site suddenly refuses to accept your waste? What if a cleaner, more efficient system or process is invented in your industry? What will you do when environmental laws tighten?

Once you have examined your business from top to bottom, start searching for similar weaknesses up and down your supply chain (FIGURE 4.3). Higher fuel prices, increasing raw material costs and changes in legislation may not affect your business directly, but what happens when your suppliers are hit hard? Working with suppliers and paying customers will help you in the long-term.

Figure 4.3
Map and examination of the entire supply and demand picture



For example, as stated earlier, Wal-Mart expects to cut \$3.4 billion from its annual waste disposal costs by ordering suppliers to reduce their packaging by 5%.⁴ At the other end of the spectrum, Proctor & Gamble discovered that 85% of the energy used in the manufacture and use (i.e. the life-cycle) of its laundry products occurred at the customer end and involve heating water. As a result the company developed a new product (Tide Coldwater) that enables customers to reduce their energy costs by cleaning their clothes with cold water. An added extra is that this innovation makes the product more environmentally friendly.⁵ It is one of seven sustainable products that helped the company generate more than \$7 billion in sales within one year.

5. On-Going Measurement and Record Keeping

The Sierra Nevada Brewing Company was created in 1979 after company founders Ken Grossman and Paul Camusi cobbled together a brewery using second-hand dairy tanks, equipment salvaged from defunct beer businesses, and a soft-drink bottling machine. Today, Sierra Nevada employs over 450 people and produces nine award-winning types of beer, ale, and stout. According to Sierra Nevada's sustainability coordinator, Cheri Chastain, regular measurement helps determine where the company is wasting water, electricity, and other resources as well as where physical waste is being produced. After a waste source is revealed, Cheri then works with teams of company employees to reduce it. 'Record keeping is absolutely critical for keeping track of progress,' she explains. 'I keep detailed spreadsheets for all of our sustainability related programmes. Without records, there's no way to know whether or not we're improving and reaching our goals.'¹

Typical measurements recorded by Sierra Nevada's waste reduction programme that have helped the company save millions of dollars annually include:

- the amount of material that is recycled through the company's various vendors (which includes weight measurements as well as income received),
- the amount of material that the company reuses (by volume [quantity or weight] – as well as what part of the company it went to), and,
- the amount of material sent to landfill by weight (based on waste hauler invoices).

To round out Sierra's waste measurements, greenhouse gas inventories are also kept. 'The amount of water produced and electricity consumed, as well as our natural gas and water consumption figures – and carbon emissions - are then compared to the number of beer barrels we produce every month,' Cheri says, 'all of which provides me with some great ratios to work with.'

As Ms. Chastain has discovered, it's difficult, if not impossible, to know how much waste a company produces, how much waste it has eliminated, or how much money it has saved without accurate, on-going record-keeping. For many companies, this involves scrutinising toxic or hazardous material purchases (as well as usage costs), examining the amount (and types) of waste different departments or processes produce (usually by recording what each one throws away), and investigating the fees, extraneous charges, and taxes associated with current waste-handling practices.

The Requirements of a Good Record-Keeping System

Simplicity is the key to sound measurement. Additional suggestions include:

- the system should be easy to understand,
- information and results should be expressed in real-time,
- collected data should be accurate, reliable, and essential,
- the entire system should be easy to use (i.e.: more time should be spent pursuing efficiency rather than keeping records), and,
- all information should be easily transferable (i.e.: easily shared and compared with other departments and employees).²

Transparency involves displaying the results of measurements. Accessibility involves making this information available and readable. Apart from providing informative feedback, regular monitoring shows that a business is serious about sustainability. Accessible, transparent measurement has also been known to create friendly competitions between employees or departments as teams try to outdo one another to reduce waste and resource use. For example, the Intercontinental Hotel Group acquired a new software system from SolveITLabs³ that focuses on over 40 sustainability-based practices that its hotels can adopt - thereby enabling its 4,000 properties to clearly see on-going electricity usage along with suggestions on how to reduce it by up to 25% (a savings of over \$200 million annually). As a bonus, the system keeps score of energy savings at different hotels so managers can compare their improvements with others. Similarly, the waste-free Subaru plant in Lafayette, Indiana (mentioned in section 3) makes its waste-reduction results an integral part of plant manager performance evaluations.

Environmental Audits

Just as the process of mapping out a work system isn't called process-mapping by waste-minimisation practitioners, when setting out to gather and/or check sustainability facts and figures, many practitioners don't refer to what they're doing as an audit. The word 'audit', however, is appropriate even though most accounting systems fall far short of what an understanding of sustainability requires (e.g.: clean air has no financial value, but try living without it). Professional auditors go a step further, using the term environmental audit to describe the gathering, checking, and analysis of material use - as well as the measuring of waste and emission levels. Make no mistake, despite the fact that the word 'environment' makes up the name, environmental audits are similar to financial audits in that they are very effective in reducing waste. Likewise, environmental audits can be performed by either trained employees or licensed professionals and they come in all shapes and sizes ranging from a simple checklist to a comprehensive investigation of a company's operations. Typical areas of examination include:

- facility inspections,
- the collecting, analysing, and explaining of data,
- communicating with contractors, customers, regulators, and suppliers,
- the measurement of key environmental parameters,
- going over internal records, policies, reports, and objectives,
- comparing audit results to industry standards (such as ISO 14001 standards and guidelines), and, employee skills, thoughts, and motivation levels,
- Additional services can include degrees of compliance with environmental laws and regulations, uncovering the expectations of customers, and liability obligations.⁴

Types of Environmental Audits

According to the American Environmental Protection Agency, the six most common audits performed by professional environmental auditors are the:

- Acquisition audit. An audit performed before or after a major purchase is made (the purchase can include another company, an area of land, and/or a major piece of

- equipment). The focus of an acquisition audit is usually on potential claims or liabilities, particularly regarding environmental damage, that can arise from a major purchase.
- Compliance audit. Usually part of an overall assessment with an emphasis placed on compliance with environmental legislation and comparisons with ISO 14004 environmental management systems.
 - Due diligence audit. Similar to an acquisition audit in that an assessment is carried out to determine potential legal claims and liabilities (usually for potential investors). Health, safety, and fire risk assessments are also included as well as site history analysis and legislative reviews.
 - Waste audit. The emphasis here is on exploring waste creation and handling (i.e.: ensuring that waste is handled safely and stored safely at a reasonable cost) as well as the origin and reason for the waste and its production. Hidden waste such as unused raw materials, wasted energy and water, and wasted time are also taken into consideration.
 - Waste disposal audit. Often undertaken to comply, in part, with ‘Duty of Care’ regulations to investigate the transport and disposal of waste by contractors. During the first part of this audit, waste management documentation is usually the first thing that is checked (e.g.: waste management licenses, waste carrier licenses, and duty of care reports).
 - Water audit. Similar to a waste audit, however, the focus is on water wastage. Onsite water use is analysed as well as wastewater production and treatment. Water intake is measured and compared with output. Discrepancies signify leakage or other problems.⁵
 - Peer review audit. An audit conducted by colleagues from outside the plant or factory. For example, General Electric runs annual ‘Green Factory’ inspections performed by other GE factory managers.

Despite a growing acceptance of environmental auditing, it’s not uncommon to hear practitioners say that the results they obtained from an outside environmental audit did little more than reaffirm what had already been discovered by employees. As one practitioner put it, ‘When we conduct a waste audit we not only measure the amount of waste produced we also know exactly where the waste came from. An outside auditor who does not have specific expertise in certain fields or equipment can only measure it.’ That being said, businesses that have been successfully reducing their waste levels for years sometimes feel the need to step back and ask an outside specialist to provide a second opinion, reveal a new way of thinking, or perhaps instigate a more serendipitous outcome.

Environmental Audits Don’t Hurt

According to companies that have undergone an environmental audit, the process is relatively painless. Particularly for first-timers, there is no shame in admitting a lack of knowledge regarding the full range of business operations in terms of regulatory compliance, energy and resource use, raw material sourcing, supply-side issues, the creation and delivery of products and services, the inputs and outputs of offices and/or production facilities, cost relationships with suppliers, and subjects related to environmental management. For example, the Glasgow

Housing Association in Scotland (the largest social landlord in the UK) had a first-time environmental audit performed at its headquarters by the British Safety Council, which identified over \$51,000 in savings. In the process several waste minimisation plans were developed, a library of resources was created, recommendations were made to get employees involved in an efficiency drive, and waste reduction goals were set.⁶

Seen this way, an environmental audit can lead to cost savings that more than pay for the price of the audit. Genzyme Diagnostics, for example, a biotechnology company in the UK, had an environmental audit performed that uncovered over \$80,000 in potential annual savings resulting from waste minimisation suggestions, reuse and recycling tips, and lighting and water reduction measures.⁶

Getting Started

- Communicate the goals of the audit to everyone beforehand. Inform employees in every department what will be done and why.
- Identify the parameters of the audit. Determine what will be studied: Waste? Water? Energy? One programme? The entire facility?
- Establish measurement metrics. How will the audit's findings be recorded? How will waste be measured (in units, in monetary terms...)? Determine these issues before an audit begins.
- Establish a 'no blame' policy. Keep the emphasis on discovery rather than assigning blame.
- Carry out the audit during normal, everyday operations to ensure that the figures are accurate.
- Verify and review the results. Check finished work and measurements and review them with all concerned.
- Discuss the results. Bring employees together, ask questions, identify areas that need improvement, gather improvement suggestions, and share successes when they've been achieved.
- Repeat the process. After agreeing on goals and objectives, set a date for the next audit and review the results. Audits should be conducted on a regular basis.⁷ Just don't fall into the trap of placing more time and effort into creating measurement statistics than performance results.

For More Information

Look for specialised private companies, government agencies, and academic institutions with experienced staff (always conduct a thorough background check before hiring a professional service). For more information, contact:

- An Environmental Protection Agency (**www.epa.gov**).
- The Global Reporting Initiative (**www.globalreporting.org**)
- The Institute of Social and Ethical Accountability (**www.accountability21.net**)

6. Taxes and Legislation

When setting a tax the idea is to match price with cost. Unfortunately, the cost of what's heavily taxed, what's minimally taxed, and what's not taxed sometimes doesn't square up. For example, a chemical that sells for \$20 per kilo may be subject to minimal taxes to encourage sales on an industrial scale, but what is the chemical's true cost when it makes its way into water, food supplies, and human bodies? Of course, raising money isn't the only function taxes perform. Taxes also carry the potential to discourage the sale of the items or activities being taxed (which is why high taxes are often placed on alcohol and tobacco). Unfortunately, when taxes are placed on items or activities that people consider valuable they can have the same effect. Consider the duty placed on employees as a case in point. Most businesses are taxed, in part, on the number of individuals they employ (a practice that began in 19th century Germany) so the more people a business hires the more taxes it has to pay. Equally as mind-boggling is the fact that the more a person works the more taxes he or she has to pay (in the USA alone, two-thirds of personal income tax - which constitutes 80% of the tax funds raised by the US government - is derived from the sale of labour). What effect does this have on consumer spending (the engine that drives a nation's economic growth)?

Making Taxes Pull Double Duty

For years, a growing number of independent thinkers have been proposing that current tax structures could be put to better use. The idea is simple: to tax what society wants less of (e.g.: pollution and waste) and to reduce or eliminate taxes on what it wants more of (employment and income). A tax on carbon emissions, for example, could help reduce climate change and the costs and dangers associated with it. Unlike a cap-and-trade system, which allows markets to stipulate the amount of emissions that are tolerated (and which allows for the price of carbon to vary), a greenhouse gas tax would set a fixed price and let it determine the amount of emissions put forth. In other words, the higher the tax on greenhouse gases, the greater the incentive to reduce emissions. How much tax would have to be imposed? To achieve an adequate reduction in CO₂ emissions without unduly hurting the world economy, it's estimated that the tax would probably have to amount to between \$20 to \$50 per ton of carbon emissions produced. In the United States, this would, in part, mean imposing a tax on gasoline, diesel fuel, and motor oil of around 6% and a coal-produced electricity tax of about 14%.¹

Since carbon emissions aren't the only harmful discharge the world wants less of, a similar duty would be placed on all dangerous discharges including chlorine, sulfur, tetrafluoromethane, hexafluoroethane, hydrofluorocarbons and nitrous oxides as well as hazardous materials such as chemical fertilisers, pesticides, and phosphorous. Detrimental practices including topsoil depletion, non-renewable logging, and most mineral and metal extraction processes (including the mining of bauxite, chromium, coal, gold, and silver) would provide additional taxation targets. Waste sent to a landfill site or tossed into an incinerator would be included as well.

No doubt many businesspeople will cringe at the prospect of a massive shift in taxation, but it's what would not be taxed that makes this proposition all the more appealing. Corporate taxes would be reduced or eliminated, employment taxes would end, and personal income tax could be greatly lowered. People and businesses could then pocket most, if not all, of their earnings and no company would be penalised for employing more workers. Taxes on interest, savings plans,

retirement accounts, and college tuition accounts could also be eliminated. In addition:

- Businesses endeavoring to become more efficient would have more control over their tax burdens.
- Profits would increase as businesses became more sustainable.
- The quality of goods and services would improve (such is what happens when waste is eliminated).
- The costs and dangers associated with climate change would be mitigated.

Needless to say, a move of this magnitude would have to be gradual to allow industries to adapt. Furthermore, once a more sensible shift in taxation has been put into place, a common sense approach to subsidies could also be adopted. Energy (including wind and solar power) could then trade at its true cost and billions of taxpayer dollars currently being directed toward problems that create waste and pollution could be redirected toward schools and social programmes, job creation, and the promotion of cleaner and healthier working and living environments.

Legislative Involvement

Redefining Progress (www.redefiningprogress.org) is a leading sustainability think tank located in the USA. For over 12 years it and several other organisations have been studying the effects of taxing waste. The conclusion is that a quarter or more of all American public revenues could be replaced if the government started taxing waste and natural resource consumption instead of revenues and income. A modest introductory tax placed on the burning of fossil fuels, for example, coupled with a reduction in payroll taxes, could boost America's GDP and create 1.4 million new jobs while cutting climate change pollutants by 50%.² The nation's economy would thus be put on a sounder footing because growth would be more sustainable, less costly, and less dependent on foreign commodities. The problem, of course, is that there are few people in government who have the vision (or backbone) to commence such a change. Equally as true is that most people don't want higher taxes placed on anything - particularly (and paradoxically) if they've already invested significant amounts of money in inefficient homes and businesses, wasteful heating systems, fuel-guzzling vehicles, and so on. Enter the need for legislation.

Historically, businesses have always fought against most forms of legislation, but the costs associated with climate change are causing many CEO's to think twice about how laws that promote higher taxes and carbon caps can be used to help industry. In early 2007, for example, the CEO's of several top American corporations called on President George W. Bush to enact mandatory reductions in carbon emissions to combat global climate change (their goal was to cut greenhouse gas emissions 60% by 2050). The group, calling itself the U. S. Climate Action Partnership (USCAP), consisted of chief executives from Alcoa, BP America, Caterpillar, Duke Energy, DuPont, the FPL Group, General Electric, Lehman Brothers, PG & E, and PNM Resources – along with four leading non-government organisations including Environmental Defense, the Natural Resources Defense Council, the Pew Center on Climate Change, and the World Resources Institute. By banding together to avoid a patchwork of potential costly and conflicting state or regional regulations, the group is trying to work with lawmakers to set goals

and targets that allow businesses time to make changes and implement solutions that will improve both the environment and energy efficiency, while protecting national trade and the economy.³

Investor Involvement

Intelligent CEO's and shrewd, independent thinkers aren't the only ones hankering for sustainable change. In September of 2007, a prominent group of state officials, state pension fund managers, and environmental organisations filed a petition with the Securities and Exchange Commission asking it to adopt guidelines requiring all public companies to disclose the risks of climate change to their business as well as the actions they're taking to mitigate those risks. The 115-page petition, signed by state treasurers, attorney generals, and state fund managers in California, Florida, Maine, New York, North Carolina, Oregon, and Vermont, states that 'climate change has now become a significant factor bearing on a company's financial condition... Investors are (therefore) looking for companies that are best positioned to avoid the financial risks associated with climate change and to capitalise on the new opportunities that greenhouse gas regulation will provide.' The petition went on to say that 'Interest in climate risk is not limited to investors with a specific moral or policy interest in climate change; climate change now covers an enormous range of investors whose interest is purely financial...'

The group claims that investors have the right to know:

- how seriously companies are taking climate change into account when making strategic business decisions (particularly the physical risks that climate change imposes on a company's operations and financial condition),
- the names of companies that are 'out front' in their response to climate risks and opportunities,
- the names of companies that are 'behind the curve' (so they can be avoided by investors), and,
- legal proceedings relating to climate change.⁴

Guidelines approved by the SEC in January of 2008 now require companies to weigh the impact of climate-change laws and regulations (including overseas regulations and accords) when assessing what information to include in corporate filings.

It's Not Just Big Business

Small businesses are also calling for increased legislation with the expectation that they'll soon reap its benefits. For example, an organisation called Small Business California worked to support the state's Global Warming Solutions Act (AB 32), the passing of which imposes tough legislation to tackle global warming. The idea behind AB 32 is simple: to balance the reduction of hazardous emissions with incentives for improvement. The programme works like an interest free loan: businesses are encouraged to exchange the profits they normally lose through wasted energy for energy-saving solutions (e.g.: increased insulation, more efficient machinery, etc) that quickly pay for themselves. The irony is that environmental groups have been lobbying for such changes for years - yet their efforts obtained fruition only after the local business community jumped on board.⁵

Additional Examples

Taxes and legislation designed to reduce waste undoubtedly leaves some people fuming, yet a government report published in the United Kingdom states unequivocally that businesses and consumers want their government to do more to make it easier to be less wasteful.⁶ The mandatory labeling and ranking of electrical goods and machinery in terms of efficiency (e.g.: Energy Star labels) is just one example of how legislation can help inform consumers about cost and energy savings while increasing the demand for environmentally friendly goods. Other changes being considered in the UK would make it easier for companies to install green technologies like solar panels and wind turbines. Currently, most businesses have to go through a lengthy planning application process (from 8 to 16 weeks) and pay the equivalent of \$3,000 if they want to install a solar panel or small wind turbine. To encourage cleaner energy practices, however, the government has expressed an interest in placing renewable energy equipment under a 'permitted development' category, which would allow it to be installed without the need for planning permission. A 'route map' for improving the efficiency of new buildings with the aim of reducing carbon emissions is also being considered.

Meanwhile, in the USA, California officials discovered that most HVAC air ducts leak 20% to 30% of the heated or cooled air they carry – so the government reduced leakage rate allowances to 6%. Further studies revealed that outdoor lights for parking lots and streets directed 15% of their beams up, not down. So outdoor lighting waste and leakage was set at 6%. Similarly, in 2009, a law was passed banning inefficient big-screen televisions from being sold in the state (the law goes into effect in 2011). The irony is that although California's energy prices are the highest in the United States, its citizens pay the country's lowest energy bills thanks to increasing laws that outlaw inefficiencies. Interestingly, the state also 'de-coupled' utility profits from consumption rates (i.e.: utility companies now base their profits on the number of customers serviced rather than the amount of electricity sold). So instead of selling more electricity to obtain more profit (which encourages waste), customers are encouraged to use less electricity so that more customers can be served by the limited amount of electricity that is produced by any given power company.⁷ This move lowers the state's energy needs while contributing to higher power company profits and an increase in consumer savings.

Additional moves to reduce wasted energy include tax breaks for buyers of fuel-efficient vehicles, equipment, appliances, and buildings. New York City is getting in on the act by declaring that all taxis must be fuel-efficient hybrids by 2012 – a move designed to save taxi drivers over \$1,000 per month while eliminating tons of greenhouse gases. The moral of the story? Expect more such laws. The best advice on offer is to not wait for your government to tell you what you already know is true. Exceed the law by becoming as waste-free as possible. You can't go wrong that way.

7. The Perils of Green-Washing

The term used to describe the deliberate distortion of the truth in order to make false environmental claims is called 'green washing' and the legislation that covers this area is notoriously lax. For example, it's within the law for the 'recycled' symbol to be placed on any product or its packaging if either one (or both) contain just 1% recycled material. Similarly, a business can make its products (or production processes) slightly less harmful to the environment, yet still boast in its advertising that it's 'greener'. Major oil companies are particularly vocal. Under attack for reaping windfall profits from soaring fuel prices, many oil companies are trying to reposition themselves as part of the solution to the world's energy problems rather than its chief cause. Other manufacturers have recognised that they too can burnish their environmental image - without having to do much - as a way of promoting their products. Naturally, there's nothing wrong with touting green credentials if the efforts behind such claims are valid. But problems can and do occur when talk and promises turn out to be nothing more than green washing.

In the spring of 2007, TerraChoice Environmental Marketing (a green-certification organisation) sent researchers into six national retail businesses to gather data about 'green' products. All in all, 1,018 products were looked at that covered a broad range of the consumer spectrum from air fresheners to appliances and televisions to toothpastes. Astonishingly, only one product turned out to be truly green – a paper product from Canada. All the others contained misleading claims that could not be proven. These claims included:

- Not Revealing Hidden Trade-Offs: 57% of the misleading claims made by manufacturers involved suggesting that the entire product was green when, in fact, the green aspect being promoted represented only a part of the product. The remainder of the product was both wasteful and destructive in terms of energy consumption, forestry destruction, and water usage.
- No Proof to Back Up Claims: 26% of the products examined boasted green credentials, yet the manufacturer was not able to confirm the claims being made.
- Vague Labeling: 11% of all misleading statements involved making a claim that was either poorly defined or meaningless, which made it likely to be misunderstood by consumers. For example, displaying a recycled symbol on the product without explaining what had been recycled.
- Irrelevant Claims: 4% of the green claims turned out to be true, yet were of no real value. For example, boasting that a product is free of CFC's may sound good, however, since CFC's have been illegal for almost 20 years making such a claim can be seen as a deliberate attempt to mislead the public into thinking that the manufacturer has gone the extra mile.
- Promoting the Green Side of Hazardous Products: Around 1% of manufacturers made claims that could be used to distract the consumer from the fact that the product is harmful to begin with (e.g.: 'organically grown' tobacco).
- Out-and-Out Lies: Less than 1% of the products studied issued claims that were absolutely false, usually by using or misrepresenting a 'green' certification by an outside authority.¹

Why Do Businesses Green Wash?

Apart from the short-term financial benefits involved, the main reasons why organisations engage in green washing include:

- an attempt to divert the attention of regulators and reduce pressure for regulatory change,
- the desire to persuade critics that the business is well-intentioned and/or has changed its ways.
- a need to expand market share at the expense of rivals that are legitimately trying to become greener,
- an attempt to reduce the turnover of environmentally conscious staff (or to attract more such staff), and,
- a desire to make the company appear more attractive to investors.

Another Twist: Capitalising on Guilt

During the Middle Ages, professional pardoners sold ‘indulgences’ that allowed sinners to be forgiven for their sins. Suffice it to say, the concept of paying a second party to atone for the sins of the first appears to still be alive and well.

The idea behind buying and selling carbon credits began in 1989 when global power firm AES invested \$2 million in a forestry project in Guatemala. The company made its purchase under the belief that laws would soon be enacted which limited carbon emissions and that these same laws would probably give companies struggling to reduce their carbon emissions the option of offsetting them.³ A growing number of businesses have since climbed onto the bandwagon by allowing customers to offset their carbon emissions by purchasing carbon credits. For example, some airlines will voluntarily add a few dollars to the price of their tickets and several power companies provide the option of paying a higher monthly fuel bill to help offset carbon emissions. In other examples, Range Rover automobiles have an emissions offset for the first 45,000 miles (72,000 kilometers) factored into their purchase price and a ski resort in Vail, Colorado allows skiers to buy energy credits to help buy a wind turbine so in the future they’ll be carbon neutral as they’re lifted to the top of a nearby mountain.

Of course, the money raised for carbon credit programmes is supposed to be used for building or promoting environmentally friendly projects such as the planting of trees, the protection of forests, the funding of alternative energy programmes, or the instigation of a pollution cleanup campaign – and according to the World Bank, approximately \$100 million is given on behalf of customers every year for these purposes. Yet some of this money never reaches its intended destination. Brokers have been known to skim as much as 60% off of carbon-offsetting investments as they’re passed from one middleman to another, tree-planting schemes have been found to be nonexistent, and some solar energy projects have reportedly turned out to be little more than scams. Money invested in environmental cleanup campaigns has also been called into question (particularly campaigns that have already been paid for) and carbon credits have been repeatedly sold to any number of different buyers.

Separating the Wheat from the Chaff

With so much room for abuse, businesses wishing to partake in green or carbon offset programmes are encouraged to investigate all claims before handing over any cash. Creators of greenwash campaigns are very good at fooling activists, customers, journalists, and politicians alike. Protective suggestions include:

- Use common sense. If a company's claims seem too good to be true they probably are (particularly if the company is situated in a traditionally non-green industry or its product portfolio is filled with goods that aren't green). Don't be fooled by slogans, tear-jerking ads, or safety claims designed to seduce.
- Do your homework. All products have a hidden history. Even bamboo, which is often billed as a green alternative to everything from building materials to textiles, uses hazardous chemicals in its processing (e.g.: sodium hydroxide, a corrosive chemical used in drain cleaners, and carbon disulfide – both chemicals are rarely recaptured and reused after processing). Do some research before buying into any green claim.
- Ask questions and demand documentation. If a company can't back up its claims with valid certifications, official audit reports, or similar documentation it's probably not telling the truth. Some companies, for example, state in their advertising that they fund endangered forests, wetlands, and species. What is not said, however, is that they were forced to do so by law because of their destructive practices.
- Seek consistency over time. It's quite common for companies to make announcements about changes in policy or the launching of new initiatives only to starve their plans of funds later on when the spotlight fades. To avoid falling victim to this practice, investigate the longevity and success of a company's previous green projects as a way to help predict the feasibility of new ones.
- Confirm the validity of industry associations. There's no shortage of questionable 'regulatory' industry associations that companies claim are watching over them and their industries. False third-party tactics makes it easy for companies to hide behind a façade of smoke and mirrors.
- Look for trustworthy certifications. These include the 'EPA' label, 'Energy Star' (for appliances and electronics), the 'EcoLogo' and 'Green Seal' (for cleaning products), and the 'Forestry Stewardship Council' (for wood and paper products), and so on.
- Follow the money. Some businesses make private donations to groups or interests that don't square with their public statements. Examples include companies that claim to be doing everything possible to lessen waste and pollutants, but are secretly funding lawsuits, legislation, and other measures to prevent them from having to do so.
- Test for international consistency. To determine if a company is truly turning green, see if it operates under different standards in different countries that have little or no regulation.
- Examine how the company handles its critics. Some companies will try almost anything to silence their critics. Tactics range from spouting legal threats to collaborating with police and military forces. Obviously, such practices are not a good indicator of environmental compliance.²

For additional suggestions on how green-washing campaigns can be spotted, visit: **www.greenwashingindex.com**.

Short-Term Gains, Long-Term Pain

With an increasing number of consumers and consumer groups on the lookout for disingenuous companies and their green washing campaigns, it's becoming more difficult to get away with making deliberately false claims in order to obtain a short-term influx of revenue. For example, in July of 2007, Royal Dutch Shell was ordered by French authorities to withdraw several costly advertisements that showed flowers coming out of smokestacks. Woolworths in Australia was publicly named and shamed in August that same year for selling toilet paper that carried fake sustainable forest fiber labels. Other companies have had fines and/or experienced drops in sales for similar unethical or illegal behaviors. For example, MacMillan Bloedel, one of Canada's largest forest-product companies, was labeled a serial forest-clearer and a chronic chlorine user by environmental activists and subsequently lost 5% of its sales almost overnight when it was dropped as a UK supplier by Scott Paper and Kimberley Clark.⁴ Simply put, neither Scott Paper nor Kimberley Clark wanted the negative publicity.

The Bottom Line

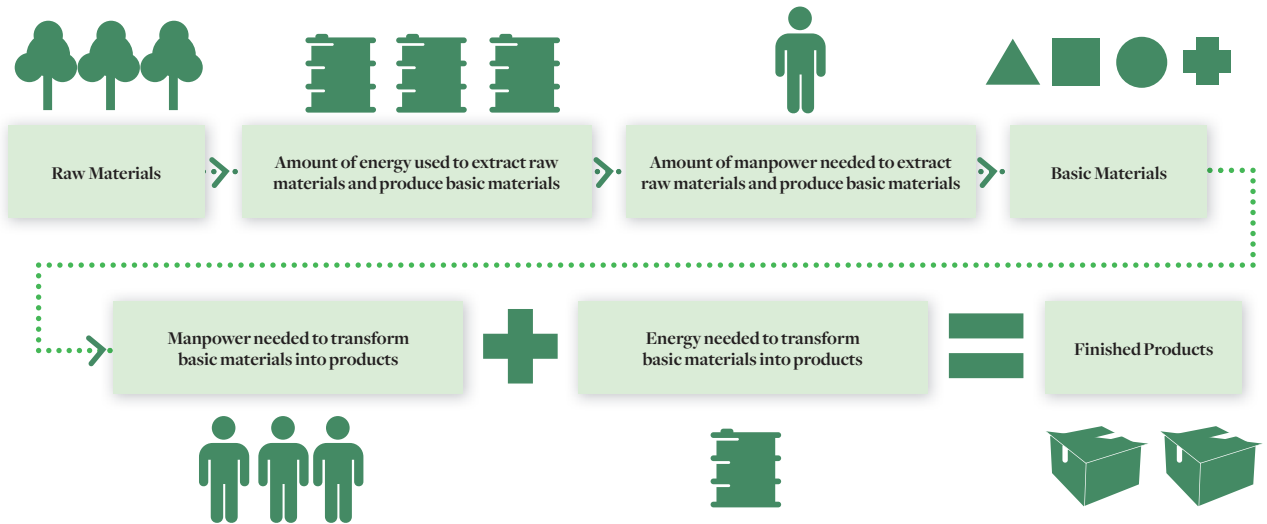
Companies that greenwash not only weaken brand image and invite further scrutiny, they also diminish the concept of becoming greener, which is something that doesn't rest easy with companies that make the effort. Recently, the American Federal Trade Commission called for a special meeting dedicated to the update of environmental guidelines, which will make green washing more of a bad idea. The European Union is even more vociferous. Simply put, short-term duplicity designed to fool customers and the public only leads to long-term pain. All it takes is one dishonest practice to be exposed in the media or on the Internet and in a flash, weeks, months, or perhaps even years of costly consumer retribution may have to be dealt with.

PROCESSES

A process is defined as: (1) a series of progressive, interrelated steps or actions from which an end result is attained, or, (2) a prescribed procedure or a method of conducting affairs. Either way, processes form the belief systems, philosophies, or thought patterns that constitute the work environments in which goods and services are manufactured (seen from this angle, a business process can also be referred to as a 'business model' or 'the way we do things around here'). Most practitioners agree that for any business process to function properly, total commitment from all involved is mandatory. Success is also reliant upon a perfect fit between the process, its product, and the business's customers.

8. Service and the Performance Economy

Figure 8.1
Energy and manpower ratios in production



As far back as 1973, several far-sighted individuals working for the European Commission made two important observations: (1) oil prices are going to continue to increase due to demand, and, (2) no matter how many jobs are created in the coming years they will not be enough to satisfy the continent's growing population. Not knowing the solutions to these challenges, the EC asked Walter Stahel, a Swiss architect working out of Geneva, to examine the relationship between energy use and manpower in production. Sometime earlier, Stahel had discovered that roughly three-quarters of all industrial energy consumption is associated with the extraction and/or production of basic materials. The remaining one-quarter, he observed, is used in the transformation of materials into finished goods or buildings. Conversely, he noticed that the opposite is true of labor. About three times the manpower is used to convert basic materials into finished products (or buildings) than is required in the extraction and production of basic raw materials (see FIGURE 8-1).

Being an architect, Stahel used this information to conclude that it's less wasteful and more cost effective to remodel old buildings than construct new ones. In other words, extending the life of a building draws out the value of the labor and energy that went into it (i.e.: increasing the use of a building to twice its intended life means that the original costs of its materials and energy are halved and the cost and subsequent waste of constructing a new structure are avoided). Perhaps not surprisingly, Stahel noted that his life-extension principle applies to most products as well. Put another way, it's less wasteful and more cost effective to reuse, repair, remanufacture, and recycle existing products than to manufacture new ones from virgin raw materials.

Look carefully at this revelation because it reveals that in the first stage of many

manufacturing processes more money is usually spent on energy than labor when it could be the other way around. In other words, by extending the life of the materials that go into a product or extending the life of the product itself - less energy is used, less waste and pollution is created, and more people are employed – with no long-term increase in costs. Indeed, manufacturing costs tend to decrease with product life-extension practices.

To expand and build upon his discovery, Stahel and a colleague (Orio Giarini) founded the Geneva, Switzerland-based Product-Life Institute (www.product-life.org) to research and promote what they call a service economy (also known as a lake economy or a functional economy) with the idea that goods and materials should be used as long and as often as possible to promote a healthy, sustainable economy.

The opposite of a service or lake economy is a river economy in which raw materials continuously flow along an insatiable manufacturing stream and end up as landfill. In other words, the raw materials, manpower, and energy used to create river-economy products are used for a short period of time and then thrown away.

For the most part, there are two ways a more efficient 'lake economy' or 'service economy' can be created. The first is to reuse, repair, or remanufacture products (including buildings), which facilitates job creation, and ultimately recycle materials and molecules. The second is to optimise the performance a product provides by converting the product into a service so as to keep its materials in the hands of the manufacturer for as long as possible.

Benefit Perception and Service

Most people, when they purchase a product, are not interested in owning the product per say. Instead, they're seeking the benefit the product delivers. For example, when an airline passenger purchases a ticket, he or she seeks the benefit of traveling from one place to another; no one expects to purchase part of the plane. This line of thinking can be adapted to other situations as well. For example, when consumers buy home heating oil most of them don't want to own a dirty, toxic, and expensive fossil fuel. Instead, they want the heat the oil provides - not the substance itself and certainly not the expense or the involvement of delivering, containing, and burning the oil.

Now let's add service to the equation. Personalised service not only keeps customers coming back, it can also help a business keep track of the benefits its customers seek. Studies have shown that a business can lose 20% of its customers if its products are of poor quality, yet 66% can be lost if the service itself is perceived as being poor. Additional statistics claim that it costs five to ten times more to attract new customers than it does to retain old ones – and that the average company can lose half its customers every four years if it's not careful.

Putting Benefit Perception and Service Together

Safechem, a division of Dow Chemical, is a solvent distribution company that incorporates benefit perception and service into a portfolio range offered to general industries across Europe.¹ These services include waste collection and refinement, parts washing, oil collection, and chemical recovery and disposal. In short, Safechem is a service company. Its customers do not have to purchase the solvents they need to conduct their operations nor do they have to pay for

costly application equipment or high disposal fees. Instead, Safechem focuses on the benefits its customers seek by traveling to the place where its customers work and applying any needed solvents for them. Afterwards, Safechem cleans up the work site, transports the used solvents back to the Safechem workshop, and cleans and/or recycles everything that was used - including the solvents, the washers, the spray guns, and the steel drums - in preparation for its next customer. By selling 'square meters of cleaning' rather than gallons of solvents, Safechem: (1) extends the life of its materials, (2) focuses on the benefits customers seek, and, (3) reduces waste and costs by reusing its materials instead of making (or buying) more. Clean Harbors Environmental Services in North America offers its customers similar services.²

The Payoff for Customers

Why would a customer want to choose a service (or the benefit a product provides) over a product itself? The incentives include:

- only having to pay for what is actually needed,
- the avoidance of major equipment purchases and subsequent maintenance costs,
- the elimination of end-of-life equipment and waste disposal costs, and,
- a reduction or elimination of inventory.

The Payoff for the Service Provider

In 2004, the Austrian government commissioned two studies that looked into the potential profitability that chemical companies have in regards to offering a service rather than selling a physical product. Both studies concluded that over half of the 4,000 chemical companies in Austria would benefit by adopting a service programme. Moreover, because of the efficiency inherent in a service system, it was estimated that chemical consumption in Austria could be cut by a third and the average company could expect cost savings equivalent to over \$12,000 per year.³ Bear in mind that although the chemical industry is being used extensively as an example in this chapter, chemical companies are not the only businesses that can benefit from a product-to-service arrangement. Similar schemes have been devised for home washing machines (the customer only pays for the number of washes), computers, cars and refrigerators – almost any product that is traditionally bought, used, and thrown away.

The Michelin tyre company, for example, has moved into selling the performance of truck tyres rather than just tyres, because it can produce a long-life tyre that's easy to re-tread, thereby earning a higher profit. If a re-treadable tyre sold as a performance service can travel twice the distance (e.g.: the distance the tyre can travel is sold rather than the tyre itself – with the tyre remaining under the control of the company) the company earns more money whereas if it produces and sells a longer-distance tyre, the buyer would probably not pay the higher price involved (to pay for R&D and disposal costs) and company turnover would decrease.

The hotel industry has benefitted from a similar practice for years thanks to linen suppliers that provide a service rather than sell a product. Many hotels do not own their linens (sheets, towels, etc). Instead, these items belong to a textile company that does the washing and repair with an average economic break-even point of around three years per item. In other words, the linens have to last at least three years before the company can make a profit so the company is

driven to lease high quality textiles that last longer. A similar example, called pay by the hour, is found in the gas turbine industry. Once again, the benefits enjoyed by the service provider include:

- control over the maintenance of the product and its equipment, which translates into long product life,
- the lowering of unit production costs because not as many units have to be produced (which reduces material and energy consumption),
- wastage is reduced to very low levels because money saved in waste reduction means lower costs and more profit for the provider,
- revenues either increase or are solidified because services are usually needed by customers continuously throughout the year, whereas equipment purchases, particularly big-ticket items, are often only made during times when customers can afford them,
- a new dimension is added to the service provider's product portfolio package, which can provide a much needed boost in company competitiveness,
- skilled jobs are created (workers not needed on production lines can be trained as service appliers),
- overall waste is reduced because the product itself is no longer moving as quickly toward landfill.

The Hurdles

Obviously, turning a product into a service is not a one-size-fits-all concept nor is it a practice that can be adopted overnight. The standards, operations, and procedures of the service provider must be adapted to work hand-in-glove with those of the service buyer to avoid dysfunctional conflict. Agreeing on a service fee is another formidable task that requires a full understanding of all operations and their costs. Additional service challenges exist in changing outdated behaviors and old ways of thinking; both the service-provider and the customer may find it difficult to overcome institutional and personal stubbornness. Customers, for example, must break the habit of what Jonathan Chapman, senior lecturer at the University of Brighton (UK), calls 'adulterous consumption'. Chapman compares the possessions that consumers purchase with the idea of adultery. 'We make a commitment to one thing and then become distracted by a younger model,' he says, '(because nowadays) everything is temporary if we want it to be.'¹⁴ What Chapman is referring to is the human desire to own the products that we use – even though this attachment often vanishes when a newer version becomes available. This throwaway-and-buy-another addiction is difficult to stop not least of which because many businesses profit from, and promote, it. Indeed, the entire concept of 'Industrial design was specifically invented to convince people that their washing machine, their car, or the refrigerator they had was out of fashion,' says Walter Stahel.

When one takes into account the low prices of everyday durable goods the concept of turning a product into a service can become even more difficult to implement. 'You can't find anybody who will work on a microwave oven now,' laments Steve Cruciani, owner and operator of Steve's Appliance Installations in Berkeley, California. 'What's the point? For \$65 you can get another one.'¹⁵

But the main reason why service concepts are of little interest to so many businesses (particularly small to mid-sized businesses) is the initial costs that can incur. Without a minimal density of goods on offer, “servicising” products (that is, reverse logistics: collecting, taking apart, and remanufacturing used products) can be difficult and expensive. Selling a product outright avoids such problems because it delegates disposal responsibilities to the buyer. Even big companies can be turned off by turning a product into a service not least because it requires a uniquely different mindset. Large production-oriented businesses, for example, traditionally invest more in capital expenditures because they are geared toward a production setup intent on making as many products as possible. Service businesses, on the other hand, tend to invest more in research and development. A service setup can therefore pose difficulties in terms of resource allocation to an organisation that wishes to do both. More to the point, becoming service-based requires long-term thinking and commitment, which goes against the short-term production strategy of many companies.⁶

Lastly, although a service-oriented selling system is applicable to more products than most manufacturing-oriented businesses would admit, sometimes turning a product into a service does not make sense. For example, a hardware store that sells drills may find it difficult to market and sell a hole-drilling service because the less expensive a drill is to buy, the more impractical and obsolete a hole-drilling service becomes. Moreover, a hole-drilling service may not be available when it's needed - or customers may want to drill holes on their own and conclude that owning a drill and having it on hand is more cost effective than paying for a service. In these situations, equipment rentals can handle short-term customer requirements. In the long-term, however, an alternative is needed that maximises the benefits that servicising provides while avoiding the perceived stigma of non-ownership. And that, say several service advocates, can be found in leasing.

9. Leasing and the Performance Economy

After formulating his 'energy versus manpower' production ratio, industry analyst Walter Stahel coined the phrase 'cradle to cradle' to help explain his notion of a closed-loop 'lake economy'. According to Stahel, in an ideal cradle-to-cradle (or closed-loop) system, waste would not exist because waste would be seen as an asset in transition and be used as a raw material. In other words, when a well-designed product reaches the end of its useful life it would be returned to its manufacturer to be reused, repaired, or remanufactured to facilitate job creation and reduce waste. Today, many researchers credit the Xerox Corporation with pioneering cradle-to-cradle practices in the 1980s by leasing photocopiers instead of selling them. The idea was to provide the company with a reliable source of parts and materials that could be used in remanufacturing 'closed-loop' processes.

Elsewhere, the Collins & Aikman Floorcovering company (now part of the Tandus Group) is widely considered to be the first business in the carpet industry to take the closed-loop plunge by collecting and breaking down old carpets into material for new carpets. Much to the company's surprise, making carpet backing from re-processed carpet waste not only proved to be much cheaper than that made from virgin raw materials, the end product also turned out to be more stable and softer. This pivotal discovery reduced the company's raw material costs, resulted in a new and inspiring company motto ('Mining buildings rather than resources') and allowed Collins & Aikman to enjoy double-digit growth in both revenues and profits when the entire carpet industry was growing at about 4% a year.¹

With old carpets proving to be a superior raw material source, it wasn't long before another multinational carpet maker, Interface, got in on the act. Interface makes 40% of all the carpet tiles sold on earth, has manufacturing centers in 33 global locations, and sells carpets in 110 countries on six continents. This activity consumes a lot of raw materials and produces a lot of waste. Since most carpet-manufacturing processes require about one kilogram of fossil fuel to make almost half a kilogram of carpet material, and because carpets can take up to 20,000 years or more to decompose, the head of Interface, Ray Anderson, decided that it would be in the best interests of his company to become not only sustainable, but restorative (i.e.: to put back into the environment what his company uses).

According to Interface, color, texture, comfort underfoot, acoustics, cleanliness, ambience, and functionality are the reasons why most people wish to have a carpet. Since it's not necessary to own a carpet to obtain these benefits, Interface looked into how it could retain ownership of its products and the value of the materials, labor, and energy that went into making them. To achieve this goal, Interface developed what it calls an 'Ever Green Lease' in which the company focuses on leasing what a carpet is supposed to deliver rather than selling the carpet itself. Turning a product into a service demands a close relationship with customers in order to discover what they want in terms of service - and the company needed to establish a steady supply of recyclable raw materials to make its leasing concept feasible - so employees at Interface realised they had to do some work. Through in-depth research, they discovered that most carpet wear occurs in heavily trafficked zones leaving areas around furniture and walls virtually untouched. This is good news for customers because it means that when a leased carpet begins to show wear, Interface will come in, pull up the worn areas, and immediately replace them (a service that is part of the lease arrangement). Customers are thereby relieved of

the expense of purchasing a new wall-to-wall carpet as well as the time and bother of shutting down an entire work area while a new carpet is installed. Moreover, the customer is not responsible for the costs of disposing the old carpeting because Interface takes it back to its factory and uses it to make new carpets. Further cost reductions for Interface and its customers have come about as the company substitutes oil-based carpet fiber materials with more environmentally friendly fibers that use less materials (and energy) and create less production waste.²

Although Interface admits that customers balk at the misperceived notion that leasing a carpet is more expensive (the company insists it isn't), the payoff from its other improvements have been enormous. By changing from a carpet selling business to one that more resembles asset management and reclamation, Interface, which claims to be halfway to achieving its sustainability goals, nearly doubled company employment, doubled its profits and increased its stock price 550% over a five year period.³

Not to be outdone, DuPont has developed a similar carpet leasing programme to enhance its carpet manufacturing arm. DuPont's leasing service includes free consultations, quick installation that minimises business disruption, professional cleaning, and on-the-spot spill and stain removal. Furthermore, because DuPont runs several different manufacturing operations, fibers from its carpet reclamation process can also be used to manufacture auto parts and sound insulation products.⁴

It's Not Just Photocopiers and Carpets

Electronic equipment, paint, cars, wood pallets, reusable totes, furniture, rags and linens, parts washers, almost anything – including temperature - can be leased. The Carrier air conditioning company in the USA, for example, leases cooling services to its clients rather than air conditioners.² As with any leasing arrangement, ownership of Carrier's air conditioning equipment is maintained by the company, which means that Carrier is highly motivated to keep its products in optimum condition. This means they last longer (which reduces costs). Carrier is further driven to ensure that the building where it administers its cooling service is energy efficient because the more efficient the building the better and more cost-effective its product will be, which translates into higher profits for Carrier. Customers love the arrangement because Carrier's commitment to increasing efficiency, reducing waste, and lowering costs ultimately means lower all-around heating and cooling prices for consumers.

In a similar fashion, the Bank of Japan collaborated with Japanese power companies to facilitate the leasing of energy-efficient automobiles, home appliances, and water heaters to everyday consumers. The aim is to encourage and promote the development of energy-efficient appliances while reducing the nation's energy requirements, carbon emissions, and waste. Appliances that aren't efficient are not allowed into the programme, which encourages the manufacturers of wasteful products (who want to be included in the programme) to make their products more sustainable.

Does Leasing Always Close the Manufacturing Loop?

Unfortunately, no. Sometimes a customer will purchase a leased product at the end of the

lease term and never return it to the manufacturer. Similarly, after a transfer of ownership, the customer may sell the leased product on the second-hand market. Both of these practices can break the closed-loop cycle needed for leasing to provide its benefits. Additional problems include the fact that some products - such as inexpensive goods and short-lived consumables - are not seen as compatible with leasing. In this regard, products may need months or perhaps years of redesigning or rethinking before leasing can become a profitable.

Conclusions

Leasing is a long-term profit strategy that demands long-term thinking. Customer needs and desires must be ascertained, insurance and liability issues must be addressed, employee training must be ongoing, and an incentive must be provided for customers to return leased products to the lessor after use. When these issues are ignored, the demands of EPR legislation (Extended Producer Responsibility), which requires manufacturers to take back their products (including packaging) after use or face legal consequences, can be more difficult to achieve. With careful forethought and planning, however, and under the right circumstances, leasing has proven to be a good way for companies to move closer to sustainability while lowering production costs, increasing revenues, and decreasing waste.

10. Cooperative Networking

In Scotland, a construction business asks for (and receives) the ash waste from a nearby coal-fired electric plant, which it uses to manufacture building materials. In Australia, a building designer teams with a rival architectural firm, a renewable energy supply business and a construction company to create affordable, energy efficient homes. In the United States, a business that produces merchandise from wood enters into talks with a plastics injection firm to discuss recyclable packaging ideas. Further north, a consortium of northeastern and mid-Atlantic states create a cap-and-trade programme to curb carbon emissions. What in the world is going on?

Cooperating Businesses

Anyone who thinks sustainability is about being independent could not be more wrong. With increasing frequency, businesses (and governments) are discovering that by working together with carefully chosen partners each can accomplish what was impossible for just one on its own. This is particularly true with small businesses that need help with large-scale projects or those that lack the funding to take on more sustainable activities. The term used to describe this is cooperative networking.

The notion of working together to achieve a common goal has been around for thousands of years and is similar to cooperatives, co-ops, or collectives, in that a group of individual entities join together to undertake an activity for the mutual benefit of all. One or more businesses can combine forces with either a competitor or a seemingly unrelated business (or both) to work together on a temporary or permanent basis. Not long ago, I conducted a survey in 14 countries which revealed that 42% of the small business operators questioned had at one time or another joined with other businesses (including competitors) in order to maximise profits. 7% of those who had not said they would like to do so in the near future.¹

For the most part, the reason for joining a co-operative network is because going it alone requires considerable cost, effort and risk - all of which can be reduced when others get involved. In practice, the number of businesses co-operating together can range from two to over 100. Common goals include:

- joint purchasing projects (purchasing materials in bulk as well as purchasing capital-intensive machinery, tools, production facilities, and/or solar panels and wind turbines),
- sharing resources and skills (sharing equipment or facilities, or pooling information, expertise, or systems),
- identifying and researching market opportunities (finding and tapping into customer bases previously not considered or combining one or more products or services with those of another business),
- banding together to ask suppliers to produce sustainable or eco-friendly products and materials,
- combining marketing resources and expertise (promoting the services and products of cooperative partners in advertising schemes, trade shows, and promotional schemes),

- combining logistics and operations (offering coordinated deliveries, designing new products, services or event packages, improving production capacity by sharing production lines, and so on), and,
- creating reuse or recycling programmes (e.g.: pooling waste to collect enough to make recycling feasible) and/or using the waste or discharge from one business as a raw material in another.¹

Getting Over the Hurdle

The notion of cooperative networking often becomes more palatable once it's understood that cooperating is not about giving away trade secrets or merging with another business. Rather, it's about working with others in a complimentary fashion. The idea is to enhance the competitiveness of members, reduce costs, create new capital bases, increase advantages of scale, scope, and speed, and open up new markets. For example, the Recycled Products Purchasing Cooperative operating out of Encinitas, California works to promote the use of recycled paper in both the public and private sectors by running a purchasing cooperative that offers members information on services, prices, shipping, and the cost benefits of reusing paper waste.

As with most 'new' business practices, joining a cooperative network requires a different way of thinking – one that debunks the traditional go-it-alone business mind-set, which dictates that every company must supply its own research, product design, marketing, office support, supply routes, financial functions, production processes, and management. For example, many agricultural producers have discovered that by working together they can purchase and share expensive planting and harvesting equipment, decide which crops should be farmed, work to reduce water usage, and even set a fixed price for wholesalers. This prevents having to needlessly compete against other growers. It also lowers costs, decreases risk in the marketplace, and ensures a fair outcome for each participant. The reported success and stability of cooperative networks, however, is perhaps the most enticing factor to those that join. Although cooperative networks are not infallible, businesses that cooperate are more apt to satisfy social and entrepreneurial objectives, avoid ethical and legal lapses, and, in general, be more economically vigorous and competitive, especially against larger rivals.²

What Type of Businesses Prosper Most?

The foremost indicator of a successful business network is a common purpose. For example, the Tokyo Metropolitan Government's 'Municipal Environmental Protection Ordinance' in Japan developed a series of cooperative networks one of which involves a shared delivery system enjoyed by 15 different retail companies. By consolidating deliveries to the 30 stores owned by the 15 companies, the network reduced the amount of delivery vehicles on Tokyo's roads by 50%, which eased traffic congestion and reduced carbon emissions by 4,000 tons per year.

Getting Started

How do networks begin? Two methods seem to dominate. The first method uses a third party such as a business development centre or a chamber of commerce to bring different entities together and propose working in unison. The Chamber of Commerce in Henrietta, New York, for example, initiated an education and assistance programme with the Audubon

International Sustainable Communities Programme to help foster energy and waste reduction programmes between local government, business, and the community. The San Francisco Bay Area Green Business Programme offers similar networking support.

The second approach to the creation of a network is more personal and involves the introduction of two or more like-minded businesspeople at a social gathering or a personal agreement between long-term acquaintances. Either way, the ingredients for a successful cooperating network revolve around mutual interests (and trust) combined with a can-do attitude.

Advantages and Disadvantages of Business Networks

Of course, not every cooperative network is filled with sunshine and smiles. As with any group endeavour, cooperative networks are susceptible to people problems. For example, a network can collapse when a key player leaves or if members grow too like-minded and become immune to new ideas and new ways of thinking. Similarly, networks can contain some participants who take more than they give or there might be a general falling out between individuals that results in the taking of sides. Claims have also surfaced, which state that business networks can take a great deal of time to make decisions.

Supporters counter these arguments by insisting that it is easy to dismiss unproductive or disruptive participants and that the more brains that are brought to the table for the purpose of making a decision the better the resolution. Moreover, proponents of co-operative networking say that once decisions are made they are often carried out quicker and with more enthusiasm than those made in big corporations. This is because commitments and involvement tend to be stronger when they come from people who share a mutual interest and reach an agreement together. By most accounts it appears that cooperative business networks operate under much the same principles, and therefore need the same forms of maintenance, as those required by teams. Additional advantages include:

- The establishment of improved communication pathways (if communication pathways are nurtured and encouraged).
- Increased human development and innovation (from the sharing of skills and experiences).
- Better long-range planning and experimentation due to the spreading of financial risk.
- The satisfying of social needs (i.e.: cooperating business owners and managers do not feel alone).
- An increased feeling of openness and learning, which is fostered by a genuine interest in what other members have to offer.
- Strength in numbers.
- Increased feedback from customers, employees, and participants (usually because cooperating partners demand it).
- Improved problem solving due to in-depth discussion and implementation – particularly when it comes to servicing niche or specialised markets.

- Improved motivation (ample research shows that close personal business ties heighten empathy and increase altruistic behaviour³).

The Rules of Cooperative Business Networking

Most cooperative business networks rely heavily on relationship building. In other words, the same elements that create and foster human relationships (honesty, communication, straight forwardness, integrity, wisdom, honour, etc...) appear to be no different from those needed to maintain successful business relationships. Unfortunately, with marital divorce rates as high as 50% (or more) around the world, many people seem to be in the dark when it comes to relationship building. Perhaps the expectation is that a good relationship can unfold on its own with no real effort from the parties involved. The following suggestions have been designed to help avoid problems:

1. Be prudent and careful as to whom you wish to do business with. Check the backgrounds of proposed partners and consult with others before shaking hands or signing on a dotted line.
2. Be a good partner. Instead of adopting a single-minded 'what's in it for me' attitude, balance the needs of your business against those of cooperating partners.
3. Be honest and sincere. Always try to exceed the expectations of your partners. Never inflate your business's abilities and never steal ideas or clients from cooperative partners.
4. Take the initiative. Rather than wait for partners to come to your aid, be the first to plan meetings, raise issues, tackle problems and introduce needs.
5. Stay committed. Enthusiasm, or the lack of it, is both contagious. Offer referrals and information on a regular basis. Such actions tend to ensure that partners reciprocate in kind.
6. Be reasonable. Co-operative business networks are professional relationships and should not be considered as friendships. Keep partners close yet still at 'arm's length'.
7. Before joining a long-term cooperative business venture test run the partnership by partaking in one or two short-term preliminary projects.

11. Lean Thinking

Lean thinking (also known as lean manufacturing) is a business philosophy that demands the total and systematic elimination of waste from every process, every department, and every aspect of an organisation. With lean thinking, waste is defined as the use or loss of any resource that does not lead directly to what it is that customers want – and what customers want, say the advocates of lean thinking, is value. Any act or process in a business that a customer would balk at paying – or any process or act that can be eliminated without the customer noticing the difference - is often interpreted as having no value in lean-thinking.

The Dell Computer Company provides a good example of a company that embraces the lean-thinking concept. Dell became a computer-manufacturing powerhouse by allowing customers to personalise their purchase before a sale was made. In other words, Dell produced its products after it received a customer order. Before it decided to branch out into retail markets, Dell had a paying customer for every product it sold. No expensive inventory of computers was stacked away in a warehouse awaiting transportation nor were any shop shelves filled with unsold products. Dell never got stuck with an unsold computer because only what its customers asked for was ever made. From the onset, one of Dell's major production expenses involved maintaining a supply of parts to manufacture its products, but since these parts are designed for use in a variety of configurations every single one is always used sooner or later. Along with a focus on made-to-order merchandise, this allowed the company to decrease its overheads and concentrate on client-oriented matters¹ – all of which are hallmarks of lean-thinking.

The Wasteful Practices Inherent in Businesses

According to the Cardiff Business School, only 5% of most business production operations are comprised of activities that directly relate to what customers want in a product or service.² This means that up to 95% of the activities in most businesses add no customer value at all.

Activities classified as 'non-value' can be split into two categories. The first, 'necessary, but non-value adding activities', constitutes as much as 35% of most organisational work and is comprised of actions that do not directly contribute to what customers want in a product (e.g.: payroll, behind the scenes cleaning, the fulfillment of government regulations, and so on...). The second category, 'non-value adding activities', can comprise up to 60% of work activities, yet these activities add no value to customers in any way, shape, or form (e.g.: production line snags, waiting periods, unnecessary paperwork, end-of-line quality inspections, etc). The aim of lean thinking is to find and eliminate the wasting of time, labor, materials, and money in both categories.

The Origins of Lean Thinking

Lean manufacturing goes back a long way. In 1926, Henry Ford was reported to have said that one of the greatest accomplishments in keeping the price of his automobiles low was the shortening of their production cycle. The longer a product takes to manufacture, and the more it's moved about, he said, the greater the cost.

After the Second World War, Eiji Toyoda (of the car company that bears his family's name) took Ford's words to heart. Toyoda visited American car manufacturers to learn about their production methods and returned to Japan intent on practicing what he had learned. With the

assistance of his colleagues, Taiichi Ohno and Shigeo Shingo, Toyoda spent years refining and continuously improving upon waste reduction. Eventually he hit upon the idea of trying to eliminate all the non-value tasks in his business for which customers were not willing to pay. Ohno in particular, became so good at eliminating waste while streamlining operations that the concepts and techniques he developed are now widely known as TPS (the Toyota Production System). Having witnessed American supermarket systems in the United States, Ohno came to realise that the scheduling of work should not be driven by production targets, but rather by sales. TPS concepts and techniques have since been reintroduced back into America under the umbrella of lean-thinking or lean-manufacturing.³ In service firms such as banks, restaurants, hospitals, and offices, lean-thinking concepts are referred to as 'lean enterprise'.

It is worth noting that in the mid-1990s Toyota more or less abandoned its model of focusing almost solely on solving customer issues and instead decided to embrace a common view in business (and business schools) that 'if you're not growing you're failing' and that being biggest is best. The subsequent strategy the company developed of borrowing huge amounts of money to become number one in production, thereby making itself vulnerable to steep declines in demand, is not the lean way.⁶ It has been said that Toyota is now returning to lean strategies.

Why Go Lean?

According to James Womack and Daniel Jones, authors of the book *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*⁴, the lean process is highly supportive of human dignity and begins by reassuring employees that no jobs will be lost. Once that fear has been eliminated companies have been known to enjoy 400% increases in production and 400% to 1,000% decreases in delays, inventories, accidents, defects, errors, and scrap. Womack and Jones go on to claim that if a business cannot: (1) quickly reduce its product development time by half, (2) cut its order processing time by 75%, and, (3) decrease production times by 90%, then the business is doing something wrong.

Why does Lean Thinking Elicit Strong Emotions?

Lean thinking contradicts a number of established production theories taught in business schools because it advocates making a shift from conventional 'batch and queue' production practices (i.e.: the mass production of large lots of a product based on anticipated demand) to a 'one-piece flow' system that produces products in a smooth, continuous stream based on customer demand.⁵ This means that customer wants must first be identified before manufacturing begins. Customer demand then 'pulls' a product or service through the manufacturing process rather than having the business push its mass-produced goods onto the market. Anything that does not contribute to the pull of customer demand is considered waste.

Typical Forms of Waste

Aichi Toyoda and his colleagues originally identified seven common forms of waste, but over time two more have been added. Today, the nine forms of waste that lean manufacturing seeks to reduce or eliminate are:

1. Over Production: which is defined as producing more information or product than a customer requires, or making the product or its components earlier than is required, or making it faster than required.
2. Waiting: the time spent waiting on materials or information.
3. Moving Items: needlessly shifting, storing, stacking, or filing materials and information, or needlessly moving people, materials, and/or information from one point to another.
4. Over-Processing: the time and effort spent processing information or material that does not add value to the product (e.g.: unnecessary paperwork or employees and managers seeking approvals).
5. Inventory: any and all materials or information awaiting processing.
6. Unnecessary Motion: any activity that does not add value to a product or service.
7. Defects: the unnecessary repairing, scrapping, or re-working of material or information.
8. Employee Resistance: the political posturing, stalling, or passive resistance taken by employees in the hope that 'this project will also soon pass'.
9. Under-utilising People: not involving all employees and not using everyone to their full potential.⁶

Starting the Journey

Lean thinking is based on five principles that must be thoroughly understood and agreed upon before work can begin. They are as follows:

1. Specify what the customer defines as value. Anything that does not add value from a customer perspective should be reduced or eliminated.
2. Draw up a value map. A value map is much like a process map with one distinct difference: a value map starts from the customer end and makes a clear distinction between value-added activities (transformational activities for which the customer is willing to pay) and non-value-added activities (activities that add cost without adding customer value).
3. Place all value-creating steps in a tight sequence so the product flows smoothly toward the customer. On the shop floor, this may involve moving machines and equipment into a tight assembly-line sequence to minimise material and product movements. An additional explanation of this stage is often explained via the '6-S' model below.
 - Sort – Determine exactly what employees need to create customer value (tools, equipment, supplies, materials, etc). Eliminate all other clutter. Tools, production equipment and information systems should be right-sized so they produce exactly what is needed - no more, no less.
 - Stabilise (or Set-in-Order) - Place tools, equipment, supplies, and materials in logical sequences where they are needed rather than in off-to-the-side areas (in lean-thinking terminology this is called Point-Of-Use-Storage or POUS). Employees must take part in ensuring that the design, selection, correction, and maintenance of every machine, tool, and process is accurate and ready to perform without interruption.
 - Shine – Inspect work areas and eliminate physical barriers so that everyone can see (literally) what is going on. This allows for further introspection and observation.

- Standardise – Reduce all variations, integrate processes, use standardised parts and materials where appropriate, establish uniform delivery schedules, make performance measures transparent, and empower each manufacturing unit so that it has the capability to produce exactly what is required without having to move along multiple work centers.
 - Safety – Develop and maintain a strict adherence to safety concerns, teachings, and practices.
 - Sustain – Enforce a continuous commitment to change with robust planning, regular inspections, much patience, trial-and error allowances, and a good reward and recognition programme.
4. As flow is introduced, let customers pull value from the next upstream activity. While wasteful activities are being reduced or eliminated, shift the business's efforts toward letting the customer determine production quantities. Remember, the point of lean-thinking is to create an enterprise that is responsive solely to providing what paying customers want, when they want it. No more, no less. This type of setup demands:
- the building and maintenance of strong relationships with customers and suppliers,
 - a streamlining of entire systems -- not just parts of the system,
 - the removal or re-assigning of anchor draggers (people or processes that slow down operations),
 - immediate results from everyone,
 - informing people that two steps forward and one step backward is okay; no steps forward is not okay,
 - the circulation of lean thinking strategies in every department and procedure,
 - the creation of a lean accounting system,
 - paying employees in relation to their performance, and,
 - asking suppliers and customers to also think lean.
5. Keep going. Just as with quality and efficiency, there is no finish line associated with lean-thinking. Never stop observing, analysing, questioning, and improving.^{1,3,5}

Ready to Begin?

Many experienced lean thinkers suggest kick-starting the lean process via the following:

1. Find a leader who is willing to take responsibility for the lean transformation.
2. Research lean-thinking practices and inform everyone about them (i.e.: initiate a training programme).
3. Find a change agent (a wasteful practice or a bottle-neck area) or locate (or create) a crisis for which action must be taken, or select a pilot project and run it for a few months during which time you can evaluate, review, and learn from, your mistakes.
4. Involve others and begin making changes as soon as possible. Don't procrastinate and don't waste time establishing any grand plans. Just do it.

The Role of the Manager

According to lean-thinking advocate Jim Womack, the manager's role in lean thinking is to eagerly embrace the role of problem solver. This means visiting actual situations, asking about performance issues, seeking out root causes, and showing respect for lower-level managers (as well as colleagues) by asking hard questions until good answers emerge. Most importantly, the lean manager realises that no manager at a higher level can or should solve a problem at a lower level (Womack calls this one of the worst abuses of lean). Instead, the role of the higher level manager is to help the lower-level manager tackle the problem through delegation and dialogue by incorporating everyone involved with the problem. The lean law of life is that problems can only be solved where they exist, in conversation with the people whose actions are contributing to the problem (which requires support, encouragement, and relentless pressure from the higher lean manager). The lean manager also realises that all problem solving is about experimentation by means of plan-do-check with the expectation that mistakes do happen and that experiments yield valuable learning that can be applied to the next round of experiments. Lastly, the lean manager knows that no problem is solved forever. New things generally introduce more problems - which is necessary to enable probing minds to continue the perfection process.

Lean Thinking Weaknesses

Despite much positive press, lean-thinking has inherent weaknesses (both physical and behavioural) that must be prepared for. The good news, advocates say, is that these weaknesses can be avoided if addressed in advance.

Physical weaknesses include making lean changes in production when:

- The design of the product or service is not ideal,
- The product or service is not economical,
- Customers are not satisfied with the current design of the product, and,
- The product's configuration does not fulfill the functional requirements of the market or the consumer.

Behavioral weaknesses include:

- Management does not support and nourish change,
- Measurement is not taking place,
- Lean thinking methodology is seen or addressed as a tertiary or secondary issue,
- Managers and employees are not rewarded for the improvements they make, and,
- The values of the business are not in sync with lean-thinking concepts (Nave, 2002).⁷

Lean-Thinking Summarised into Ten Concise Steps

1. Eliminate waste.
2. Minimise inventory.
3. Maximise flow (streamline processes).
4. Determine and meet customer requirements.
5. Pull production from customer demand.
6. Do everything right the first time.
7. Empower workers.
8. Allow for changes to be made rapidly.
9. Partner with suppliers.
10. Create a culture of continuous improvement (AHRQ, 2007).⁸

For more information about lean thinking visit the Lean Thinking Institute at: www.lean.org.
The international arm of the Lean Thinking Institute is located at: www.leanglobal.org.

PEOPLE

Sustainability is not a technological issue. At its core it is a behavioural issue and as such it is dependent upon teamwork, co-operation and motivation. For sustainable practices to take root and produce results, every employee - whether he or she is a cleaner, a production line worker, or an administrator - must contribute to the process (even paying customers). No matter what level or experience a person has, everyone has the potential to discover a sustainable path that has been overlooked. Just as important, any employee has the ability to add that final jolt of effort that avoids failure and promotes success. Understanding the importance of people in all phases of the sustainability process is necessary to ensure that a thorough and combined effort on all fronts is made

Simply put, people are a business's ultimate competitive advantage.

12. Understanding The Importance of Customers

To understand how important customers are to sustainability, it is first necessary to define the word 'customer'. In business, a customer is everyone that an organisation serves. Look carefully at this definition because it includes everyone involved in the business - not just the folks whose money is taken in exchange for a product or service, but also the people who serve these individuals. Customer transactions are a two-way exchange. Every paying customer wants something from the business that has a product or service that is wanted and the business wants something from paying customers in return (money). Similarly, every employee wants something from the business he or she serves (wages, training, respect) and every business wants something back from its employees (skill, labour, loyalty, honesty). This two-way, give-and-take service scenario allows the word 'customer' to be classified into two categories:

- External Customers: the people that exchange money for a product or service, and,
- Internal Customers: the individuals that are employed by, that use, or who rely on the work of others within an organisation to perform responsibly (including employees, suppliers, contractors, shareholders, the community where the business is located, and other stakeholders).

Back to Basics: The Ten Commandments of Business Success

One of the better ways to understand the importance of customers is the '10 Customer Commandments' list, which can be traced back to Mahatma Gandhi. He reportedly taught them to his law clerks. Think of each in relation to internal and external customers and two-way service:

1. Customers are the most important people in our business
2. Customers are not dependent on us – we are dependent on them
3. Customers are not to argue or match wits with
4. Customers brings us their needs – it is our job to fill those needs
5. Customers are not an interruption of work – they are the purpose of it
6. Customers do us a favor when they call – we do not do them a favor by serving them
7. Customers are part of our business – they are not outsiders
8. Customers deserve the most courteous and attentive treatment we can give them
9. Customers are the individuals who make it possible to pay our wages
10. Customers are the lifeblood of this and every other business

Going Green and People

Although being more environmentally friendly is an admirable way to conduct business, as we have seen 'going green' represents only one component of the overall sustainability picture. That being said, the value of 'green' markets is estimated to be worth around \$600 billion.¹ Wal-Mart began introducing green versions of several of its products several years ago to test this market and gauge customer reactions. The conclusion? Consumers are indeed 'embracing products that help the environment'.² Note that this does not mean that going green is a guaranteed ride to success. Early findings suggest that the following issues should be addressed:³

- Keep prices down. Extra costs associated with going green (if there are any) can usually be offset by making production processes more efficient and sustainable – which means reducing the expenses associated with toxic or hazardous production processes (e.g.: specialised transport requirements, health and safety costs, specialised equipment needs, and expensive waste disposal bills).
- Focus on quality. Many successful green business practitioners suggest that the overall quality of a green product should be improved before announcing its virtues. In other words, improve the reasons why customers purchase the product rather than hoping that ‘greening’ it will make it more appealing.
- Incorporate new green products into a traditional product line. By adding a green alternative alongside traditional product lines it becomes easier to enter the green market, learn the needs of consumers, overcome mistakes, and gather information and ideas for further improvements.
- Make small changes first. Many consumers still believe that environmentally safe products don’t work as well as conventional products. This is largely a legacy of the 1970s when such charges were usually true. To offset this hangover, some organisations advocate being modest when announcing greenness and to refrain from announcing any green intentions until after an improvement in quality has been detected by consumers.
- Be upbeat. Avoid doom-and-gloom messages in green product advertising. Most consumers are turned off by negative messages and, as rule, respond better to positive messages.
- Seek out a bona fide green accreditation. More government agencies, consumer organisations, and environmental groups are issuing certifications to bolster the credentials of green products.
- Green the place where your product is sold. Minimising waste not only reduces costs, it also leads to increased sales. For example, a small grocery business in California named Vic’s Market cut its annual energy bills by \$48,000 (and its carbon emissions) after adopting basic efficiency practices. An added bonus was an increase in sales due to brighter, energy efficient lighting and the covering of food freezers with glass doors, which made interior temperatures more comfortable. As a result, customers shopped longer. Elsewhere, retail giant Wal-Mart fitted half of one of its stores in Lawrence, Kansas with energy efficient skylights and the other half with fluorescent lights – then watched with astonishment as sales rose substantially on the naturally lit side.⁴

Jobs, Sustainability and People

Job security and job creation undoubtedly fare better when businesses cut unnecessary costs and make money. Obviously, no one wants to work for a company that is going to give them a pink slip through no fault of their own, but is job security sustainable – particularly during a recession? Laying-off workers is a time-honoured practice undertaken by many companies to survive difficult times, but the bottom line is that making workers redundant costs money. A study conducted by Bain & Company (featured in the April 2002 issue of the Harvard Business Review) concluded that when a job is refilled within six to eighteen months of a lay-off the

business loses money on the deal⁷ (see also, 'Lay Off the Layoff's by Stanford University professor Jeffrey Pfeffer, Newsweek, Feb 5, 2010) Expenses include severance package costs, declines in productivity and quality, rehiring and retraining costs, and poor morale suffered by those left behind. Fortunately, there are better, more sustainable ways to treat people and get the most out of them in the bargain. For example, nine companies recently featured in Fortune magazine's '100 Best Companies to Work For' list (2009) have never laid-off an employee - ever.⁶ These companies - and their strategies - include:

- Publix Super Markets. A strong balance sheet with no debt helped the Publix grocery chain acquire 49 stores and hire over 1,250 people in 2008. In its 79 years, Publix has never laid-off a single employee – mostly because every employee owns a stake in the company.
- The Container Store, a storage retailer based in Coppell, Texas, froze salaries and watched its spending during 2008 to avoid layoffs. This strategy enabled it to expand operations in the midst of the recession by opening four stores and adding 70 employees to its roster.
- Aflac, based in Columbus, Georgia (USA), sells supplement insurance. Suggestions from employees that keep the business going (and save it millions of dollars) include telecommuting and flexible schedules. In return for their input, employees receive benefits that include onsite gym memberships, childcare programmemes and job security.
- Nugget Market in Woodland, California avoids layoffs with careful job placement and shrewd labour management. Instead of handing out redundancy notices during hard times, the 81-year-old grocery store refrains from replacing employees who leave. Since its worksites are fairly close to one another, employees are trained to perform many different duties, which makes temporarily vacant positions easy to fill. In 2009, despite a worldwide recession, the company filled 173 jobs, a 22% increase in job growth that year.
- Southwest Airlines, the only American airline that has never had an involuntary layoff in its 40 year history, is now the country's largest domestic airline with a market capitalization bigger than all its domestic competitors combined. 'If people are (a company's) most important asset,' says the airline's former head of human resources, 'why would you get rid of them?'

As these examples show, engaging employees to find ways to cut costs and increase profits (instead of throwing them overboard when difficulties arise) can be both winning and sustainable.

Work Environments, Sustainability and People

Over the past 10,000 years, sunlight, fresh air, and natural settings have greatly influenced human evolution; so it should come as no surprise that artificial settings - combined with industrial noise - have been shown to adversely affect human productivity and performance. For example, studies show that workers labouring in windowless factories experience more headaches, faintness, and sickness compared with workers who toil under natural light. Additional studies have revealed that prolonged exposure to artificial light decreases antibody activity, increases infections and colds, and results in depression.⁸ Creating workplaces that reduce these impediments must therefore be considered an integral part of sustainable work practices. For example:

- Lockheed Martin reported saving half a million dollars on its energy bills and enjoyed a 15% reduction in absenteeism after moving its offices to a building lit by natural light. The company subsequently saved hundreds of thousands of dollars every year on energy costs and discovered, much to its surprise, that a 2% increase in productivity equates to \$3 million extra per annum. This increase in productivity alone paid for the new building in less than one year.
- The Boeing aircraft company and Prince Street Technologies (PST) introduced natural light into their workplaces and watched as their quality control systems improved. Specifically, at Boeing, tool measurements could be read easier, previously unseen cracks in fuselages were detected, and subtle shades of colour were better differentiated. At PST, the introduction of natural light was so successful it reduced worker compensation cases by 90%.
- The Diagnostics Products Corporation in Flanders, New Jersey saw employee productivity increase 19% after the installation of an efficient climate control system and the addition of skylights that 'let in lots of (free) natural light.'¹⁰
- By installing skylights and additional insulation to improve lighting and temperature control, Verifone's credit card verification facility in Costa Mesa, California, decreased energy consumption 59%, reduced absenteeism by 47%, and boosted productivity 5-7%.¹¹
- At the headquarters of the West Bend Mutual Insurance Company in West Bend, Wisconsin, efficient workstation controls, which allow employees to alter temperature, airflow, lighting, and noise based on their personal preferences, contributed to a 15% increase in claims processing per employee.¹¹ (For more on this topic, see the Place section of this guide)

A Word about Bad People

In November 2009, lean-thinking guru Jim Womack described in a newsletter an experience he had while touring a large service company. During the visit, his hosts complained about the people in another department and how they were dragging their feet in response to needed change. Sometime later, in a different area, another team moaned about the resistance being generated by the finance department over the same changes. At some point, Womack asked his hosts if the way changes were being made benefited the two departments where the 'bad people' were located. And the answer, after a bit of discussion, was obviously 'no'. Indeed, it quickly became clear that those offering resistance were, in fact, reacting quite rationally to protect their interests. Since the end result of the changes being requested would eventually end up benefiting everyone, Womack explained that the real problem was not the change itself, but rather a lack of discussion, inclusion, and negotiation in which winners could compensate those who saw themselves as losers in order to make everyone whole. Think of this story as a parable in regards to internal and external customers and the problems encountered when managers choose to think by themselves and broadcast edicts rather than work collaboratively with others.

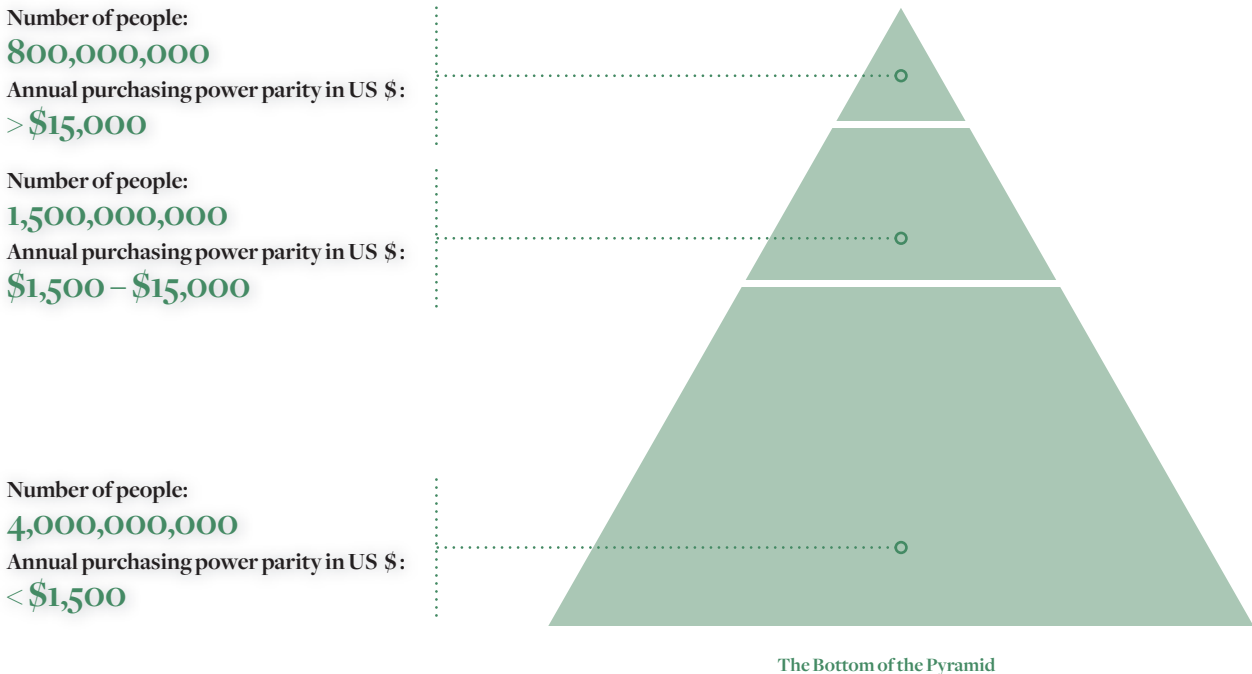
The People at the Bottom of the Pyramid

Eliminating the wastage of people is as much a part of sustainability as reducing physical waste. Consider then, that the world's largest consumer markets - upwards of two-thirds of

humanity - are comprised of poor people that are either ignored or forgotten by most businesses because of tradition, ignorance, or prejudice (see FIGURE 12-1). Much to their credit, however, an increasing number of companies have discovered that poor people, if given a chance, represent an economic force unto themselves. 'Inclusive business' is the term used to describe a company that works to include 'bottom-of-the-pyramid' (BoP) customers in its business model. The key to tapping into this powerful economic base is local partner selection. Many BoP companies don't become successful by simply selling products to the poor. Successful inclusive business strategies rely heavily on embedded processes that include working with and/or helping to create intermediary businesses that bring local and outside companies into close personal relationships with BoP communities.

Figure 12-1
The global economic pyramid

Adapted from C. K. Prahalad and Stuart Hart: *The Fortune at the Bottom of the Pyramid* Strategy + Business (2002)



Three Examples

In 1998, the Cemex cement manufacturing company in Mexico sent a team of managers into one of the poorest areas of the country to conduct a six-month study on how to increase sales. People with limited incomes accounted for around 40% of Cemex's cement sales so the company wanted to learn how best to serve what they suspected was a virtually untapped market. After living amongst this customer base and learning its needs, the Cemex team discovered how poor people used cement, how they could pay for it, and a host of other profitable facts, which they then used to make their products more accessible. A savings organisation named 'Patrimonio Hoy' was then set up to finance the selling of Cemex products to the company's new customer base. Sales subsequently grew 250% yearly.⁵

Cemex's story is not unique. In 2006, the Nobel Peace Prize was awarded to Mohammad

Yunus, a former economics professor from Bangladesh who invented the concept of micro-finance (giving small loans to poor people so they can start their own businesses). Although Yunus was repeatedly told by the establishment that poor people could not be trusted with money, his research (and his conscience) suggested otherwise. Yunus's solution was to help poor people help themselves by creating a new financial institution called the Grameen Bank (grameen means village). Currently, the Grameen Bank provides over \$445 million in small loans each year (\$10 to \$50 at a time) to those who need it most. It operates by visiting its customers rather than having them come to the bank. Far from being unable or unwilling to pay back their loans, those that borrow money from the Grameen Bank pay back their borrowings at a higher rate than any other group of borrowers in the world.

Realising that he was on to a good thing, Yunus next helped a telecom company called GrameenPhone (from an idea conceived by former investment banker Iqbal Quadir) to adapt the selling of mobile phones to fit another wasted market. Basically, GrameenPhone sells mobile phones to villages rather than individuals. Selling phones to villages helps spread the cost of the phones, thereby enabling more people to receive information about crop prices, market conditions, and other vital statistics without wasting days walking back and forth to major communication hubs. The result? Profits from the GrameenPhone project are expected to rise to over \$100 million despite the fact that the company operates in a region of the world where the average yearly wage is only \$286.

Meanwhile, in Central America, Corporacion Dinant is producing biodiesel from African Palm trees, which have low water needs and require intensive manpower – a situation that provides excellent opportunities for job creation (currently 2,000 small producers are involved in the project).⁵

The message of BoP economics is not about selling products to people who don't need them. Rather, the point is that companies - particularly global players - should not turn their backs on BoP opportunities in their search for new markets, new products, and new business partners. Businesses astute and creative enough to adapt to the needs of the world's largest collection of potential customers are currently reaping the benefit of increased profits, improved regional economic stability, and intense personal satisfaction - with little or no competition. For more information see: *The New Age of Innovation: Driving Co-created Value Through Global Networks* by C.H. Prahalad and M.S. Krishnan (McGraw Hill, 2008) and *Capitalism at the Crossroads: Aligning Business, the Earth, and Humanity* (2nd Edition) by Stuart Hart (Wharton School Publishing, 2007).

The Final Word on People

Nothing is as crucial to a business as customers – both internal and external. With few exceptions, the role of every business is to serve customers what they want, where they want it, and the way they want it. No business should ever lose sight of the fact that every decision it makes and every action it takes must be customer oriented. Anything else is a complete and utter waste of time, money and resources. Period.

13. Managing Change

Change is never easy. Just ask Amy Spatrisano, principle and cofounder of Meeting Strategies Worldwide (an international meeting and event organiser). Some time ago, Amy took a look at the number of everyday items used during a typical five-day conference and found that 2,500 attendees used and discarded over 62,500 plates, 85,000 napkins, 75,000 cups and glasses, and 90,000 cans and bottles. Determined to eliminate this (and other) waste, Amy did some research and discovered that using online registration could eliminate paper, printing, and postage costs, thereby saving \$3,900. Not providing conference bags could save \$11,700. Avoiding presentation handouts saves \$1,950 in printing and paper. Providing water in pitchers instead of plastic bottles saves \$12,187. Serving condiments in bulk rather than in individual packages and eliminating the need for buses by choosing hotels close to the convention center provided additional savings, all of which amounted to more than \$60,000. Unfortunately, as Amy later lamented, many of the meeting planners, hotels, caterers, and other businesses she works with remain unimpressed by these figures. 'Even if you show them they'll save money and even if you make it easy,' she says, 'it doesn't mean they'll do it.'¹

This story is not uncommon. Many people and their organisations actively resist change even if the desired change guarantees the making of money and/or additional job security. Species that survive, said Charles Darwin, are usually not the smartest or the strongest, but the ones most responsive to change.

Preparing for Change

For any type of change to take hold within a business (particularly sustainability changes) breadth and depth is required. Breadth means that the change must take place across the entire organisation (e.g.: every department and/or person must be made aware of the need for change). Depth means that everyone becomes involved with, and brings their skills to, the change process. Having employees become part owners in the change process by asking for their input is a powerful way to win them over. Involving employees also taps into a wider knowledge base, initiates motivation, and reduces the chances of something being overlooked. Just as important, when a change process is shared the words, 'that's not my job' are heard less often. In 2003, for example, Dow Chemical achieved hundreds of millions of dollars in cost savings thanks to the pursuit of employee-led efficiency practices at its facilities in Texas and Louisiana. As part of the change process, employees worked alongside managers from the highest levels of the company. The solutions they came up with – on their own - included identifying and fixing steam leaks, reducing electricity consumption, super-insulating industrial furnaces, and introducing real-time monitoring (i.e.:immediate feedback from mechanical processes). By involving as many employees as possible from a wide range of departments, Dow's on-going efficiency drives ensure that: (1) breadth and depth is achieved, (2) there are fewer chances that something is missed and, (3) problems are attacked from every angle.²

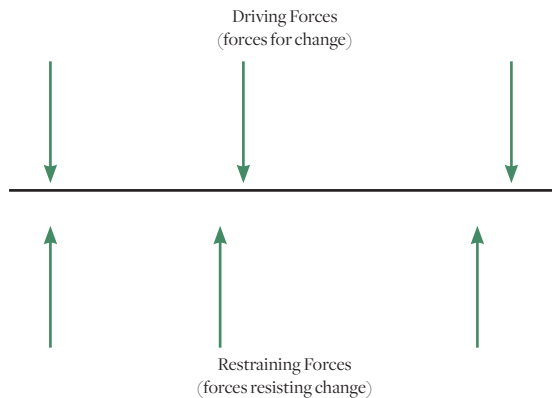
Probably the Most Important Management Theory Ever Developed

An adage often attributed to Albert Einstein states that 'insanity is the constant repetition of a behavior with the expectation of a different result'. Consider, then, the following model developed by Kurt Lewin in 1951³ (see FIGURE 13-1). Lewin's 'Force-Field Theory' states that two forces come into play when change is introduced into a work setting. The first force derives from those trying to instigate change (driving forces). The second force results from those who try to resist change (restraining forces).

Lewin's belief is that most managers use force to bring about change by exerting pressure on those who oppose them. In practice, however, the more management pushes, the more the other side pushes back. The result is that both sides get locked in an I'm-going-to-win-this power struggle hidden behind a thin veil of civility (e.g.: the way most employees push back is not with violence or anger, but through inactivity, excuses, and other forms of procrastination).

The better way of overcoming resistance, says Lewin, is to get off the power-struggle merry-go-round and focus on why the opposition is resisting change. Almost always, the reason why people resist change is because they are afraid of something. Thus, the question management should be asking isn't, 'How can we persuade these people of our arguments for change?' (i.e.: 'How can we force change upon them?') But rather, 'What are their fears and objections and how can we remove them?'

Figure 13-1
Lewin's Force Field Theory



Why Employees Fear Change

Initiating change in a business can be a gut-wrenching experience. This is because in many instances change removes comfortable habits and protective barriers and leaves people feeling stranded and defensive. The following text, adapted from *Creating Value for Customers*⁴ by William Band, describes the typical concerns associated with workplace change.

Job loss

Mention 'efficiency' or 'change' in a workplace and many employees immediately assume that jobs are on the line. That is why many change initiatives begin with the promise that job losses are a last resort.

Fear of loss of control

Feeling that things are being done to employees rather than by them

Too much uncertainty

The future is not obvious and everyday feels like the beginning of the end. This can lead to employees wanting excessive details and other procrastination techniques (i.e.: paralysis by analysis)

Too many surprises	People like novelty, but hate surprises. Early warnings are therefore necessary to avoid unwanted shocks.
The changing of habits	Habits are easy and mindless. Change is uncomfortable.
Need for familiarity	Everybody likes what is familiar. Most people feel comfortable going to places and doing things they know are risk free.
New things mean more work	This is usually true, especially when introducing change. But the initial workload often subsides when new tasks become easier (which is often the reason for change).
Concern for competence	Whenever something new is introduced, people will question their ability to master new skills, particularly if training and ongoing support are not provided.
No time to adjust	Saying, 'let's do things differently' is not enough. It takes time for new skills to develop. Rushing through the change process can lead to disruption, sabotage, foot-dragging, and/or poor performance.

Change from Another Angle

Kurt Lewin later developed his Force Field Theory further (with input from Edgar Schein) by introducing a 'Three Stage Approach to Change Behavior'. Since good habits are recognised as being just as difficult to break as bad habits, the analogy the two men make is to unfreeze bad habits and freeze improved habits once they've been established. Here's how it works:

1. Unfreeze existing behaviours. Gain acceptance for change by getting employees to admit that a change is needed. This does not mean that a decision must be made or a solution must be found just yet. At this stage, only a general consensus is required in which everyone agrees that something new has to be done. Examples of how some businesses get their employees to admit that waste reduction is needed is to involve them in estimating the amount (and cost) of the waste the business produces, analysing energy and fuel consumption, offering carbon emission estimates, and/or pointing out garbage levels and costs. Studying the cost savings achieved by sustainable businesses (particularly competitors) is another tactic that has produced results.
2. Change existing behaviours. Get employees involved in the change process by asking for their advice and input (breadth and depth). This can be accomplished by putting together a team (or teams) whose job is to collect ideas. Once again, the more employees that contribute the more likely change will be accepted because, in effect, change will be seen as the employees' idea rather than management's.
3. Freeze new behaviours. Reinforce new work practices with rewards. If this is not done, people will stop making progress and will revert to the safety of their old habits.

Building the Commitment for Change (A Summation)

George Bernard Shaw once said that to learn something at first feels like losing something. To eliminate the feeling of loss (and the sense of fear that loss creates), try the following:

- Involve as many people as possible. Participation leads to ownership, enthusiasm and motivation.
- Emphasise that job loss is not part of the change process. Explain and show that every redundant employee will be reassigned and retrained.
- Communicate clearly and often. Make the change message unmistakable and provide as much information as possible about every change.
- Divide changes into manageable, comprehensive steps. Make these steps as familiar as possible and make them small and easy. Ensure each step is deemed a success before moving on to the next.
- Never surprise anyone with change.
- Let commitment grow. Don't ask for allegiance to new and untried ways (you won't get it).
- Make clear what will be expected of people during and after changes are made. Communicate these standards and requirements often (i.e.: provide feedback).
- Provide as much continuous training as needed.
- Bear in mind that new work habits often require three to four weeks (or longer) to make or break.

Learn as You Go

Lack of experience in a change situation is not an excuse for inactivity. Indeed, most successful efficiency initiatives begin with a handful of individuals stepping into the unknown with little more than common sense, a healthy understanding of their business (and its customers), and an overwhelming desire to succeed. Ken Tannenbaum, a technology associate at Dow Chemical who has successfully led several efficiency projects, explained this concept as follows:

'Most of the work on efficiency (at Dow Chemical) is done by Dow employees. We have utilised consultants from time to time to validate our assumptions or to give us an opportunity to ensure we did not miss anything, but in most of our plants, (because) the processes are very specific, external experts cannot bring much additional help.'⁵

Ken went on to say that the same techniques used every day to change, improve, and maintain Dow Chemical's numerous plants are the same techniques Dow uses to increase efficiency because when it comes to change there is no sense re-inventing the wheel every time.

Just Do It

In some businesses employees will refuse to undertake new tasks and responsibilities no matter what is tried. Managing change in the face of strong opposition may therefore require stern procedures that include disciplinary action, reassignment, or perhaps termination. Most practitioners agree, however, that managers should first try to stimulate change by encouraging employees to lead their own way through the change process. To be sure, stepping into the unknown is intimidating and frightening to many, but just as with life, sometimes one simply has to do what needs to be done while being afraid. The alternative, as the saying goes, is that if you continue to do what you've always done, you're likely to end up with what you always got.

14. Putting Together a Team

The following team-creation recommendations have been compiled from a number of successful waste elimination schemes:

1. Before putting together a team, state the company's goals. What is the current situation and what does the business want to achieve? Zero-percent waste? The replacement of toxic substances with safe alternatives? A reduction in production times? A revised budgeting system that charges the cost of waste to the department that creates it? Examine the difference between what exists and what is wanted. Assume that everything being examined is broken and must be improved.
2. Keep team sizes at a manageable level. Research shows that team sizes should be limited to less than 10 or 12 individuals for maximum effect. Larger groupings are usually difficult to handle.
3. Involve individuals who are knowledgeable about what is being examined. Input will probably be needed from front-line workers, suppliers, maintenance crews, health and safety personnel, the purchasing department, engineers, the legal department, research and development staff, paying customers, the community where you are located, environmental specialists, etc. Bring these folks on board. For example, Proctor & Gamble set a goal of sourcing 50% of its innovation ideas from outside the company in a bid to shake things up and create new ways of thinking.
4. Do not turn away volunteers. Enthusiasm should not be curtailed and no one should be made to feel left out. For example, the Scandic hotel chain involved its employees in reducing unnecessary costs and discovered that most ideas came from the maids that cleaned the rooms (proving yet again that workers on the front lines often know more than most).
5. Start off small. If energy saving is the goal, take a look at the company's electricity meter then go around and switch off all unneeded lights and equipment. Read the meter again and determine the savings. Multiply the daily savings by the days of the year the business is in operation and you'll end up with a rough estimate of how much money can be saved in a year just by turning off the lights and equipment you don't use. That should provide enough motivation to keep going (see section 24).
6. Provide continuous communication, results verification and training. Consolidate training and information distributions to allow different groups to meet and communicate. Ensure that every employee (including shift workers) is aware of what needs to be done, what is being done, what has been done, and why.
7. Agree on motivational tools. Determine how employees will be motivated. Recognition, extra holiday time, cash bonuses or award ceremonies are all valid motivators. In one business, employees wanted to be rewarded with a carrot cake baked by the wife of their foreman. Another business displayed team achievements on giant scoreboards (thereby satisfying the 'nudges' concept explained in segment 2: What the Reformer is Up Against). Points were generated for reducing kilowatt-hours of electricity, saving amounts of raw materials, reducing production minutes, and so on. Other companies tie annual bonuses to the waste minimisation performance of employees.
8. Maintain links between your teams and the rest of the organisation. Learn the fears and

needs of the individuals involved. Be aware and share what every team is attempting and accomplishing.

9. Update goals as they are achieved. Emphasise the notion of on-going, no-finish-line improvement, build on previous successes, and measure and track all progress no matter how small. Fifteen or twenty ideas that can each save 1% of costs will quickly add up. Let them.¹

Organising Team Meetings

The following issues should be discussed, agreed upon and written down before a team can be expected to perform:

- The purpose of the group posted for all to see. For example, in a waste reduction scenario, typical questions that should be presented can include: What is the waste? Where is the waste created? When is the waste created? How much waste is created? What can be done to reduce the waste?
- Attendance expectations. Some practitioners suggest that efficiency teams should meet at least two to four times a month. Whatever is decided, put it in writing and enforce it.
- Behaviour rules. Examples include: no interruptions, no eye-rolling, no name calling and no criticism focused on personality rather than the task.
- Work performance expectations. Set the standards that determine if members are pulling their own weight and what will be done if they are not.
- Methods of agreement (or dissent). Will votes be cast? Will objections be listened to?
- Clearly defined tasks and responsibilities (both general and specific). For example, inform every department that energy use must be cut by 10% in one month. Then let it be known that more such improvements will be expected.
- Explanations that articulate how deadlock will be handled. Will lots be cast or will a coin be flipped?

Ideas and suggestions should be recorded on a large display board where they can be clearly seen and referred to. Concentrating on positives is essential. Staying upbeat is a good way to build morale and reinforce individual cooperation and participation. Those who work with teams on a regular basis suggest countering every negative criticism with a positive suggestion for improvement. Negative outcomes can also be corrected with measures designed to overcome defeatist attitudes. These include:

- Hold second chance meetings after a consensus has supposedly been achieved,
- Avoid being partial to only one course of action (perhaps make it a rule to always come up with two or three alternatives),
- Go around the table with team members and insist on feedback (this helps prevent quiet people's opinions from being withheld and big-mouths from dominating discussions),
- Encourage team members to do their own research and collect their own facts,
- Remember that the point of formulating a group is to produce results (i.e.: assigning teams is not a solution in itself),

- Understand that every group is unique and requires a different start-up, functional style, and form of leadership,
- Assign team members to question suggestions and obtain better solutions.²

What to do when Efforts Slow

Of course, not every team project story has a happy ending. Sometimes the enthusiasm and work of even the best teams can slow or falter. Typical comments associated with stalled efforts include: 'We don't have time for this', 'This isn't working', 'This stuff isn't relevant', or 'We're just treading water'. Additional examples include the development of a 'committee mentality' where 'too much analysis leads to paralysis' and nothing gets done. Further problems can develop when the smug air of superiority creeps into a team or when the team refuses to consider what it feels are weird or different viewpoints from outsiders. As a result, contradictory data is ignored or shelved, other alternatives are not considered, and a jumping to conclusions or inactivity dominates. More often than not, this usually results from a lack of clear goals and leadership. Suggestions include:

- Make sure that everyone knows what is expected of him or her and what needs to be done. This may involve establishing another form of readable compass that helps explain where the business wants to go and what it wants to do (and why) before numerical targets are set.
- Make a 'to do' list. Although it may seem a bit basic, a simple list filled with clear, itemised tasks that can be checked off after they've been completed could be just what's needed to help employees focus on one goal at time and affirm that progress is being made.
- Delegate tasks. Reward good people with additional responsibility and recognition by letting them come up with their own solutions.
- Display results. Provide feedback. Let employees know that you're taking this seriously and that they're being watched. Give everyone free rein to compete with other departments and/or coworkers.
- Analyse and reflect. Divide every workday into time blocks and record what was done in each. Compare what was accomplished to what was expected. Do the two compare? If not, why not?
- Avoid procrastination. If a task seems too daunting or elusive stop thinking about it and move on to the next item on the 'to do' list. This can help maintain momentum.

Waste Minimisation: Implementation Essentials

1. Assign responsibility (keep that in mind "that everyone is responsible" is often interpreted as no one is responsible).
2. Display appropriate measurements for all to see.
3. Educate and involve all employees and departments.
4. Gather ideas and put them into action.
5. Make improvements, tabulate and display the results, keep going.

PLACE

Whether in an office, a factory, a store, or a home, most work is conducted in buildings – and the vast majority of the world’s buildings are problematic. In the United States alone, buildings consume more than 68% of all electricity produced. Buildings also account for over 39% of America’s energy demands and are responsible for contributing 38% to the country’s total carbon dioxide emissions. Equally as unsettling, it’s not uncommon for indoor pollution levels to be two to five times higher (occasionally 100 times higher) than outdoor levels due to dust and fumes from interior building materials, cleaning solutions, production processes, central heating and cooling systems, radon gas, pesticides, paint, glue, carpets, and so on. In addition, building-related productivity losses and illnesses resulting from toxins are estimated to cost businesses \$60 billion annually. Eliminating these obstacles is therefore fundamental to the sustainability process. (Source: U.S. Environmental Protection Agency)

15. Building Better Buildings

The Rocky Mountain Institute (RMI) is an entrepreneurial, non-profit, environmental think tank located in Old Snowmass, Colorado. Within its 372 sq. meter headquarters is a fishpond where turtles, frogs, carp and catfish swim year round. Bougainvillea blossom under insulated skylights that cast a warm glow upon a profusion of grapevines and mango trees. Papayas, passion fruit, and bananas are also harvested inside the RMI building despite the fact that the entire structure is situated at an elevation of 2,164 meters, the outdoor growing season amounts to 52 days a year, midwinter cloudy spells last as long as a month and a half, and temperatures occasionally drop to minus - 44 Celsius. Yet the RMI has no central heating system and its monthly energy bill amounts to around five dollars. Layers of super efficient insulation, heat-recovering ventilators and insulated windows help keep the building and its occupants warm all winter long. Most astonishing, however, is the fact that this building actually cost less to construct than a conventional structure its size and that the efficiencies which make it so cost-effective came from 1983 technologies that paid for themselves within ten months.¹

Further north, in Minnesota, stands the Phillips Eco-Enterprise Center (PEEC), a \$5.3 million commercial and industrial facility. Currently, PEEC, which is a pilot project for the Green Building Council, is home to 20 manufacturing companies and office tenants. Features built into the 5,946 sq. meter building include salvaged and recycled construction materials, wind and solar power sourcing, geo-exchange heating and cooling (heat pumps), active daylighting, a green roof, non-toxic low-emission wall coatings, and exterior stormwater retention and treatment systems. Because of these efficiencies PEEC has won two design awards - including one from the American Institute of Architects. Interestingly, however, that's not why the building is in such high demand on the rental market. What draws clients to PEEC is the fact that it's less expensive to operate a business under its roof. According to the Building Owners and Managers Association (BOMA), normal utility costs for a 5,946 sq. meter building add up to around 20% of its annual operating budget. PEEC's annual utility bills amount to only \$25,000 or about 5% of its annual operating budget. Furthermore, PEEC spends only 17% of its operating budget on repairs, security, and ground maintenance, compared with the 23% that BOMA says is typical.²

Additional Examples of Efficient Buildings

Commercial buildings that pay for their costs and, in some cases, produce more energy than they use, are not a fantasy. Low cost technologies combined with common sense have been producing efficient structures for years. For example, Verifone (a division of Hewlett-Packard) renovated its California headquarters and subsequently saw its energy consumption drop by 59%. Soon thereafter, employee absenteeism decreased by 47% and employee productivity increased by 5%. The California State Automobile Association office in Antioch, (the cheapest CSAA building ever built), decided to flood its 1,459 sq. meter interior with lighting from energy-efficient light bulbs and (free) daylight that streams in through super-insulated windows. The resulting 63% reduction in energy bills covered the cost of improvements in six months. One of the most written about case studies in commercial building efficiency, however, concerns the ING Bank in Amsterdam (The Netherlands), which was built in 1987. The ING Bank building requires 92% less energy to operate compared with standard structures its size.

Moreover, the \$3 million in annual reduced energy costs paid for the building's efficiency upgrade in three months. Today, the building is so aesthetically pleasant to work in that absenteeism is down 15%, productivity is up and employees sometimes do not want to leave in the evening.¹

Overcoming Wasteful Building Practices

Slowly, architects and builders are waking up to the fact that buildings – where most people spend over 90% of their time – do not need to be a major cause of waste or inefficiency. The main reasons why most of the world's buildings either remain inefficient or are built inefficiently include:

- compensation paid to architects and engineers is usually based either directly or indirectly on a percentage of the cost of the building or the equipment specified for it (i.e.: fees are based on how much the building costs rather than how much it saves), and,
- most property developers do not expect to pay the energy bills of the structures they build so they have little or no interest in energy-saving or waste reduction solutions.

Fortunately, progress is being made remunerating contractors for long-term savings rather than how much money can be saved in building expenses in the short-term. This is good news when one takes into account that efficient buildings typically sell or lease faster and retain tenants better than their inefficient counterparts. In addition, green buildings have greater visual, thermal and acoustic comforts that yield valuable financial gains in terms of productivity, retail sales and manufacturing output. In a 2004 survey of 719 building owners, developers, architects, engineers and consultants, 91% believed that green buildings improve the health and well-being of their occupants.³

Efficient Buildings Increase Profits

Financial savings in terms of lower energy needs are not the only benefit provided by energy efficient buildings. Following is a list of documented improvements obtained after natural light (derived from windows or tubular skylight systems) was introduced into workplaces:

- Dramatic staff-turnover reductions.
- A doubling of customer numbers.
- Customers shop for longer periods of time.
- An increase of up to 40% in retail sales.
- Productivity increases of up to 18%.
- A drop in accident rates by as much as 50%.
- Improvements in task performance times.
- Employees able to identify items (including defects) better and faster.
- An increase in patient recovery rates and reduced hospital staff stress.
- Improvements in the vision abilities of the elderly.
- Students enjoy increased health benefits and, strangely enough, fewer dental cavities.⁴

These types of improvements have not just been recorded in the United States. The Canada Green Business Council drew similar conclusions when it discovered that the introduction of

natural daylight raised productivity 13% in Canadian businesses, increased retail sales by up to 40% and helped improve school test scores by as much as 5%. Improved ventilation added to these enhancements by increasing productivity an additional 17% and decreasing sickness by up to 50%.⁵

Getting Over the Hurdles

Without question, the greatest misconception about energy-efficient buildings is that they always cost more - which many architects insist is not true. Any building can be made either more expensive or less expensive depending on how it is designed and constructed. Yes, adding more insulation, installing rainwater collectors, fitting higher quality windows, placing solar panels on roofs, and putting passive shading structures over windows can incur extra expenses, but when these improvements eliminate the need for a heating and cooling system the extra costs are often negated.

High-rise tower buildings can also enjoy the benefits of efficient construction even though, on average, they require 30% more energy and materials to build and operate. Just as with small buildings, most extra costs can be neutralised through efficient design and materials. For example, the Rocky Mountain Institute has shown how a six-story building can fit into a five-story structure (five-stories is usually the limit for building code heights in many towns and small cities) by making a few structural changes and virtually eliminating ducts and suspended ceilings. Under-floor ventilation and wiring and super efficient windows and day-lighting are also incorporated. Construction expenses remain virtually unchanged (mostly because of a reduction in heating, ventilation and air-conditioning needs) with subsequent energy costs reduced by one-half to three-fourths. Natural light and ventilation, the building's low energy and maintenance costs, a propensity to produce more income, and natural good looks and interior comfort means that everybody wins: the owners of the building, the occupants of the building, and the neighbourhood where the structure is located.

Fix an Existing Building First

Efficient buildings do not have to be built from scratch. A business looking to build a new factory, office building, or retail operation, should first consider upgrading an existing building before constructing a new one. It's relatively easy (and often more cost-effective) to re-fit an old building - even historical buildings - than to build new. For example, the American National Audubon Society upgraded a 100 year old 9,104 sq. meter building in 1992 at a cost roughly 27% below that of building from scratch (all costs were recouped within five years). The resulting retrofit cut two-thirds off the building's energy requirements, improved ventilation, eliminated indoor toxins, and introduced an office recycling programme that reduced waste by 70%.

Maximising Building Interiors

One of the more intriguing aspects of waste is that the costs it creates don't just add up, they tend to multiply. Take, for example, a parametric analysis of an office building in Florida, which revealed that:

- 30% of the building's annual cooling load was used to fight the heat produced by its lighting system,

- 20% was used to combat solar heat that streamed in from the windows,
- 15% was used to offset heat build-up from the roof, and,
- 13% was used to neutralise the heat generated by internal office equipment (i.e.: photocopiers, computers, printers, coffee makers, etc).⁸

What this study reveals is that 78% of the building's cooling needs were needed to offset wasteful inefficiencies (ie one poorly designed system was fighting against that of another and the bill-payer was funding both sides). For either a small or big business, these costs create significant money loss. To be sure, firms that lease or rent their premises or share building space with other companies may not be able to perform major work that optimises the workplace. That being said, it may be feasible to negotiate new lease terms if whatever improvements can be made are seen to reduce operating costs.

Suggestions for Improving the Efficiency of Building Interiors

How can a business reduce the unseen, unfelt and silent pileup of compounding inefficiencies in the building it occupies? An effective first step is to turn off all office equipment and machinery at its source when the items are not in use, which can cut 5% to 40% off energy bills. Even the battery charger for a mobile phone draws electricity when the phone is not hooked up to it. Additional suggestions include:

- Replace all light bulbs with energy efficient light bulbs. Energy efficient light bulbs save money by: using less electricity, emitting less heat (which reduces a building's cooling needs), and lasting longer than standard bulbs (a recent study showed that 70% of energy-efficient bulbs last significantly longer than their manufacturers claim).
- Install intelligent lighting systems. Instead of lighting up entire rooms or work areas, use 'task lighting' that produces light only where it is needed.
- Replace old exit signs with Energy Star rated alternatives. For every sign changed, \$10 can be eliminated from the energy bills and the bulb will last ten times longer than a standard bulb.
- Put lighting systems on a timer and hook up exterior lights - as well as bathroom, closet, and storage area lighting - to motion detectors. The city of Eindhoven, in the Netherlands, for example, is considering attaching motion detectors to its outside lighting - including its billboards - which is predicted to reduce the city's energy bills by 30%.
- Insulate interior walls, ceilings and wall spaces. Extra insulation is usually worth the cost.
- Replace all office equipment with energy efficient alternatives. Doing so not only reduces energy costs, it also reduces the heat these devices emit. Electrical equipment always carries two price tags: the purchase price and operating cost. Look for accredited energy-saving labels to ensure that the electricity requirements of the equipment you need will be reduced by as much as 30% (or more). The A-OK Auto Body Shop in Philadelphia, Pennsylvania, for example, replaced its interior lighting system with efficient substitutes, installed motion detectors on exterior and bathroom lighting, placed timers on water heaters and coffee pots, and added programmable thermostats to its climate control system. As a result, its energy bills declined \$5,577 in one year.⁹
- Remove paper towel dispensers from restrooms and replace them with low-energy blow

dryers. Making one ton of paper towels from recycled paper requires 26,498 liters of water, 1,363 liters of oil, and 158 million BTUs of energy. During this process 39 kilos of pollutants are released into the atmosphere. Noting this waste, the university student union at California State Northridge removed its paper towel dispensers and replaced them with wall mounted, low-energy hand dryers that eliminated \$21,000 worth of annual paper towel costs.

- Seal all leaks in ducts and ventilation systems as well as around plumbing and wiring. Duct system leakage can account for up to 30% or more of wasted energy. Proper duct sealing also keeps dust, mould and mildew at bay.
- Take advantage of under-floor heating. Heat rises so an under-floor heating system is usually more efficient than one that uses wall-mounted radiators or ceiling vents.
- Take extra care to select non-toxic carpets (and carpet glue), paint, varnish and other safe interior decorations. Fumes and particles from these materials debilitate human health and performance.
- Consider purchasing an evaporative cooler (or 'swamp cooler') for cooling needs. Evaporative coolers pull air over pads soaked in water, which uses a quarter of the energy of refrigerated air.
- Install low-energy ceiling fans. By gradually circulating air through a building, slow-speed ceiling fans make the most of a heating and cooling system and can drastically reduce energy costs. A Subway Sandwiches shop in Norman, Oklahoma, for example, cut its annual energy costs by \$20,000, in part, by installing ceiling fans in its kitchen. The shop also replaced its lighting with energy-efficient bulbs (reducing the number of bulbs, yet doubling the store's brightness), replaced old ice makers and water heaters with efficient models, and tinted the building's windows.⁹
- Use a programmable thermostat. For every degree a thermostat is lowered, up to 5% can be saved on the heating portion of an energy bill. Another good tip is to keep electrical equipment and lamps away from thermostats where they can adversely affect temperature readings.
- Wrap hot water heaters in an insulated blanket. This not only saves money the electricity it saves can prevent hundreds of pounds of carbon emissions from entering the atmosphere.
- Where possible, fill workplaces with indoor plants and trees. Indoor gardens have a remarkable effect in reducing employee fatigue and can be instrumental in increasing productivity.
- Consolidate offices and work areas located in several buildings into one. This practice, along with sealing off and shutting down unused work areas, can save huge amounts of money.
- Check to see if your business is eligible for energy efficient tax incentives. Some governments offer tax breaks or tax credits for businesses that strive to increase the efficiency of the building in which they operate. Typically, tax credits are awarded for installing energy-saving technology and equipment, using hybrid vehicles, adopting

efficient heating and cooling systems, switching to solar (or wind) energy systems – and/or for making efficient constructions or renovations.

- Keep in mind that these suggestions are just a fraction of the energy-saving practices available to building operators and owners. Involve your employees in finding more.

For more information on how the overall energy efficiency of a workplace can be improved along with a reduction in energy bills, visit the Energy Star website (**www.energystar.gov**) - a no-cost programme run by the U.S. Environmental Protection Agency. In Europe, visit Energy Star at: **www.eu-energystar.org**. Alternatively, in the UK, seek out the Energy Saving Recommended (ESR) logo when buying electronics. The ESR endorses products considered to be the most energy efficient available (the ESR programme is managed by the Energy Saving Trust: **www.energysavingtrust.org.uk**). A third European label is the TCO Certification (Tjanstemannens Centralorganisation) established by TCO Development (**www.tcodevelopment.com**) and run by the Swedish Confederation of Professional Employees.

When Building New, Think before Doing

If upgrading an existing building to maximise sustainable practices is not an option and the decision to construct a new structure has been made, planning should begin well in advance. Most buildings can cut 20% to 50% (or more) off their annual heating and cooling costs - with no additional expense - by maximising location, positioning, and shape before construction starts. This includes placing the building close to major transportation routes, locating next to hills or trees for protection from wind and sun, aligning the building with the sun's trajectory to maximise or minimise solar heat gain, and using the structural mass and shape of the building to the utmost benefit. Additional examples include:

- Cover parking areas with light-coloured cement or other light-coloured surfacing rather than asphalt. This can reduce exterior air temperatures around a building by as much as five-degrees.
- Install a porous parking lot. Chunky, light-coloured gravel that has had its finer particles removed allows rain and snow to be absorbed into the ground. This simple idea was once presented to administrators at the Ford Motor Company and they refused to consider it. Eventually, however, they were persuaded to gravel a small test zone. Soon managers and employees from all over the Ford complex were going out of their way to park their cars on the test area because it contained no standing water or ice (or road salt), which kept the cars cleaner.⁶
- Carefully choose the colour and texture of the building's exterior. Dark colours absorb sunlight (and heat) as do textured surfaces. To prevent solar heat build-up, paint buildings a light colour and make sure the finish is shiny and smooth.
- Utilise natural storm water treatment. Channeling rainwater runoff from a building into tanks (for later use) or swales lined with indigenous vegetation is not only eco-friendly it's also cost-effective when compared to an expensive network of underground pipes and treatment plants.
- Avoid unshaded rock, cement, or asphalt landscaping on the south or west sides of a building, which increase ambient temperatures and radiate heat long after the sun has set.

- Surround buildings with as much indigenous vegetation as possible. Not only does this decrease surrounding air temperatures and reduce landscaping water needs, it also reduces labour costs, fertiliser expenses and landscaping waste (non-native plant species are often more labour, water, and cost intensive). Trees are not only valuable ‘carbon sucking tools’, they’re an excellent source of shade and a great way to increase property values.
- Ivy or grapevines grown in window boxes or on trellises can shade and beautify entire sides of a building (this is called a ‘green wall’).

Building Efficiently

If the following suggestions were used to build the over 170,000 commercial buildings constructed across the USA every year, it has been estimated that these structures would not only pay for themselves very quickly (and be cheaper to operate), they would substantially reduce the country’s dependence on foreign oil and drastically reduce its carbon emissions:

- Reuse, reclaim and recycle from demolition sites. Nearly 44,000 commercial buildings in the USA are demolished every year – and the construction, renovation and demolition debris from these work sites accounts for nearly 60% of the country’s total non-industrial waste. Recoverable materials include concrete, asphalt, metal (including wiring), bricks, plumbing material and wood.
- Use local materials. The further afield materials are sourced, the more energy, labour and money it may take to harvest, package, and transport them.
- Reduce the use of concrete. Cement production accounts for almost 10% of global carbon emissions. If concrete must be used, consider a mixture of 55% concrete and 45% slag (a waste product from blast furnaces) which saves energy and produces an alternative that is stronger than concrete alone. When bricklaying, use reclaimed bricks with a carbon-neutral lime mortar.
- Use sustainable engineered wood products in place of standard wood products. Also called composite wood, engineered wood is manufactured by binding fibres from young trees, sawmill scraps and wood particles. Engineered woods produce more open living and working space by reducing the amount of wood needed for load-bearing interior walls.
- Ensure that all wood products are approved by the Forest Stewardship Council or a similar recognised environmental organisation to ensure that they come from a sustainable source.
- When wiring a building, use the next higher size diameter of electrical wire than that recommended by building code requirements. Thicker copper wire costs more, but because it reduces electrical resistance it costs less to operate. In a typical office lighting circuit, using a larger wire size yields about a 193%-per-year (after tax) return on investment.⁷ A student of mine in France lowered his monthly electricity bill more than two-thirds by re-wiring his house with fatter wire and replacing all the light bulbs with energy efficient bulbs.

- Use water-based paints and wood treatments that are less toxic and emit fewer harmful fumes.
- Insulate, insulate, insulate. By insulating a building both inside and outside, it is possible to dramatically reduce or eliminate a heating and cooling system. For example, around 10,000 structures (called passive houses) without furnaces or air conditioners have been built in Germany, Sweden and Switzerland. Within these structures, everyday appliances (such as a television or hot water heater) emit enough heat to keep the occupants warm and snug in winter.
- Use energy efficient windows. Energy efficient windows are fundamental to the overall reduction of a building's energy requirements. It has been estimated that a routine renovation of all big office towers in the USA with insulated windows would probably save the country \$45 billion in energy costs. Standard glass windows have an efficiency R-value of 1, which means that more heat is lost through a window than an entire exterior wall (a reasonable R-value of an efficient wall is around 25 or 30). Super-insulated windows have an R-value of up to nine (or more) and can be 'programmmed' to reflect unwanted heat and/or ultraviolet light while letting in more ambient light. An 18,581 sq. meter office building in Chicago replaced its 20-year-old windows with energy efficient 'superwindows' that let in more daylight, reduced the amount of heat that was let in, and lowered the cooling load of the building by 85%. This meant that the old climate control system could be replaced with a model that was three-fourths smaller and a quarter of a million dollars cheaper. Furthermore, the new air-conditioning system requires 75% less energy to operate - thereby saving hundreds of thousands of dollars each year in energy costs.
- Ensure the heating and cooling system is both efficient and not too big for the building. Far too many buildings are constructed with HVAC systems that are more powerful than what is actually needed. In addition, many HVAC systems leak up to 30% of their heating and cooling.
- Solar shading is essential for all glass exteriors that face the sun. Although super efficient windows and skylights do a good job of letting in light while keeping out heat, 'light shelves' (a type of indoor awning) offer additional protection from solar heat and are much cheaper than buying and running an air-conditioning system to offset solar heat. Adjustable window glazing allows a building to either deflect unwanted light and heat or capture it like a greenhouse during cooler months.
- Look into drilling geothermal wells that use ground temperature to both heat and cool. Just a few meters down from sea level, the Earth's crust remains relatively constant at 14 degrees Celsius. Low-cost interior environmental control systems can use this consistency to either warm or cool a building.
- Consider installing a green roof on your building. Roofs are huge accumulators of heat that usually require massive amounts of air conditioning to offset. A green roof is an inexpensive and lightweight roofing system planted with heat-loving foliage. The benefits of a green roof include a reduction in ultraviolet radiation (which helps prolong the life of the roof), increased energy efficiency for the building (green roofs provide excellent

insulation properties), a decrease in rainwater runoff, and excellent noise reduction properties. Wider, regional benefits include increased air quality, lower electricity demands (particularly in the summer), reductions in local air temperatures, and an improvement in the aesthetics of the area where the building is located. When used in conjunction with a system that collects and stores excess rainwater, green roofs can also reduce maintenance costs associated with standard roofs.

- If installing a green roof is not possible, cover your roof with reflective material or solar panels.
- Incorporate good cross ventilation in the building. Take advantage of side vents, wind scoops, skycourts, balconies, atriums and low-power ceiling fans. Good air movement promotes temperature balance (which reduces the need for heating and cooling) and provides greater comfort. Tower buildings should allow occupants to open their windows, if just a few inches, to promote ventilation.
- Avoid the use of PVC and other energy-intensive, non-ecological construction materials. Replace them with sustainable alternatives. For example, sewer pipes can be made of clay rather than plastic.

Building a Better Future

As one developer put it, once you learn a better way to build you do not go back. For more information about the planning and construction of efficient, energy-saving buildings, visit the Advanced Buildings website at www.advancedbuildings.org. Another option is to contact the U.S. Green Building Council (USGBC). The USGBC (www.usgbc.org) is a network of 10,000 construction leaders from every sector of the building industry who have made it their mission to transform the building industry. The USGBC has developed a rating and certification system titled Leadership in Energy and Environmental Design (LEED) to recognise the efficiency performance of buildings (as well as healthcare systems and labs) in five key areas: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. The purpose is ‘to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment to improve the quality of life.’

The average LEED certified building uses 32% less electricity, consumes 30% to 50% less energy, draws 40% less potable water, enjoys a 70% savings on waste output, and saves 350 metric tons of carbon emissions every year.

16. Saving Water

The amount of water in the world is finite, yet between 1900 and 1995 global water consumption rose six-fold - more than double the rate of population growth.¹ Interestingly, although our planet is mostly covered by water, more than 97% of it contains salt, making it unsuitable for drinking or irrigation (desalinating salt water produces one-third potable water and two-thirds poisonous, intensely salted waste that cannot be reintroduced into the environment without repercussions). The less than 3% of what remains is either frozen at the poles, crystallised in glaciers, or is locked in underground aquifers and is too deep to retrieve. Less than half of one percent can be used by humans, but this amount increasingly poses a potential hazard because it is rapidly becoming more polluted. Currently, around 50% of the world's diseases are caused by contaminated water, and water rights have been – and continue to be – a worldwide source of conflict because water shortages often translate into food shortages and manufacturing difficulties. The bottom line is that minimising water consumption in business not only lowers operating costs, reduces water disposal expenses, and promotes regional stability, it is also the right thing to do.

How Businesses Waste Water

According to local and national Australian government offices, most businesses waste water in the same ways they waste energy and other materials. Among these practices are:

- installing wasteful production systems that require more input than is needed,
- acting as if supplies are ubiquitous and renewable and don't need to be managed,
- using pristine supplies for purposes that don't require pristine inputs,
- not thinking in the long-term, and,
- in general, not making better use of what little is available.

How a Business can Save Water

Saving water is always worth the effort. For example, the Frito Lay factory in Casa Grande, Arizona is working to recycle 85%-90% of the water used in its plant combined with an intense energy efficiency programme. Faced with regional droughts and potential water use restrictions, the company decided to act fast and expects to save \$60 million annually.² 'When water becomes scarce our ability to produce products comes into play,' says Al Halverson, Frito Lay's director of environmental sustainability. 'We want to have technology developed and scaled so we don't need to move production to follow the water.' Suggestions used by Frito Lay and other companies to conserve water include (see also page 127):

- Educate employees and involve them in all water conservation practices. It's everyone's job to save water so make it everyone's job to save water. Kraft Foods set an objective of reducing its water consumption by 15% before 2011 and surpassed that goal by obtaining a 21% reduction. 'We're changing behaviour and getting results,' says Steve Yucknut, vice president of sustainability.
- Designate a water efficiency coordinator, support him or her and, as with other sustainable practices, constantly remind employees what your company is trying to achieve.

- Locate the sources where water is used at your place of work (washrooms, sinks, climate control systems, hoses, etc...) and discuss and identify ways that water can be saved at each.
- Get employees in the habit of reporting all leaks and water losses immediately. Train security guards and cleaning crew to identify, handle or report water wastage when they are making their rounds.
- Install motion detectors under taps, which operate when a hand is placed beneath them and immediately turn off afterwards. Alternatively, install taps that automatically shut off after running a few seconds.
- Install water flow fixtures (aerators) on all faucets, toilets, urinals and showerheads. This alone can reduce water requirements by 60% or more. Screw-on water flow reducers (also called aerators) cost just one or two Euros and can cut the amount of water that flows from a faucet by one-half or more. The remaining water is mixed with air and the result feels as though the tap is full on. Additional water saving devices can be installed in toilets (which are widely considered to be the greatest wasters of water in any building) and urinals. Toilet technology has advanced to such a degree that some toilets require no water for flushing. A university in California, for example, replaced its 13 male restrooms with waterless urinals and saved \$15,000 on its annual water bill. Further east, an office building in Denver, Colorado switched its toilets, urinals, faucets, and showers with water-saving replacements and saw its water bills plunge 80%.³
- Fix all leaks and repair or replace inefficient control valves, pumps and pipes. 10% to 20% of a business's water loss usually comes from ignored leaks – which is tantamount to pouring money down the drain. A single tap left trickling in a washroom, for example, can cost up to \$80 in water charges per year. A leaking toilet (particularly one with its valve stuck open) can cost up to \$90,000 per year.⁴
- Install a closed-loop water system to reclaim and reuse industrial wastewater. High efficiency reverse osmosis (HERO) systems, for example, reclaim wastewater. Similar techniques to filter and re-use water from industrial processes or air conditioning cooling towers can cut water bills by 90%.
- Recycle 'grey water' and rainwater. Most industrial systems use tap water (drinking water) for most, if not all, of their production needs. The irony is that recycled water from sinks, showers, production processes, washing machines, and drinking fountains (also known as 'grey water') can often be used in place of tap water. Even rainwater is of sufficient purity for most industrial processes and has the added benefit of being free. Harvested rainwater (from collection tanks on rooftops or building sides) can be used for irrigation, landscaping, toilet flushing, and other purposes.
- Use pressurised air to perform functions previously done with water. Pressurised air can be used to clean equipment, products and packaging (for example bottles and cans).
- Do not use toilets as a garbage disposal.
- Shut off all cooling units when they are not needed.
- Optimise the blowdown or bleed-off controls on boilers and cooling towers.

- Minimise water used in cooling equipment in accordance with the manufacturer's directions.
- Turn hoses off at the faucet rather than the nozzle.
- Use drip irrigation methods for landscaping needs. Drip irrigation involves laying a perforated water hose a few centimetres below the ground. When turned on, the holes emit water – one drop at a time – which is sufficient to keep plants hydrated. This system was used at a business I ran in the Middle East. We were located in the middle of a scorching desert, yet the grounds were surrounded year in and year out with flowers, fruit trees and shrubbery. Potable bottled water cost twice as much as petrol, so we used gray water (from a sewage treatment plant) in our drip irrigation system.
- Never place watering or irrigation systems on a timer. If you recall the last time you passed through a neighbourhood in the rain and saw the water sprinklers on you will understand why.

Efficient Wastewater Treatment

All work places produce sewage, which is an expense. There is, however, a way to eliminate sewage costs: treat the sewage where it is produced instead of paying to have it transported and treated elsewhere. Ecological engineering (also known as ecological sanitation or living machines) is an emerging industry that treats raw sewage, including effluent, heavy metals, and other chemicals, economically and safely by pumping them through a series of open tanks filled with organic plant and animal life. Based on the science of estuaries – nature's own filtration system - each tank, which averages about four meters in depth, contains a unique ecosystem designed to breakdown select toxins before passing them on to others further down the line. The result is odour free and can resemble a pristine garden complete with waterfalls, lily pads and fishponds. Indeed, one ecological engineering company (Living Technologies in Burlington, Vermont) held a wine and cheese party at one of its 'living machine' locations and had to keep reminding the guests to keep their hands out of the water.⁵

Typically, it takes one to three days for sewage to pass through all the required tanks in a living machine system. The first tank is covered with a layer of soil and living grass. Odours and gases filter through the layer and are broken down into carbon dioxide and oxygen. Bacteria and plants work their magic in the remaining tanks. The only waste created is that from the plants, which feed off the system and have to be pruned regularly. In regions that experience harsh winters, tank systems can be positioned in a passive greenhouse-type structure or they can be built into, and compliment, the building they service. Conversely, a system can be arranged outside. Every system can be uniquely tailored to suit the volume and makeup of its waste. The end result is water of such high purity that it only requires a small amount of additional treatment to make it drinkable. Some companies even harvest and sell the methane gas their living-systems produce, as well as the flowers, fish, tomatoes, and lettuce that grow within them – which means that 'living machine' systems can be money-spinners.

Like many efficient processes, the cost of a living machine not only pays for itself, it is also a huge source of pride and admiration for employees. For example, M&M Mars in Brazil and Australia, the Vermont Welcome Center on U.S. Interstate 91, the Sonora Mountain Brewery in California, the Body Shop factory in Ontario, Canada, and the National Audubon Society in

Florida have all boasted at one time or another about the beauty and efficiency of their wastewater treatment 'living-machines'.

For More Information on How to Save Water...

Many regional and national governments (particularly those in dry parts of the world) are keen to help fund water saving and water treatment business projects. Contact them. Additional organisations that can help minimise water use (many of which come from regions where droughts force inhabitants to treat water respectfully) can be found at: **www.bewaterwise.com; www.epa.gov/watersense; www.savewater.com.au; www.savingwater.org; www.sydneywater.com.au; and www.waterwise.org.uk**

17. The Macro Advantages of Micro Power

Although oil has traded at \$147 a barrel, and may climb to \$200 relatively soon, many experts insist that the worst is yet to come. Here are the numbers. Last year, the world consumed 86 million barrels of oil a day (up from 78 million barrels in 2002) and every year consumption increases. Between 1995 and 2004, for example, demand grew by 3.9 million barrels per year in the USA alone (currently, America consumes 25% of the world's oil production). China and India still have not caught up with that amount (China's demand grew by 2.8 million barrels annually during the same period), but there is no doubt that these two countries are securing additional amounts every year and need more to continue their growth. The problem, as Jeroen van der Veer, CEO of Royal Dutch Shell, stated in a recent e-mail to his staff, is that '... after (the year) 2015, supplies of easy-to-access oil and gas will no longer keep up with demand.'

John Hess, Chairman of the Hess Corporation agrees. 'An oil crisis is coming in the next 10 years,' he says, 'it's not a matter of supply. It is not a matter of demand. It's both.' James Mulva, CEO of ConocoPhillips, is also worried. In November of 2007, he told a Wall Street conference, 'I don't think we're going to see the supply (of oil) going over 100 million barrels a day... Where is it going to come from?' Earlier, in October of 2007, Christophe de Margerie, CEO of French oil company Total S. A., relayed that the production of even 100 million barrels of oil a day by the year 2030 'will be difficult'.¹

When the CEOs of the world's oil companies start issuing warnings - and with climate change resulting from the burning of fossil fuels posing an ever-increasing threat - there is no better time than now for astute businesses to consider alternative sources of energy. Micro-power involves equipping a building or group of buildings with an independent power source that either wholly or partially supplies needed energy. For example, the Mauna Lani Bay Hotel on the Kona-Kohala coast of Hawaii turned its premises into a 100-kilowatt power station by reroofing its roof with solar cells. In Aberdeen, Scotland, the Cults Primary School set up a five-kilowatt wind turbine in May of 2007 that not only reduced its electricity bill, but also cut its annual carbon emissions by 5,633 kilos. And across the American state of Iowa, wind turbines now power ten schools either partially or completely. The 4,924 sq. meter elementary school in Spirit Lake, Iowa, for example, installed a 250-kilowatt wind turbine that provides an average of 350,000-kilowatt hours of electricity per year. Excess electricity, which can be fed into the local utility system, earned the school \$25,000 in its first five years of operation.²

Wind Power

Many energy analysts claim that if they could do just one thing to alleviate the world's energy problems they would allow every form of energy to compete fairly without the intervention of governments and corporations. For example, Dr David Toke of Birmingham University (UK) estimated that onshore wind power is now producing electricity at the equivalent oil price of \$50-60 a barrel - and offshore wind power is pumping out energy at the equivalent of \$70-80 per barrel. Keep in mind that Toke's estimates assume a guaranteed income flow of 15 to 20 years and do not take into account any government subsidies associated with coal and oil.³

Whether for sailing or rolling a grindstone in a flourmill, wind power has been around for centuries. Today, Denmark derives over 20% of its electricity needs from wind turbines; Germany gets about 10% of its electricity from the wind; and every year Spain installs over

2,000 megawatts of wind turbine generators. At the end of 2009, the installed capacity of wind power in the United States was just over 35,000 megawatts (enough to power over 10 million homes) and every year the number grow (as do the total number of jobs that wind turbines create).

Wind turbines come in a variety of shapes and sizes and usually last around 20 years or longer if they are maintained correctly. The traditional variety looks like a windmill, but other designs resemble the whisks of a giant eggbeater. Size-wise, wind turbines range from huge three megawatt, 11-story towers (that can power up to 1,000 homes), to relatively modest one-megawatt turbines that can power 350 homes, or much smaller one to ten-kilowatt roof-mounted turbines that can be purchased from specialised retailers and meet the needs of a single household or business.

Is Wind Power Right for Your Business?

The single most important factor in deciding whether or not a wind turbine will provide an adequate energy source for a business is to measure the force and duration of wind that is available. Some turbines are designed to operate at low wind speeds while others can withstand powerful gusts. A good site must have a minimum annual average wind speed of around 18 to 21 kilometres per hour. To determine the average wind speed in your area, contact a local airport or meteorological station. Installing a wind turbine also involves learning about a variety of factors including costs versus productivity, ice throw, net metering, rotor radius (the length and size of a turbine's blades is directly proportionate to the amount of energy it can produce) as well as the programmes, laws, and incentives of local, state, and federal authorities. For example, some coal-producing regions actively discourage the use of sustainable energy by insisting that electricity production must come from coal-fired utility plants. Additional considerations that should be researched before buying into wind power include:

1. Determine whether or not a favourable agreement can be reached with the local utility company. Some electricity producers and governments will not tolerate competition and may refuse to buy the additional electricity a sustainable power supply produces or may force the micro-power to be fed directly into the nation's grid rather than the business.
2. Project feasibility concerns. Will the noise, movement and aesthetics of the proposed wind turbine be an issue for the local community? Is the site's geology suitable? Will the turbulence (which is created by every wind turbine) effect nearby structures? Can zoning permits be obtained? These questions will need answers.
3. Availability and maintenance concerns. The availability of wind turbine parts, the reliability of the manufacturer, and the services of a professional who is familiar with their operation and maintenance is exceptionally valuable. Will a qualified professional be available to maintain and repair your wind turbine when it needs servicing?

Most users of wind power seem to agree that the benefits outweigh the disadvantages. A model created by the National Renewable Energy Laboratory (USA), for example, found that several locally owned wind turbine projects in Iowa generated significantly higher economic impact levels than projects of equal capacity owned by other investors. Additionally, in every case, the use of wind power was found to positively influence the entire community, which led to increased community pride and cohesiveness. That being said, not all wind turbine stories

have happy endings. Years ago in Poland, for example, a village invested in a huge wind turbine that produced hundreds of kilowatts of extra power. Unfortunately, the regional power company would not buy the additional electricity and residents discovered that the cost of their purchase would end up taking years to recoup. If the locals had done their homework, they would have discovered that a smaller, less expensive wind turbine would have been more suitable. For more information on turbines, visit the American Wind Energy Association website at www.awea.org or the European Wind Energy Association at www.ewea.org.

Solar Power

Solar power is often considered one of the most expensive sustainable energy options available. Generally speaking, it does cost three to four times more to produce power from solar cells than it does from conventional sources. The good news, however, is that the cost of solar power drops almost every year because prices decrease about 18% every time production doubles. Power from the first solar cells, for example, cost about \$200 per watt. In 2007, the price was \$2.70 per watt. Electricity produced from solar power is now so competitive that in some cases it is actually cheaper to use solar cells than conventionally produced electricity. Isolated street lamps, emergency phones on highways, and electrical systems in remote communities are cheaper to operate with solar power when one takes into account the cost of installing long distance electrical transmission lines.

In situations where solar power costs are greater than conventionally produced electricity, solar voltaics can still pay for themselves in a relatively short period of time. Take the Times Square headquarters of Conde Nast, for example. Situated in a 48-story building in New York City, 14 of the building's floors are covered with solar panels that added an additional 5% to 10% to the overall construction price tag. The half million dollars in annual energy savings, however, paid for their cost within five years.⁴ Meanwhile, in Madrid, Spain, telecom company Telefonica installed Europe's largest solar power plant on its roof. The 16,000 solar panels generate three-megawatts of power, which means that the building is energy self-sufficient and also makes money by selling excess power.

Solar Cell Facts

- Solar cells do not require direct sunlight to operate. They function quite well under cloudy or rainy conditions. For maximum effect, however, they should be placed where direct sunlight will hit them.
- Solar energy offers a one-time capital expense. Virtually no other costs accrue.
- Solar cells last a long time. Many solar cells produced in the 1970s still function to this day. Lab testing has shown that under the right conditions solar cells can last up to 40-years or more (although the energy output of solar voltaics usually decreases over time).
- Most solar cells are made from silicon, which is plentiful and does not have to be mined.
- Some solar cell applications are so thin they can be 'painted' onto foil or other materials. solar voltaics can also be sewn into clothing, backpacks, and briefcases to provide power for portable electrical devices.

- Solar panels can be used on new and old buildings as roofing, or mounted vertically on exterior building walls, or used as sunshades or covers over windows, walkways and carports.
- Solar cells reduce a business's impact on the environment, cut its electricity costs and send a positive message to the public about the business's commitment to clean and sustainable practices.
- Most solar voltaics have efficiency variables of between 5% and 17%. Specialised solar cells produced in the laboratory - as well as those used in space - can reach efficiency levels of 25% to 40%. The reason why solar voltaics are so inefficient is because about 30% of the energy they collect is converted into heat. Moreover, most solar cells cannot convert a broad spectrum of the sun's wavelengths into electricity. Improvements in technology, however, are making up for these shortcomings. Since sunlight is plentiful (and free) 'waste' is not much of a concern.

Are Solar Voltaics Right For Your Business?

If your organisation can afford to buy several years of its power in advance while awaiting payback then yes, solar power may be for you. Note that energy from the sun can also heat water (and buildings) as well as drive steam turbines. For example, calculations for concentrated solar power, which uses mirrors to concentrate sunlight onto a fluid-filled container to produce steam that drives a turbine, is cost-equivalent to oil priced at \$50 per barrel - or as low as \$20 per barrel when the technology is scaled up.³ For more information about solar power visit: www.solarserver.de and click on the English translation icon at the top of the home page.

Fuel Cells

Without question, of all the clean-energy producing alternatives currently being talked about, fuel cells elicit the most excitement. Fuel cells require no combustion, have no moving parts, are silent, and are virtually pollution-free. Most important, since hydrogen is almost always found combined with other elements, its supply is cheap and plentiful. Some fuel cells run on the hydrogen found in sugar. Others use the hydrogen in the water produced by the cell itself. Hydrogen derived from traditional hydrocarbon sources (i.e.: coal, gasoline, methane, methanol, natural gas, or propane) can also be used as a fuel, although a small amount of carbon dioxide, sulfur, and other bits of matter from these sources is emitted as a result. Just as important, fuel cells can be made in all sizes, which makes them as versatile as they are clean. For example, a fuel cell can be reduced to fit inside a portable music player - or be increased to the size of a refrigerator to power a house, office, or apartment. Fuel cells are also reliable. Manned spacecraft and submarines have been using them for decades because they don't produce toxic emissions and thirsty crews can drink the pure water emitted as a waste product.

Advantages of Fuel Cells

- 70% to 85% of the energy obtained from the fuel in a fuel cell can be converted into power and heat compared to coal or oil, which is around 35%.
- Fuel cells are inherently reliable, rugged, quiet, and versatile and they can be used to power almost anything from a hearing aid to an office building. Currently, fuel cells are

being developed to power cars (every major automotive manufacturer in the world now has a fuel cell vehicle in development), buses, boats, trains, planes, consumer electronics, portable power units, and wastewater treatment plants (where the methane produced by the wastewater is used as a fuel source).

- Since fuel cells are smaller than coal-fired furnaces, less land is required to set them up as compared to traditional power plants.
- The pure water emitted as a waste product from a fuel cell can always be put to good use.
- Recent breakthroughs in fuel cell technology have produced electricity from carbon and bacterial enzymes, which eliminates the need for precious metals (such as platinum).

Disadvantages of Fuel Cells

- The price of electricity produced by fuel cells makes the technology somewhat prohibitive. Fuel cells big enough to power businesses cost tens of thousands of dollars, which means that they can take over a decade to pay for themselves. Slowly, however, fuel cell costs are coming down. In 2002, electricity produced by fuel cells averaged over \$1,000 per kilowatt. In 2009, the US Department of Energy reported that volume production fuel cells for the automotive industry were producing electricity at \$61 per kilowatt (the goal is \$35 so as to compete with internal combustion engines). Depending on the cost of the hydrogen source, and if the amount of platinum used in fuel cells can be reduced (or replaced), a two-kilowatt fuel cell could, in theory, provide power at around ten cents per kilowatt in the next ten to twenty years.
- Long-term performance estimates for fuel cells have not yet been determined – although, to date, most fuel cells require maintenance overhauls every five years or so.
- For more information visit: **www.fuelcells.org** or the U.S. Fuel Cell Council website at: **www.usfcc.com**.

Micro-Hydro Power Stations

Micro-hydro stations use natural water flows from rivers and streams to produce hydroelectricity. The turbines they house are small so they blend into natural settings while producing enough electricity to power several hundred homes or businesses. Micro-hydro stations are particularly viable in areas where industrialists during the 18th and 19th centuries built now-unused weirs to turn water wheels that powered looms and other industrial machinery. To read more about micro-hydro stations visit: **<http://www.energysavingtrust.org.uk/Generate-your-own-energy/Hydroelectricity>** or, **<http://www.absak.com/library/micro-hydro-power-systems>**.

For More Information about Micro-Power...

When it comes to energy, or any resource for that matter, payback is always better than pay more. With the rising cost of fossil fuels showing no signs of abatement, and carbon emissions placing increasing levels of stress on the environment (and the purse strings of businesses), micro-power is an ever more appealing option. On a broader scale, the more efficient and energy independent a nation's businesses become, the less the government has to spend on expanding and building electricity plants. For these reasons and other reasons, a growing number of building owners, managers, and governments are wondering why they did not take advantage of micropower sooner. More information about sustainable micro-energy sources is available at: www.clean-energy-ideas.com, or www.alternative-energy-news.info, or www.eere.energy.gov/greenpower.

In the meantime, download the (free) booklet The Lean and Energy Toolkit at: www.gov/lean/toolkit/LeanEnergyToolkit.pdf. The material in this publication is specifically designed to help businesses reduce their power needs. It is highly recommended, that a complete in-house energy reduction programme be implemented before buying into any micro-power system to ensure that your business ends up purchasing the least amount of equipment needed.

PRODUCT

Because of the vast quantities of materials and energy that most products require, not to mention the huge amounts of waste they produce while they're being manufactured, making products more efficient (and more efficiently) is crucial to reducing the costs of running a sustainable business. To be sure, redesigning products and the methods used to make them is time-consuming and arduous; however, many practitioners attest that it is one of the most financially rewarding.

18. The Hidden History of Products

Ever wondered what is involved in the making of a Styrofoam cup or a pair of blue jeans or even one serving of a hamburger, fries and a soda? What about the costs involved? How much do a business's products really cost before they are made and how much do they cost the business after they have been sold? Most of us are blissfully unaware of the genealogy of the products we use as well as the trail of waste and inefficiency products leave behind. For example, take a look at the making of a typical aluminium can for the UK soft drink industry (provided here courtesy of the Lean Enterprise Institute).

To make aluminium, bauxite is needed. This reddish, clay-like ore is mined in Australia, Jamaica or Guinea and is then transported to a local chemical reduction plant (or a smelter). One ton of bauxite is needed to produce a half-ton of aluminium oxide. When a sufficient amount of aluminium oxide has been collected it is taken from the smelter, loaded onto a ship and sent to Sweden or Norway (a journey of one month across two oceans). Next, the aluminium oxide is dissolved in a salt solution and zapped with powerful electric currents that purify it (electricity is cheap in these countries, which is why the process is done there). Making about half a kilogram of aluminium from aluminium oxide, which amounts to 34 beverage cans, requires 7.5 kilowatt-hours of electricity – or enough energy to power a home or small business for a single day. The electrical process reduces the aluminium oxide by half before what's left is shaped into ingots and trucked to a different part of Sweden or perhaps Germany. The ingots are then heated in ovens and pressed into thin sheets that are rolled and trucked to another country where they are rolled and pressed again. Following these procedures, the sheets are shipped to the UK where they are punched and formed into cans.

Next, the cans are washed, dried, primed and painted. After a thin lacquer has been applied, the cans are flanged and sprayed with a protective film that prevents them from corroding. The empty containers are then sent to a bottler where they are washed again and filled with a beverage. The beverage contains sugar harvested from beet fields in France (or cane fields in the tropics) as well as phosphorous from mines in Idaho (in Idaho, the 24-hour phosphorous mining process consumes, in one day, an amount of electricity equal to that required for the daily needs of a city of 100,000 people). After the beverage has been made it is squirted into the aluminium cans, which are then sealed at a rate of 1,500 cans per minute. The cans are next inserted into cardboard packaging (derived from trees cut down in Canada, Sweden or Siberia) and loaded onto pallets. More shipping ensues as the cartons are transported to supermarkets and vendors across the UK. On average, the finished product is purchased within three or four days and consumed within a week. Drinking the beverage takes a few minutes and throwing the can away takes a few seconds. All in all, the entire process takes about 319 days. Small wonder that even a one-percent reduction in the aluminium needed to make a beverage can is enough to save manufacturers \$20 million a year – or that recycling just one aluminium can saves enough energy to power a television set for three hours.

Plastic is another material used to package soft drinks, yet bottles made from plastic, like their aluminium counterparts, create their own unique waste trail. The total mass of a typical one-litre plastic container, for example, contains 25 grams of non-recycled polyethylene terephthalate (PET). Making half a kilogram of PET requires over 6.5 kilograms of oil, 294 kilograms of water, and emits 3.7 kilograms of greenhouse gas emissions. This means that every one-litre PET bottle requires 162 grams of oil and over 7 litres of water to produce - while

emitting around 100 grams of greenhouse gas emissions (which is as much as the average car produces driving half a kilometre). Keep these figures in mind when taking into account that Americans throw away approximately 2.5 million plastic bottles an hour.

Shipping and distribution merely increases the trail of waste. Transportation emissions are measured in grams (in units of CO₂ equivalencies) per metric ton, per kilometre. Container ships emit about 17-grams of CO₂ per ton, per kilometre. Trains release 56-grams per ton, per kilometre; trucks spew out 102-grams per ton, per kilometre; and jet aircraft emit 570-grams per ton, per kilometre. When the costs of packaging and marketing, as well as a profit margin, are factored in, a one-litre container of bottled water can end up costing two to five times more than a similar amount of petrol – or 50,000% more than tap water (which is ironic when one considers that many brands get their product straight from municipal taps.).¹

Ecological Rucksack

The proper term for the amount of waste a product generates as it winds its way through production (and its lifecycle) is called ecological rucksack – and almost every product carries a greater load than meets the eye. For example, according to Friedrich Schmidt-Bleek, formerly of the German Umweltbundesamt and the Wuppertal Institute, an ordinary cotton T-shirt carries an ecological rucksack of approximately 4,584 kilos.² How? First, the processes behind the growing of the cotton must be taken into account including the manufacture, transportation and distribution of fertilisers, herbicides and pesticides. Irrigation equipment (and water usage), farm machinery, and petrol – as well as the processes behind these items - must also be factored in. Next come the steps involved in turning the cotton fibres into thread. Weaving, dyeing, packaging the completed product and transporting it to retail outlets results in the creation of even more waste. Additional factors to consider include after-sale practices such as the efficiency of the washing machine the customer uses, the use of hot or cold water (hot water uses more energy), whether the shirt is air dried or put in a tumble dryer, and so on. Every process produces some form of waste.

To be sure, the waste estimation of a product is dependent upon how far back its materials can be traced, which makes any study highly subjective. Estimates claim, however, that a semiconductor chip can leave behind 100,000 times its weight in waste during its manufacturing process and the making of a laptop computer produces 4,000 times its weight in waste. The production of platinum creates 250,000 units of waste for every unit of precious metal created and every gold ring leaves behind approximately 400,000 times its weight in waste. The manufacture of one ton of paper requires the destruction of 20 trees and enough electricity to power the average home for six months. Two-quarts of petrol are needed to produce one-quart of orange juice - and one serving of a hamburger, fries, and a soft drink requires 7,000 litres of water. With statistics like these, it is easy to see how raw material use in the United States multiplied 17 times between 1900 and 1989 while the country's population multiplied only three times.

Why is Waste (and Its Costs) so Difficult to See?

Mention the amounts of waste most products leave behind and many people roll their eyes under the assumption that the numbers are being exaggerated to prove a point. 'How can a

quart of orange juice require two-quarts of petrol to produce?’ a student once asked me, ‘that means orange juice should cost twice as much as petrol.’

What he and others are not considering is that mass production, bulk raw material costs, and mass transportation not only lower the costs of making a product they also hide the cost of waste. I will use a city public transport ticket to illustrate this point. In many parts of the world, a \$1 or \$2 ticket enables a passenger to board a bus or a light rail service and either get off at the first stop or stay on until the vehicle reaches the end of its route. Although the lengthier journey requires more energy and produces more waste, it is not reflected in the price of the ticket (which is low and remains constant). This is the logic that many sceptics use to try to prove that product waste is not an issue. In other words, since the price of the ticket remains the same, the reasoning is that the bus or train cannot be using more fuel during its longer journey or be producing more waste. Understanding mass production economics is the key to rectifying this misconception. The general rule is that when production volume doubles, the price of whatever is being produced tends to drop 10% to 30% even while waste outputs increase. Put another way, by selling more, the costs of raw materials and waste spread out and seemingly disappear.

Hidden Poisons

Just as worrisome as a product’s trail of waste is the amount of toxins that are found in – or are used to make - everyday products. The average television, for example, contains 4,000 toxic chemicals (200 of which emit hazardous fumes when the TV is turned on) and many buildings are insulated with formaldehyde-laden particleboard that heavily pollutes indoor air. The average PC consumes ten times its weight in hazardous chemicals and fossil fuels to complete its production (in India and China alone, about 70% of arsenic, lead, cadmium, chromium, cobalt, mercury and other heavy-metal pollutants come from electronic waste created just by computer manufacturers). If that isn’t enough, of the over 8,000 chemicals used to dye clothes and fabric, less than .004% are actually considered non-toxic. Even glues and paints contain solvents that steadily pollute the air long after they are dry.

Ten Ways to Minimise Product Waste

The key to reducing ecological rucksack is innovative thinking in the form of product waste minimisation, a design process that goes beyond the examples of a carpenter examining a piece of wood before it’s cut to ensure that all its pieces will be useable afterwards – or a dressmaker arranging pattern pieces on a length of fabric to reduce wasted cloth. True waste elimination takes into account the waste created during the production of a product while reducing the product’s potential to create waste during and after its use. For example, when designers at Nike Inc. tried to manufacture shoes in a sustainable way, they ran into problems because they still used traditional materials and specifications. Roadblocks were overcome by developing product engineering concepts called “considered design” principles with the aim of reducing environmental impact, eliminating waste, using environmentally sustainable materials and eliminating toxins in manufacturing processes and the shoes themselves. Nike estimates that this will reduce waste in its supply chain by 17% and increase its use of sustainable materials by 20%.

Following are ten common guidelines³ designed to reduce product waste:

1. Carefully design the product beforehand so that the amount of resources and raw materials used to make it are reduced (and optimised) and can be used in a closed-loop recovery system. In the past, product design was based on appearance, function and financial profit. Today's goods need to add 'material recovery' and 'reduced complexity' to the list in regards to the two types of raw materials that constitute most products: technical and biological. Technical materials are synthetic or mineral and can remain in a closed-loop system of recovery and reuse. Biological materials are biodegradable and should be returned to the environment where they can be broken down safely and organically. For example, the 'gDiaper' came into existence after its inventors learned that approximately 38,000 'disposable' diapers go into landfill sites in the USA every minute and each takes 500 years to decompose. gDiapers are made from biodegradable materials that are put together using environmentally friendly production methods. This means that unlike their wasteful counterparts, gDiapers contain no elemental chlorine, no oil-based plastics, no perfumes and no smell. They are so benign that they can be flushed down a toilet or composted in a garden after use.

Reducing the complexity and/or number of components in a product minimises waste, labour and manufacturing costs. For example, in the USA a toilet valve was redesigned by its manufacturer and ended up weighing seven times less, went from 14 parts to one moulded part, and had its production costs reduced by 80%. Meanwhile, a windshield wiper was re-engineered, went from 49 parts to one, and could therefore be manufactured at a lower cost despite the fact that the new product was made from more expensive carbon fiber.⁴

2. Design products so they can be easily disassembled after use. One of the more important aspects of product waste minimisation is called 'designing for disassembly'⁵, which allows a product to be quickly taken apart at the end of its life for recycling or remanufacture (more about this later). Designing for disassembly involves:
 - enabling the removal of the product's parts without damaging them (including the quick removal of all fasteners and connectors),
 - clarifying and simplifying the parts classification process (thereby making it easier to determine which parts can be reused, remanufactured, or recycled),
 - maximising all reuse, remanufacturing, or recycling processes, and,
 - ensuring the processes that sort, separate and purify disassembled parts does not create waste.
3. Reduce the hazardous makeup of the product. Lower or eliminate the toxicity of a product's raw materials or parts by replacing them with non-toxic alternatives. Reducing toxin use helps eliminate the (often unconsidered) expenses induced by hazardous materials. These costs include: (a) specialised handling and packaging requirements, (b) specialised transport needs, (c) health and safety costs, (d) specialised equipment expenses, (e) employee training expenses, and, (f) specialised disposal costs.

Examples include: In Poland, a street light manufacturer discovered a way to replace the methylene chloride used to make its products with an environmentally safe alternative and saw its costs plummet. The Hollywood Memorial Hospital in Hollywood, Florida replaced the

hazardous mercury-based batteries in its portable cardiac monitoring equipment with environmentally friendly zinc-air batteries. Although the new batteries cost 15 cents more, they reduce costs by more than 25% because they last longer and they lowered the hospital's mercury waste by 155 kilograms annually. In Sweden, chemist Mats Nilsson discovered a flame retardant chemical that's both harmless to humans and safe for the environment. Currently, the most widely used flame retardant in the world (bromide) is lethal, yet the danger is seen as a price worth paying for reducing the flammability of clothing. Derived from grapes and citrus fruits, Nilsson's alternative can be used in applications from mattresses to high-tech goods to kid's clothes and is set to revolutionise the flame retardant industry while reducing bromide levels around the world.⁶ Nilsson's work is a good example of 'biomimicry' - replacing toxic or hazardous production processes with safe, sustainable, and biodegradable alternatives. Carpets, chemicals, clothing, medicines, motor oils, and plastics are just some of the products that can now be created by biological organisms in a safe and environmentally sustainable manner.⁷

4. Switch to non-hazardous manufacturing methods. Manufacturing processes that rely on hazardous chemicals, heavy metals, refrigeration or combustion are usually more expensive than they appear. For example, the GlaxoSmithKline pharmaceutical company in Verona, Italy reduced the environmental impact of manufacturing a chemical being tested to treat chemotherapy-induced nausea and vomiting. Originally, the method for making the chemical relied upon subfreezing temperatures that required huge amounts of energy and produced significant amounts of waste. The improved process removed a number of hazardous substances from the production of the chemical, reduced the need for extremely low temperatures (which saved energy), reduced waste by 75%, and lowered the cost of raw materials by 50%.⁸ In another example, a laboratory in the United States that manufactures biological slides used a toxic solution made from mercury to prepare its specimens. The laboratory could not find an alternative for the mercury solution until one day one of the lab workers jokingly suggested using the soft drink he had just purchased (7-Up). It worked. Since 7-Up is safer and cheaper than the costs of mercury it helped the lab reduce expenses.
5. Reduce the amount of energy required to make the product and use sustainable energy sources. Examples include:
 - using energy-efficient equipment in production processes (more about this later),
 - using remanufactured material in the product's makeup, and,
 - using sustainable energy supplies (i.e.: wind or solar energy) from major energy producers or using micro-energy sources to supplement the powering of production equipment.
6. Use newer and cleaner technologies whenever possible. Many products can be made more efficient by teaming them with new technologies. Examples include containers that safely and effectively store liquids yet are still biodegradable; tubular skylighting, which captures outside light and redirects it into buildings; transmitting subscriber-based news and information over the Internet instead of printing it (university courses can also benefit from this practice, which eliminates the need for students to travel to a classroom); and the eCube, a device the size of a hockey puck that attaches to a refrigerator's temperature

sensor (the eCube prevents the wasteful turning on of the cooling unit every time the refrigerator door is opened, which can reduce energy requirements by up to 30%). Meanwhile, Proctor & Gamble super-concentrated its detergents so they fit into smaller containers, thereby eliminating 40,000 truck deliveries annually. In 2007, Wal-Mart announced that it would begin a transition toward selling only similarly concentrated laundry detergents, which use less water and therefore require less packaging and space for storage. Every major supplier in the detergent industry has now become involved.

7. Use sustainable re-manufactured, recycled or scrap materials to manufacture products. Closed-loop practices allow the original raw materials, energy and manpower of a product to be recaptured and used again. For example, in 2004, the 3M company reformulated a brand of carrier tape so it could be manufactured entirely from the waste materials of other products. The new product, which is made of 100% recycled material, not only costs less to make, it also reduced the plant's waste by 120 tons in the first year of production. Similar examples include efficient-minded paper companies that return damaged rolls to their production lines and plastics manufacturers that take off-cuts and re-incorporate them into their machining processes.
8. Improve quality control and process monitoring in all production processes. By increasing the frequency of production inspections (as well as the number of inspection points) and displaying real-time production information, most production problems can be identified, stopped and corrected at an early stage before waste becomes a problem. For example, American retail giant JCPenney's installed a computer programme that shows ongoing electricity use in several of its stores in 15-minute intervals. Any spike in power usage is immediately investigated by employees.
9. Find ways to have products returned to their place of manufacture so they can be disassembled, harvested and used to make new products. By rewarding customers for returning used products, a steady supply of (free) raw materials is maintained and relationships with customers are strengthened.
10. Reduce packaging requirements, use recyclable packaging material or find ways to eliminate packaging altogether. Less packaging saves money in two ways: it reduces production expenses and it reduces waste disposal costs. A Pollution Prevention Pays team at 3M, for example, redesigned the packaging of Post-It notes by eliminating cardboard back cards and blister covers from every unit. The result saves the company over \$350,000 annually and eliminates 35 tons of waste every year.

Additional examples of companies that have used these guidelines in one form or another to reduce waste and costs and promote long-term profitability include:

- Clorox recently unveiled its first new brand in 20 years (Green Works), the initial launch of which includes five cleaning products that are at least 99% natural. The company subsequently won a rare endorsement from the Sierra Club for its efforts.
- In a bid to become more competitive, floor-cleaning machine manufacturer Tennant declared itself an environmental solutions provider and then lived up to its new label by designing a floor cleaning apparatus that uses electrically charged tap water to clean floors without costly chemical cleaning solutions. The toxin-free result has been confirmed as

superior to everything else on the market. Talk about a 'game changer!'

- The Nitech company (a battery manufacturer) replaced its disposable batteries with rechargeable batteries and developed a new product line.
- The Hoover washing machine company created a new range of washing machines that reduce energy, water, and detergent consumption. The new designs won several awards and have dramatically increased profits.
- Frigidaire improved its refrigerators by reducing chemical levels, improving the efficiency of its motors, improving compressor design, developing better seals and gaskets, and designing smaller refrigerator doors (which helps keep cold air in). Increased profits followed.
- Stelrad Ideal (Caradon Heating) improved its line of domestic boilers by using flue heat to supplement the heat produced by the boiler's gas burner – thereby boosting the efficiency of its product to over 95%.
- SC Johnson Wax made a pledge to develop product packaging from 100% recycled materials. The change saved the company much money and generated lots of welcome attention in the press.
- The Trannon furniture company developed a whole new range of sustainable products from locally-grown forestry thinnings and coppiced wood. As a result, the company won several awards.
- Pax designed a new line of air gun pellets (under the brand name Prometheus), all of which are lead free. Since 80% of Prometheus pellets are sold to farmers in Indonesia for pest control, this has greatly reduced the amount of lead detected in paddy fields. What's more, Pax now uses the waste plastic from the production of its pellets to make its packaging.⁹

The bottom line: public expectations about corporate sustainability efforts are continually rising. To future-proof products (i.e.: to insulate them from risk and uncertainty) reduce waste in all phases of their lifecycle to avoid new legislation, increases in raw materials expenses, and bad publicity. Forewarned is forearmed.

19. Minimising Packaging

Packaging comes in many shapes and forms: boxes, bags, cans, foam pellets, shrink wrap, tubes, paper, etc. Its purpose is to protect a product and keep it fresh. Additional benefits include enhanced attractiveness and protection from tampering. The three most common types of packaging are:

- Primary packaging, which is the wrapping or container handled by the consumer.
- Secondary packaging includes larger cases, boxes, or bags used to group goods for distribution, ease of carrying, or display in shops.
- Transit packaging refers to pallets, boards, plastic wrap, and containers used to collate products into larger loads for shipping.

Despite the benefits that packaging provides, many products contain too much. This is annoying to those who have to pay to throw it away. Wal-Mart, for example, recently unveiled a packaging ‘scorecard’ to its suppliers demanding that their packaging be reduced by at least 5% (Wal-Mart discovered that up to 20% of its garbage was directly attributed to packaging). By issuing this edict to its 60,000 suppliers, Wal-Mart expects to reduce solid waste by 25% and shave \$3.4 billion off operation costs.

The improved milk jug is an excellent packaging improvement example. Many plastic milk jugs are now more cube-shaped, which lowers packaging expenses by 10 to 20 cents per jug. Square containers also store 50% more milk per square metre so more milk can be put on trucks thereby reducing trips and fuel costs. Sam’s Club (a division of Wal-Mart) says that these jugs allow for almost three times the amount of milk to be placed in coolers and eliminate over 11,000 truck journeys annually.

Reducing the Costs and Waste of Extraneous Packaging

Since packaging is responsible for a substantial amount of waste, and waste is always a sign of wasted money, reducing the amount of material that surrounds a product is a good way for a business to decrease its expenses. How much packaging delivers true customer satisfaction? Knowing the answer to this question can lead to a substantial reduction in costs as well as the elimination of extraneous materials that nobody wants or needs. Tried and tested suggestions include:

- Use the least amount of packaging possible (or better yet, none at all). Estimates claim that up to 98% of secondary packing (i.e.: a box outside a box, a bag outside a bag...) and a significant amount of primary packaging can be reduced without any perceived decrease in the quality of the product or its package. In Australia, for example, several small business manufacturers have been able to save up to \$30,000 a year by reducing the packaging surrounding their products.¹ In the USA, the State Farm Insurance Company in Bloomington, Illinois saved \$23,100 in annual packaging costs by eliminating unnecessary shrink-wrap from the booklets it distributes.²
- Redesign packaging to reduce material use. Sometimes a small change in the design of a package can significantly reduce the cost of raw materials. For example, Anheuser-Busch reduced its aluminum usage by 9.5 million kilos per year by shaving a third of a centimeter off the rims of its beer cans. In 1989, the Digital Equipment Corporation in Maynard, Massachusetts made it a priority to reduce packaging materials and subsequently

redesigned the amount of packaging used to ship metal computer cabinets. As a result, the company saved \$300,000 in one year. Furthermore, by using bakery racks on wheels in place of disposable packaging to transport sheet metal parts from one area of a plant to another, the company saves an additional \$200,000 annually.²

- Reuse packaging materials and containers whenever possible. Extending the life of packaging materials saves money. The 3M corporation's plant in Valley, Nebraska, for example, worked with a supplier to produce returnable packaging that reduced shipping waste by eight tons and saved over \$1,500 per shipment in packaging and disposal costs. Other companies have begun similar policies by asking customers if they mind having their purchases placed in used packaging (apparently, most customers don't mind a bit). Some CEO's consider this practice to be so financially advantageous, that they see re-useable packaging as akin to being given money by suppliers.
- Repair and re-use heavy-duty shipping materials. This is particularly true with pallet shipments. For example, like many large companies, Wilton Industries paid over \$100,000 every year for approximately 14,000 new pallets. Now the company saves \$64,400 annually by repairing and reusing damaged pallets and avoiding unnecessary pallet disposal costs.
- Use recycled materials from sustainable, renewable sources or alternative materials (such as wheat straw) whenever possible for packaging. With the third largest emitter of global pollution in the world being the pulp and paper industry the benefits of this practice cannot be overstated.
- Maximise the amount of material shipped on pallets and in vehicles. This practice alone has saved many companies millions of dollars a year in shipping costs. For example, 3M Inc.'s St. Ouen L'Aumone facility in France developed a new stacking system that allowed more materials to be packed onto transport vehicles. The new system has doubled load capacity, reduces the number of daily truckloads by 40%, saves 47,316 liters of fuel, and cut transportation costs \$110,000 per year.
- Use cardboard edges on the corners of large items (or those shipped in bulk) and shrink wrap what remains rather than boxing each item separately. This practice saves furniture maker Herman Miller, Inc. (of Zeeland, Michigan) \$250,000 every year in packaging costs with just one of its products.
- Use thinner, stronger, and more opaque paper for paper packaging needs.
- Replace cardboard boxes with more durable, reusable containers. This is especially advantageous for warehouses or interdepartmental shipments. In Cottage Grove, Minnesota, a 3M facility designed collapsible, reusable steel crates robust enough to stack on top of one another. As a result, the company avoided producing 315 tons of solid waste and saved \$101,800 in the first year alone.
- Ask suppliers to accept returnable containers and packaging materials. Automotive giant General Motors did this and slashed over \$400 million from its supply chain costs.
- Sell unused packaging waste to a recycler. Contact a local waste disposal company or public works department for details.

- Work out a shipping system that reduces the time it takes to package and send items.
Generally speaking, the more time it takes to package and ship products the more it costs.

It's Not Just Good Business, It's the Law

Local, state and federal governments are passing laws making it mandatory to return products and their packaging to the point of origin after use. Recyclable materials such as paper and plastic are being banned from landfill sites in a bid to force economical use. The day may soon come when products - and their packaging - will be tagged with a toll free telephone number or a bar code so that they can be identified and picked up at the end of their useful life for reuse, remanufacturing, or recycling purposes. Stay ahead of the curve.

20. Reuse, Remanufacturing, and Recycling

Of all the sustainable options available, the simplest and most cost effective is to reuse a product (or its components) as many times as possible without altering them in any way. Stewart's Shops in the northeastern United States, for example, has been using refillable glass soda bottles and plastic milk bottle containers in its over 200 stores for more than 40 years. Stewart's milk bottles are reused around 50 times before they're replaced (which saves the company five cents per bottle). The company's soda bottles are reused about 20 times, thereby saving 14 cents per bottle. With sales of more than twelve million bottles annually, these savings add up. One programme in particular that Stewart's is involved with sells milk in refillable bottles to a local school. Since the bottles are reused 100 times before being replaced, the school's waste has been reduced by 700,000 milk cartons per year, which dramatically lowered the school's disposal and purchasing costs.

In a similar product reuse story, the Ashbury Park Press in Neptune, New Jersey changed its machine-cleaning procedures by switching from disposable rags to reusable cloth rags. Even though the reusable cloth rags must be laundered, the company still enjoys an annual cost savings of \$36,400. Further west, in Minnesota, the Itasca County Road and Bridge Department replaced the disposable air filters in its garages with reusable filters. The switchover means that a bit of extra labour is needed to clean the reusable filters, but fewer filter purchases and reduced disposal expenses amount to thousands of dollars in savings every year.¹

When Extending the Life of a Product, Quality Counts

The ability to extend the life of a product is reliant upon quality – and, as most people are aware, quality usually costs more. The good news is that the extra cost of quality almost always results in the ability of a product or its materials to be used longer - and the longer a product is used the less expensive it becomes (as the old adage says, 'if you buy cheap, you buy twice'). Take, for example, another cost-saving example made by local authorities in Itasca County, Michigan. County buyers chose to purchase only one brand of high quality chainsaw instead of a multitude of cheaper chainsaws. The more expensive purchases were approved after county officials factored in the savings from the longer product life of higher quality combined with the ease with which the quality chainsaws could be repaired. Furthermore, when it came time to make repairs, the county saved even more money because parts from the higher quality saws could be used as repair replacements (something that couldn't be done with the cheaper saws). This practice not only helped extend the life of the remaining saws (thereby reducing the number of new saws needed) it also reduced the disposal costs associated with throwing away a used chainsaw.

Product Life Extension

Reusing products and their materials is a win-win situation for all involved. From a customer's standpoint, reusing a product decreases waste, reduces disposal costs, and lowers the expense of purchasing replacements. From a manufacturer's viewpoint, similar savings occur. At some point, however, a product or its parts may undergo too much wear and tear and be deemed unsuitable in a reuse application. This does not mean that the product or its parts have reached the end of their useful life. In many cases, they can be broken down into their base materials or components in order to be used again for the same or other applications.

Remanufacturing (to as good-as-new-condition)

Remanufacturing to as good as new condition is a three-step process whereby: (1) a used product is disassembled, (2) its parts are cleaned and repaired, and, (3) the parts are reassembled to a sound working condition. The term 'sound working condition' is key because in some areas of the world, reassembled products made from used parts are considered new and come with the same guarantees and warranties as products made from virgin raw materials. Conversely, in other regions, remanufactured (or refurbished) products must be labeled as such by law even if they carry the same warranties.

A Case Study

In 1972, Caterpillar Inc, a manufacturer of heavy earth-moving and construction equipment, was chosen by the Ford Motor Company to supply diesel engines for a new Ford delivery van. Ford's decision surprised a number of people. At the time, the Cummins Diesel Company was expected to win the Ford contract because it dominated the diesel engine business partially by keeping its costs down through the remanufacturing of used engines. Caterpillar knew that to remain competitive and retain its relationship with Ford, it too had would have to keep its costs down and increase its knowledge base. So after careful analysis Caterpillar decided to open up a remanufacturing plant in Bettendorf, Iowa, close to its Peoria headquarters. The idea was to test this new venture and see where remanufacturing would lead.

Ten years later, convinced that it was moving in the right direction, Caterpillar relocated its growing remanufacturing activities to Corinth, Mississippi and set-up shop in an abandoned factory building. Land was cheaper in this part of the country and the location was more central to the majority of Caterpillar's customers as well as a proliferation of road networks. Three years passed before a second Caterpillar remanufacturing operation was opened up across town.² Success met with success and soon thereafter the company began operating a third facility in nearby Prentiss, Mississippi. Today, Caterpillar's Sawyer plant in Corinth receives worn engines and assemblies from all over the country - mostly from dealers who send the company around 160 tons of used equipment (about 17 truckloads) every day. The items Caterpillar finds suitable for remanufacturing include engines, fuel pumps, injectors, oil coolers, cylinder packs, and hydraulic assemblies - each of which must be exhaustively taken apart by hand. On average it takes two workers a half-day of hard work to reduce one engine to its components. Every piece, including the tiniest screw, is saved because employees have been taught that anything placed in the trash is money thrown away.³

Almost every part that Caterpillar tries to salvage is embedded with grease, oil, carbon build-up, paint, or rust. A mixture of baking soda with 10% alumina grit is needed to remove these contaminants. Afterwards, the scrubbed parts are sent away for inspection and sorting and the waste used to clean the parts is collected and used as a reagent in the neutralisation of acidic liquid waste – a process that renders both liquids non-hazardous and has reduced the company's annual liquid waste from over 4 million kilos to just over 2 million kilos.⁴ Of course, not everything is recoverable. The parts and materials that aren't suitable for remanufacturing are passed on to the company's foundry in Mapleton, Illinois, where they're melted and recast. In 1999, Caterpillar's foundry recycled 106,835 kilos of aluminum alloy; 7,650,312 kilos of cast iron; and 2,576,679 kilos of steel.

It hasn't all been smooth sailing. One of the difficulties inherent in remanufacturing is maintaining a steady stream of used equipment. Without prior preparation it's quite possible to receive several truckloads of used products one week and then nothing for several weeks afterwards. Caterpillar eliminates this problem by offering its customers incentives that make them unwitting suppliers in the remanufacturing process. For example, when a customer needs a new part or a new piece of equipment, he or she is first asked to submit the old one. The customer is rewarded with a new part at up to half its full price. If the customer does not hand in the old part, the full price is charged.

Additional lessons have also been learned. By designing and producing higher quality parts in advance, Caterpillar has discovered that it can get two or three lives out of its products. Manufacturing a component with another millimeter layer of metal on it may cost more, but the company knows that this investment will ultimately yield more profits because the improved product can be remanufactured. For example, Caterpillar estimates that it can remanufacture a good engine three times before it simply can't be used again – a practice, which produces such substantial profit margins that more than \$1 billion worth of sales were reported in 2005 at Caterpillar's Corinth operation alone.³ Before the recession of 2009, this number grew at least 15% annually.

Further savings are derived at Caterpillar from the company's commitment to reuse and recycle common work materials to add to its remanufacturing processes. For example, the wood pallets on which most equipment arrives are regularly inspected, repaired, and reused. When they can no longer be repaired they're sold to a packaging company as boiler fuel. Similar waste reduction systems are in place to reduce office paper, aluminum cans, computer equipment, and cardboard packaging. Today, 96% of the waste stream at Caterpillar's Corinth plant is either reused or recycled – making the programme so successful that it's sparked off similar programmes in local schools, government offices, and 15 nearby industries.⁵

The Basics

For all the dirty work involved, the costs of revitalising a previously manufactured product can be 30% to 70% less than creating the product from scratch. This is because remanufacturing conserves the original energy, materials, labor, and manufacturing effort that exist in every product.

Generally speaking, in many manufacturing processes 70% of the cost of producing a product from scratch is needed for materials and 30% pays for labor. Remanufacturing tries to recover the 70% of material costs invested in the original product.

How much energy and materials can be exhumed from a remanufactured product? According to studies undertaken by Dr Rolf Steinhilper formerly of the Fraunhofer Institute in Stuttgart, Germany, (he is currently at the University of Bayreuth) the energy savings derived from remanufacturing worldwide equal the electricity generated by five nuclear plants or 10,744,000 barrels of crude oil carried by a fleet of 233 oil tankers. In addition, the amount of raw materials saved would fill 155,000 railroad cars and form a train 1,770 kilometers long. By avoiding these expenses, remanufacturing allows companies the choice of offering lower cost product ranges to customers while enticing new buyers into markets where the price of introducing new products is seen as prohibitively high.⁶ Refurbished (i.e.: remanufactured)

computers, for example, particularly laptops and PC's, are renowned for offering exceptional value-for-money.

The Economic Advantages of Remanufacturing

Over 70,000 firms in the United States, most of which employ 20 people or less, are involved in remanufacturing. Because these firms are virtually unknown, remanufacturing is often called the 'invisible industry'. Together, these businesses accumulate over \$50 billion in annual sales and directly employ over half-a-million workers. If all the people indirectly employed by remanufacturing were added to the latter figure (e.g.: suppliers, distributors, retailers, installers, service providers, etc...) it has been estimated that the total number of people involved would be in the millions.⁶ Evidence has shown that most remanufacturing firms also do well during times of recession and that no end to the industry's growth is in sight. According to researchers Robert Lund and William Hauser, the total financial value of products that could be remanufactured is around \$1.4 trillion. With only \$50 billion worth of goods currently being remanufactured, this suggests that the potential of the remanufacturing industry has yet to be fully tapped.

Despite the positive outlook, however, remanufacturing is virtually ignored by most businesspeople, which is why it's called the stealth business model. Those who study the remanufacturing industry say this invisibility is due to the wide dispersion of remanufacturers, the diversity of products they breathe new life into, and the small size of the majority of players. With the profit margins of remanufactured goods as high as 40%, however, one can only wonder why more businesses aren't taking advantage of this practice.

The Challenges Involved with Remanufacturing

As with any product process, remanufacturing is not a panacea nor is it suitable for every product, market, or business operation. Traditionally, it has proven difficult to remanufacture the following:

- Products that regularly undergo rapid technological changes.
- Products that take advantage of current or fleeting trends ('Industrial design is a field that was specifically invented to convince people that the washing machine, the car, or the refrigerator they had was out of fashion,' says efficiency pioneer Walter Stahel, 'and fashion is something that can't be remanufactured.')
- Products specifically designed to thwart attempts to disassemble and rebuild them (an act of protectionism to prevent firms from remanufacturing another business's products).
- Products that are sold at such a low cost that it's cheaper to buy a new version.
- Markets where consumers consider the terms 'remanufactured' or 'refurbished' to be synonymous with low quality.

Getting Started in Remanufacturing

Despite the gains that can be obtained from remanufacturing, the commitment to establish a remanufacturing setup should not be taken lightly. First and foremost a study should be taken of the market potential for the proposed remanufactured product and the company involved should be certain that it will not be competing against itself and its other products. A sound

marketing plan must also be established to inform new and current customers that remanufactured products are just as durable as new products made from virgin raw materials. Additionally, employees will need to be educated and trained so they firmly believe that what many of them used to call garbage is seen as 'assets in transition'. Equally as important is that the company must have the means to locate, recover, and transport its used products and have the resources and ability to disassemble, clean, sort, and inspect them for remanufacturing (a.k.a.: reverse logistics). For this reason many companies partaking in remanufacturing practices find it advantageous to have their disassembly-process employees communicate openly and often with their product designers. This allows for a wealth of information to be accumulated as to how long-life improvements can be made in original products. In addition, tools and equipment may have to be purchased or developed to quality-test remanufactured parts before they're used again. Lastly, a plan for properly disposing unusable parts (as well as any chemical agents or materials used in the remanufacturing process) must also be developed and implemented.⁷

Recycling

Cascade Engineering, a Grand Rapids, Michigan, plastics manufacturer that makes parts for cars and various plastic containers -- including trash cans -- has cut the amount of trash it sends to landfills from 2,475 tons in 2003 to just over 700 tons this year. "We've gone from every-other-day pickups to once every couple of weeks," says Kelley Losey, an environmental services manager at the company. The secret to this success is recycling.⁸

Although the word 'recycling' is a generic term that often includes the reuse or remanufacture of a product or material, for the most part it refers to a process in which used products or packaging are collected, cleaned, shredded, melted down, or otherwise reduced to recover their basic materials. What remains is used as a total or partial replacement to create something new. Virtually anything from building materials to metals to chemicals to paper to plastic to fabrics or food and cloth - and in some cases, unused medicine - can be recycled. Even substances at a molecular level can be tagged with nanotech markers for later reclamation and recycling. That being said, recycling should always be considered *after* a successful waste minimisation programme has been implemented.

Although recycling is more expensive than reuse and remanufacturing, it often makes financial sense because it recaptures the value of raw materials as well as the energy and manpower that went into converting them into basic product materials. In some cases as much as 70% or more of this value can be reclaimed. For example:

- Making paper from recycled materials uses 70% less energy and produces 73% less air pollution compared with making paper from virgin raw materials.
- Recycling a plastic bottle saves enough energy to power a 60-watt light bulb for three hours.
- 25-30 plastic one-liter plastic bottles can be recycled into one fleece jacket.
- A recycled glass bottle saves the amount of energy needed to power a computer for 25 minutes.

- Manufacturing aluminum from scrap requires up to 95% less energy than producing it from scratch.
- In Britain, it's been estimated that if all the aluminum beverage cans in the UK were recycled instead of thrown away, the country would need 14 million fewer garbage cans.⁹

Recycling and Job Growth

According to a White House Task Force study, recycling activities prior to 1998 employed more than 2.5% of the USA's manufacturing workers – which amounted to one million jobs and more than \$100 billion in revenues. Two years after this study was published, recycling was credited with producing 1.1 million jobs and grossing over \$236 billion in revenues. Indirectly, it has been estimated that recycling creates an additional 1.4 million jobs and over \$173 billion in receipts. According to the Institute for Local Self-Reliance, the United States grew 2.1% per year between 1967 and 2000 while the recycling industry enjoyed, on average, an 8.3% increase in employment and a 12.7% increase in sales per year.¹⁰ This means that for every 10,000 tons of waste that's recycled, around 36 new jobs are created. Compare that to incinerating the same amount of waste, which creates one job.

The Complexities of Recycling

Despite the good news, recycling is not without its costs and complexities. Many materials cannot be endlessly recycled because they weaken or degrade during the recycling process (or they have been blended together with other materials and cannot be separated), which means that part or all of the original value of the material, energy, labour, and other manufacturing inputs that went into making the product is lost, compromised or destroyed (a process called 'downcycling') Additional labour, energy and manufacturing capital may therefore be needed to bring the desired material up to scratch. In terms of strength and mass, for example, aluminum is reduced by around half after being melted down in a recycling process and requires pristine inputs to meet quality standards. The most common forms of glass, however, can be endlessly recycled - a fact that can open up new cost-saving opportunities in terms of packaging and building materials (e.g.: liquids that are traditionally shipped in aluminum cans or glass bottles can instead be shipped in giant vats and be poured into bottles at their destination, which reduces transport costs and carries the potential to create local jobs). Still other materials (such as those used to make carpets), actually improve after recycling for reasons that continue to puzzle scientists.

A good way to illustrate the versatility, strength, and weakness of recycling is with plastic. Some plastics, such as those made from high-density polyethylene (HDPE), can be recycled several times. Others either aren't recyclable or require a percentage of non-recycled material added to them so as to maintain an acceptable level of quality. For example:

1. Type one plastics, polyethylene terephthalate (PET or PETE), are clear and tough and resistant to heat. PET plastics are commonly used to make food and drink containers. When recycled, PET plastic shreds can be endlessly converted into recyclable fibers (also known as polyester) for clothing, carpeting, fiberfill, and geo-textiles.
2. Type two plastics are stiff and tough and are made from high-density polyethylene (HDPE). Because HDPE plastics have good chemical resistance, they make excellent

opaque containers for household and industrial chemicals. When recycled, HDPE plastics are reduced to landfill liners, fencing material, flower pots, plastic lumber, recycling bins, buckets, oil containers, and benches.

3. Category three plastic (polyvinyl chloride or vinyl) is commonly referred to as PVC and is used to make food containers, medical tubing, wire and cable insulation, clear packaging (cling film), plastic pipes (for plumbing and construction), gutters, floor tiles, carpet backing, and window frames. When recycled, PVC is often reduced to traffic cones, flooring, garden hoses, and mobile home skirting.
4. Category four plastics, low density polyethylenes (LDPE), are used to make garbage bags, dry cleaning bags, shopping bags, squeezable bottles, food storage containers, and flexible lids. After recycling, LDPE's are downgraded to floor tiles, shipping envelopes, and furniture.
5. Type five plastic, polypropylene (PP), is resistant to heat, chemicals, grease, and oil and is therefore used to make food containers such as margarine tubs, microwaveable trays, packaging material, medicine bottles, aerosol caps, and drinking straws. Recycled PP is reduced to ice scrapers, rakes, sheeting, traffic signal lights, automobile battery cases, brooms, and oil funnels.
6. Polystyrene (PS) is quite versatile and can be made into a hard, brittle plastic for compact disc jackets, combs, pens, plastic tableware, aspirin bottles, etc. Polystyrene can also be injected with air (foamed) and molded into Styrofoam packing, grocery store meat trays, clamshell containers (used in fast food restaurants), and egg cartons. When recycled, polystyrene can be converted into foam packaging, foam plates, thermometer casings, light switch plates, vents, and desk trays.
7. The seventh category of plastic includes plastics that do not fall into the previous six categories. One example is melamine, a plastic used to make plastic cups and plates. Category seven plastics are often mixed with resins and used in multi-layer configurations. Applications include large reusable water bottles, citrus juice bottles, food containers, and Tupperware. When recycled, seventh category plastics can be used to make plastic lumber and plastic bottles.

It is important to note that mixing together any of the seven types of plastics often renders the result more difficult or even impossible to recycle.

Recycling and Industrial Waste

Almost any substance, no matter how toxic or filthy, can be recycled in some way. This is particularly true with hazardous substances found in industrial waste that would otherwise require specialised and costly disposal methods. Most industrial waste contains potent properties that can be used in applications that require large amounts of inherent material strength. Foundry sand used in metal casting, for example, can be recycled into sub-base filling for road construction, road embankments and structural fill. Coal waste (ash, boiler slag, fly ash, flue deposits and desulphurised material) can improve the strength and durability of concrete and manufactured wallboard. Material from construction and demolition sites (including shingles, scrap wood, and drywall) can be recycled into asphalt paving, re-milled lumber,

wallboard, and concrete.¹¹ Even paint and old tires can be made into high quality caulks and flooring. The point is that recycling carries almost endless possibilities. In India, for example, discarded plastic bottles and bags are being shredded, melted and added to roadway asphalt to improve the integrity, water resistance and durability of paved roads. Apparently, roads embedded with melted plastic last three times longer than conventional roads (although keep in mind that the environmental impact of this practice is unknown).

If Recycling has So Many Advantages, Why do So Many Businesses Ignore It?

‘So let me get this straight,’ a student once remarked, ‘reusing, remanufacturing, or recycling the products and materials we throw away can (he held up a finger to emphasise each point): (1) drastically cut a company’s energy needs, (2) lower raw material costs, (3) reduce climate-change problems, (4) employ more people and, (5) lower production costs up to 70% or more, and yet most of the world’s businesses don’t take part in any of them?’

This wry observation helps explain why pressure is mounting to increase recycling legislation. Economists claim that if the possibilities of cutting costs and increasing profits exist with recycling, companies operating in a free market will eventually find these savings whether or not government intervenes. Yet for countries stricken with rising unemployment and rising waste and pollution levels, the question increasingly being asked is ‘when will businesses take note?’

Is Everything Recyclable?

Unfortunately, no. Substances used in the medical and livestock industries, for example, can be unsuitable (some scientists believe that the mad cow disease outbreaks in the UK began when infected sheep carcasses were ground up and recycled as cattle feed). Clearly, there is no substitute for research, common sense, and basic safety that errs on the side of caution when it comes to recycling.

For More Information

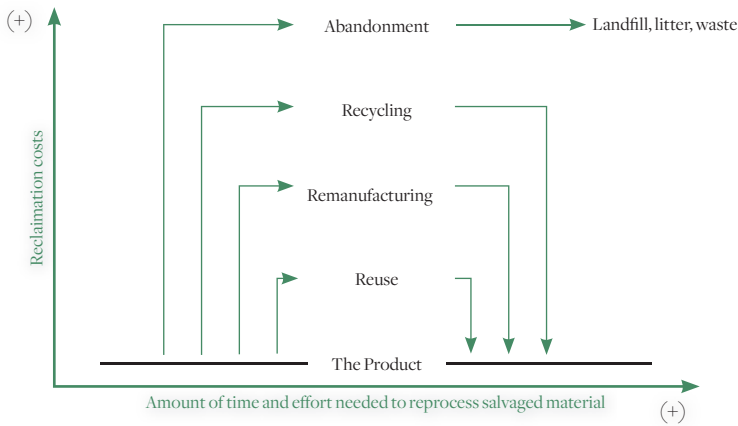
For additional facts about recycling and its financial benefits, the book, *WASTEnomics: Turning Waste Liabilities into Assets* by Ken Tang and Jacob Yeoh is highly recommended. Contacting a local waste disposal company or public works department for the names of nearby recycling centers is also recommended. In addition, visit: www.euwid.de (click on the appropriate language translation icon). ‘Euwid’ is a German-based organisation that publishes newsletters and trade journals in German, English, and French. Many waste specialists keep abreast of the latest recycling developments using information posted on this site.

Alternatively, visit the Recycled Products Purchasing Cooperative website at: www.recycledproducts.org or try: www.nfib.com/object/IO_28768.html (an American recycling site for small businesses). In the UK, visit: www.defra.gov.uk/environmental/waste/business/regulation/index.htm.

Reuse, Remanufacturing, and Recycling: An Overview

FIGURE 20-1 illustrates the costs and time involved in reuse, recycling, and remanufacturing. The further away from the original product the reclamation process lies, the more the investment in raw materials and other inputs is lost and the greater the costs are to the manufacturer (who has to purchase replacements). Similarly, the wider the base of each closed-loop practice, the more time, effort and expense is involved in collecting and reprocessing reclaimed material:

Figure 20-1
Amount of time and effort needed to reprocess salvaged material



PRODUCTION

...The mechanical, biological or chemical processes used to transform materials or information into products or services and deliver them to where they need to be. Offices, factories, farms, and restaurants all rely upon equipment and machinery in one form or another to turn information and resources into goods and services and since many of these tools (and processes) can waste as much or more than they produce, they present a prime target for efficient, sustainable practices.

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21. Sustainable Production Locations

The term ‘industrial ecology’ was coined in 1989 by Robert Frosch and Nicolas Gallopoulos to describe the growing practice of bringing manufacturing and service facilities together in a symbiotic manner. In layman’s terms, this involves arranging businesses in a way so that their wastewater, emissions, wastes and other outputs can be used as raw materials by other businesses. In a process called ‘energy cascading’, excess energy from one company (usually in the form of residual heat or steam) can also be used to provide heating, cooling, or system pressure for another. The advantages include a reduction in raw material costs, low waste disposal expenses and reduced energy requirements. Additional benefits associated with eco-industrial setups involve a reduction in pollutants, a decrease in company regulatory burdens, and lower demands on municipal infrastructures. Nearby cities and towns benefit too, thanks to enhanced business and job development, increased tax revenues, and reduced environmental concerns and health costs. The city of Londonderry, New Hampshire, for example, became interested in eco-industrial parks after spending ten years and \$13 million of taxpayer money cleaning up three toxic waste sites.

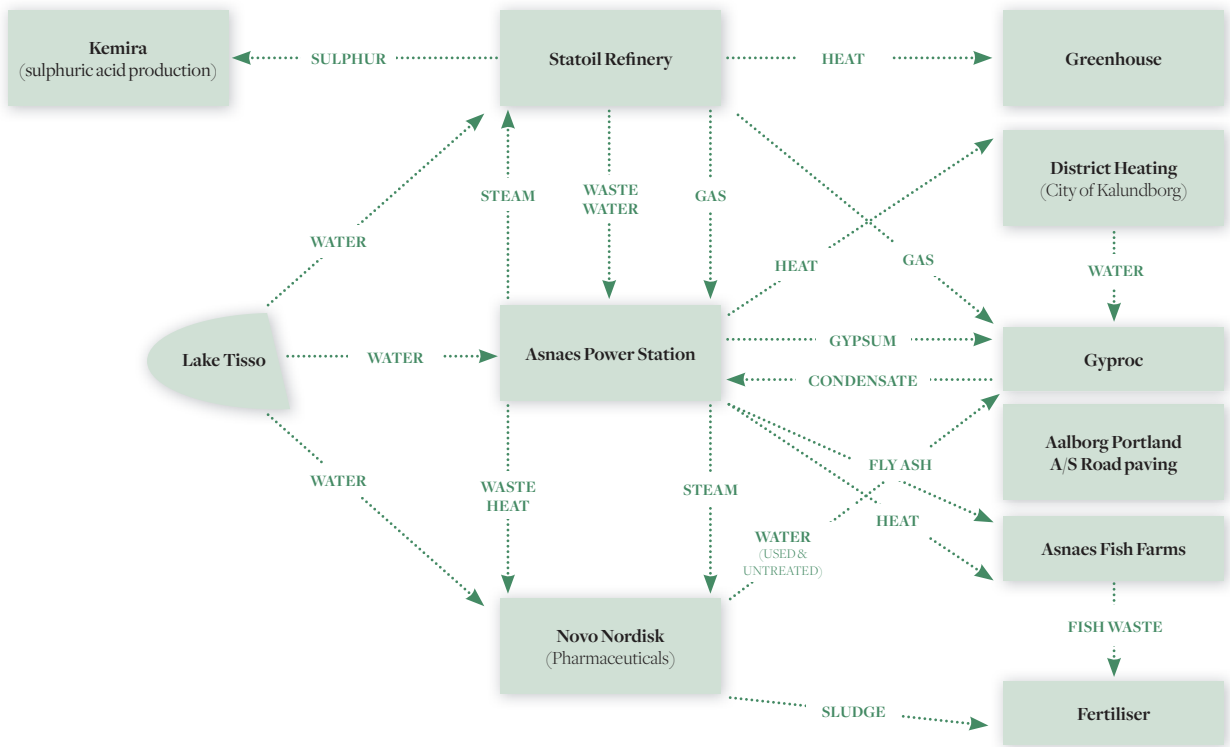
Building a Closed-Loop Eco-Industrial Park

Most eco-industrial park projects start by estimating the material, water, and energy needs of interested businesses. A network flow strategy is then devised to examine synergistic links between existing or interested companies (see FIGURE 21-1). Afterwards, active recruiting takes place to entice businesses whose production processes will help fill any gaps. According to industrial ecology planners, the most common characteristics of a successful eco-industrial park include:

1. Establishing material, water, and energy flows that can be used as raw materials to build sustainable or semi-sustainable closed-loop systems (material flows can include heat, steam, fly ash, sulphur, sludge, gypsum, steam, paper and plastic packaging, metal scrap, wood pallets, machine oil, and so on).
2. Placing companies in close proximity to minimise transportation and material transfer costs.
3. Establishing strong informal ties between plant managers and promoting free exchanges of information (which helps participating companies work toward a more collaborative work environment).
4. Helping with the minor retrofitting of existing infrastructure (carrying out modifications to the involved companies so their outputs can be more easily shared).
5. Maintaining ‘anchor tenants’ (usually in the form of a wastewater treatment facility or an energy producer) whose continued presence and outputs make industrial symbiosis practical.¹

Figure 21-1
Waste Exchange at the Kalundborg Eco-Industrial Park, Denmark

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How Successful are Eco-Industrial Parks?

A study of eco-industrial parks in Denmark (Kalundborg), Texas (Brownsville and Pasadena), New Hampshire (Londonderry), and Mexico (Matamoros), revealed that the annual economic benefit enjoyed by participating companies in an industrial ecology arrangement is as high as \$8 million, with an annual return on investment reaching 59%. In addition, reductions in millions of pounds worth of materials, waste, and emissions were also identified as well as significant decreases in the need for natural resources such as water.¹ The longevity of the Harjavalta industrial area in Finland, however, best demonstrates the amount of success an eco-industrial park can enjoy. After World War II, Finland suffered from severe energy shortages that forced Finish copper company Outokumpu to resort to 'autogenous smelting' (or 'flash' smelting) in which the heat produced by oxidising metal is used to maintain smelting processes. Outokumpu's flash smelter, which was the world's first, started operations in Harjavalta in 1949. Over the years, the Harjavalta site has expanded to include over a dozen major firms that rely on each other to compliment various production processes. Sulphur, sulphuric acid, slag, heavy metals and wastewater are just a few of the waste outputs used as resources. Today, almost 60 years after it began, the Harjavalta site employs over 1,000 people and incorporates the services of more than 100 subcontractors on a regular basis.³ Eco-industrial parks, it seems, have staying power.

22. Clean Production

Banskia Food Products Pty Ltd is a multi-million dollar company in the Sydney, Australia suburb of Moorebank. Its 30 employees process and package apples for the baking and catering industry. Not long ago, at the beginning of each production cycle, the company used a substantial amount of fresh water for washing the company's main raw material (apples). Afterward, the floors of the production areas became littered with apple cores and peelings that were then washed into drains using the excess juice derived from apple parts blanched in heated tanks. Recognising that a sizeable amount of money was literally being washed away due to wastage and other inefficiencies, the company asked an independent environmental management team to come in and investigate its efficiency options. As Banskia saw it, it was time to transform waste into profits.

A thorough investigation revealed that a significant portion of the company's raw materials was indeed being wasted at every stage of operation due to a poorly designed plant layout, the inability of certain production stages to cope with the smooth flow of production, and inefficient conveyors and dicing machines. In addition, far too much juice, rich in sugar and fine apple particles, was being flushed away. Steps were subsequently taken to collect and concentrate the excess juice, together with waste peelings and cores, for use as a sugar supplement in sauces and jams. Annual returns from this practice alone amounted to between \$6,000 and \$10,000. Next, a new conveyer and a more efficient dicer were obtained that reduced product loss (and cleaning requirements) and helped to generate a three-percent increase in product yield. Further measures the company adopted included collecting and bailing cardboard and other waste packaging for recycling (a practice that eliminated between \$3,000 to \$4,000 in rubbish disposal costs) and the conversion of recovered apple peels into powder for use in baking, confectionery, and as a pectin replacement (this project was the result of a waste stream analysis done in conjunction with the University of Western Sydney). Banskia has since used the knowledge and impetus gained from its efficiency successes to further clean up its production processes by identifying additional profit-making and cost-cutting practices including: lagging steam pipes to save energy, seeking better electricity and gas rates, and utilising cleaner, more efficient, labelling and purchasing processes.¹

Clean Production Defined

'Clean Production' or 'Cleaner Production' is often defined as an integrated preventive strategy used in the production of products and services to increase efficiency and reduce risks to humans and the environment. According to the United Nations Environmental Protection division, clean production is neither a legal nor a scientific definition to be dissected, analysed or subjected to theoretical disputes. Rather, it is a broad term that encompasses what many different people, countries, and organisations refer to as 'eco-efficiency', 'waste minimisation', 'pollution prevention', or 'green productivity'.²

In many countries, at organisations both large and small, clean production methods encouraged by national environmental agencies, regional conservation groups, and university departments are reducing business operating costs, improving profitability, increasing worker safety, and reducing negative environmental impacts. Far from being expensive, most companies are surprised at the cost reductions achievable through the adoption of clean production techniques and the minimal capital expenditure required to obtain worthwhile gains.

Fast capital payback periods are also common. Furthermore, by utilising clean production methods, waste handling charges are being cut, raw material use is being lowered, and business insurance premiums are being slashed.³ For example, the Cleaner Production Challenge (CPC) conservation programme, a voluntary resource programme that helps the metal finishing and printed circuit board manufacturing industries in the American state of Washington, has helped 40 businesses reduce wastewater by 67% and sludge by 40%. In the process, CPC has helped its clients gain more control over their production, produce less waste and greatly improve compliance with local environmental laws. A key to the success of the programme has been the willingness of industry leaders to share their techniques with other agencies and companies.⁴ Good news, it seems, is contagious.

Putting Together a Clean Production Line

For the most part, cleaner production starts with lean production systems. Chaku-Chaku (Japanese for Load-Load), for example, is a single-piece production system designed to eliminate waste, improve product quality, reduce production setup times, lower inventory costs, and reduce floor space requirements. Central to its success is the creation of a dedicated production line consisting of dedicated machines or tools that perform only one or two steps in the sequence of making a part or product. As Peter Zelinski, editor of *Modern Machine Shop Magazine* points out, usually there are two ways to produce a machine part or product. The first is to purchase an expensive machine tool capable of multiple functions. The second is to identify every step involved in transforming a raw material into a finished component and to create a separate, simplified machine or workstation for each transformational step. The steps must then be arranged in a close-knit series of workstations so operators can move unfinished parts or products from one station to another as they're being produced.

Although the first method sounds faster (and less complicated) than the second, it is not always the case. Big, multi-function machines can cost much more when compared to a series of smaller machines that perform the same function. In addition, big machines all-too-often waste the time of workers because they usually have to be programmed and calibrated for each function they perform. Production bottlenecks are also a concern with large multi-functional machines, especially if the numerous operations they perform have to be scheduled or performed in a single cycle (most multi-functional machines can only perform one function at a time). Moreover, an entire production operation can grind to a halt when a large, multi-functional machine tool is shut down for repairs (in addition, maintenance costs for large machines are also higher than those of smaller machines). These factors are what the Boeing Corporation took into consideration when it replaced several giant, multi-function machine tools at a number of its production sites with a series of smaller, simplified machines that performed the same functions of big machines for a fraction of the cost. For example, a contoured composite part used on 777 aircraft was previously machined on a \$1 million grinder capable of performing five different functions (four of which could not be used when the machine was in operation). Boeing replaced this machine tool with a one-function grinder specifically designed to do only what was required. The cost of the smaller machine? \$50,000. Elsewhere, Boeing engineers discovered that one of its landing gear support assemblies involved a 1.6 kilometre long production process. Determined to eliminate this waste, the engineers

consolidated assembly operations into a series of close-knit procedures, thereby reducing the part's travel distance by 80%. In the process, a large machine costing more than \$1 million was replaced with a \$15,000 alternative and a large 'oven' used for curing was replaced with a smaller one that matched the part's size and shape and cost one-percent that of the larger oven's price tag (the smaller oven also uses less than one-percent of the electricity of the larger oven). Further production achievements from the improved setup at Boeing included reducing the various stages required to manufacture metal parts from five days to 25 minutes.

Before Chaku-Chaku, employees used to have to travel to separate locations all around the production shop to drill and grind components to a desirable shape. Now Boeing's production procedures are performed on smaller, more numerous, but dedicated machines placed in close proximity - thereby saving much time and money.⁵

Putting Chaku-Chaku into Practice

The first rule in setting up a lean and efficient production line is 'don't overbuy'. Overbuying includes: (1) purchasing equipment that will only be used once or twice, (2) buying machinery that produces or performs far more than what is needed, and, (3) taking on board anything that requires more investment in time, input, and money (i.e.: energy) than what is obtained in return. To help avoid these pitfalls, the following questions⁶ should be asked before purchasing any piece of machinery or equipment:

- Is this machine or item really necessary? Big is not always better. Big machines can cost a lot more in terms of time, money and energy - and result in extra capacity that will never be needed. Before buying large machinery, find out if smaller, more efficient machinery is more economically feasible.
- Is the full life-cycle cost of the machine being considered rather than its purchase price? Buying a cheaper piece of equipment is not always the bargain it seems. Inefficient, energy-hungry machines can consume their initial purchasing cost in energy per week. When buying equipment or machinery, remember that there are always two price tags. The first reveals the machine's purchase cost. The second includes how much the machine costs to operate in the long-term.
- Make certain that it is possible to accurately measure - in real time - what the machine produces and consumes in terms of materials and energy. Deficient (or zero) measurement makes it difficult, if not impossible, to determine how much a machine costs. Additionally, too many production systems contain monitoring procedures that measure what occurs after the manufacturing process has been completed. This means that a mistake or malfunction can repeat itself countless times before someone realises what has happened. Real-time monitoring avoids this scenario because it provides instant feedback. Yes, real-time monitoring usually requires an initial investment in equipment - as well as the subsequent training of employees - but the results are worth it. For example, in 1897, efficiency advocate Sakichi Toyoda innovated his company's power-driven weaving looms with real-time-monitoring measures that automatically shut the machines off when a thread broke, thereby preventing the wasting of good thread and the making of defective cloth. The money this idea saved was substantial enough to create the Tomen Corporation (a large Japanese general trading company) and the Toyota Motor Corporation.

Additional Suggestions for Reducing Production Waste

- Establish and support an in-house employee training and sharing programme. The more people that are involved in a waste-reduction programme, the more cost savings will be enjoyed. More often than not, employees hold the answers to most waste reduction and efficiency questions. Coax these answers out of them with motivational management and teamwork techniques.
- Seek outside help when needed. If answers from inside the business aren't forthcoming, seek assistance from a local environmental agency, a dedicated government programme, or an interested university. Many times the services these institutions offer are either free or minimally priced. The School of Chemical Engineering at the South China University of Technology in Guangzhou, China, for example, developed a cleaner production process for producing sodium chlorite by reducing sodium chlorate with hydrogen peroxide. The result? Waste acids were dramatically reduced and the byproduct (sodium sulfate) can now be minimised and reclaimed.⁷ This discovery has saved several companies in the chemical industry the time and expense of figuring it out on their own. (Note: many government agencies will gladly provide funding for production improvements if the improvements reduce water or energy needs and/or minimise waste.)
- Replace toxic or hazardous substances with nontoxic raw materials. Using safe and sustainable raw materials reduces raw materials costs, lowers the training expenses and danger of handling toxic substances, and reduces waste disposal costs while avoiding resource depletion and environment destruction. For example, in the USA, a 3M plant saved \$120,000 in capital investment - and \$15,000 annually - by replacing the toxic solvents it used with water-based alternatives.
- Reduce the energy requirements of machines and equipment. Clean production requires that every piece of equipment and machinery be inherently efficient before production starts. Whether production requires a photocopier, a million-dollar machine tool, a coffee maker, or a vast configuration of motors and pumps, everything should run on as little energy as possible. Before buying any piece of equipment or machinery read the label to determine the amount of power it consumes and compare its efficiency rating with other models.
- Keep equipment and machinery running at optimal levels. Good maintenance not only involves operating most equipment and machinery at peak levels (anything less and the full potential of the machine is being wasted), it also requires keeping these items in optimal condition with scheduled inspections and maintenance. Regular, scheduled machine maintenance may not be glamorous or exciting, yet it saves money in four ways: (1) it prevents possible breakdowns, (2) it reduces additional costs resulting from broken equipment, (3) it extends the life of the machine and, (4) it lowers energy costs (well-maintained machines almost always use less power). To ensure that equipment and machinery is operating at optimal levels:
 - conduct (and record) frequent inspections,
 - ensure that all moving machine parts are properly lubricated,
 - clean equipment and machinery on a regular basis,

- replace worn or damaged parts as soon as they are discovered,
 - ensure that drive belts, couplings, chains, and bearings are adjusted and in good condition,
 - keep equipment or machinery well ventilated, and,
 - replace old and/or outdated equipment with more efficient models.
- Mix only the volume of materials needed to fill an order. This guideline is a classic building block of Lean Thinking. Knowing how much of a product is needed before it is produced can greatly reduce raw material costs, energy expenses, and the costs of labour and storage. A good example of this is seen in the publishing industry with ‘print-on-demand’ technology. The number of books a publisher prints is often based on guesswork, which can result in piles of unsold books that have to be collected and pulped. Today, specialised printing machines can print the electronically stored text of almost any book in less than a minute (like this one), which means that only the number of books ordered is printed – and that publishers can keep titles ‘in print’ indefinitely at little or no cost.
- Collect all recoverable materials and outputs for re-use. This includes steam and water as well as oil, solvents, chemicals, cleaning liquids, and material scraps. If you cannot find another business that needs these materials, figure out how your organisation can use them at a profit. 3M’s Traffic Safety Systems Division, for example, used its scraps and outputs to devise a new reflective product for signs that uses less energy, reduces process and design waste by 65%, and emits fewer toxins during production. As 3M sees it, anything not built into a product is waste – and therefore a cost - and is thus a sign of poor quality. In another example, a small modification to the production process of a Polish metalworking plant allowed scrap metal to be incorporated straight back into the system, which led to a 30% reduction of raw materials and annual cost savings amounting to \$70,500. In Germany, a paper manufacturer virtually eliminated its massive water needs by filtering its base supply and re-using it in a closed-loop system. Across the Atlantic, an American jewellery-making business saved nearly \$300,000 in capital costs and more than \$115,000 in operating costs per year by introducing a closed-loop system that recycles and reuses its jewellery-plating outputs.
- Recover waste heat from kilns, ovens, and other high temperature machines. Waste heat from furnaces and boilers, exhaust, compressors, and hot-liquid blow-downs can be collected and used in other processes. In the USA, for example, most power stations convert only 34% of their fuel into electricity. The remainder, 66%, escapes as waste heat. Denmark, on the other hand, converts 61% of its electrical-plant fuel into power by, in part, recapturing heat through efficient furnace design.
- Insulate boilers and furnaces with ceramic fibres or other super-efficient materials. Even with efficient flue technology, more than 23% of the heat a furnace generates can go up its smokestack while up to 40% can dissipate through the furnace’s walls. To minimise heat loss, focus on where it occurs most. As one factory worker told me, ‘If you can’t place your hand on the exterior wall of a furnace because it’s too hot, you’re burning money.’
- Explore and discuss alternative practices to reduce energy requirements. A Kraft Foods

plant in Campbell, New York, for example, reduced its natural gas needs by over 13% per year by improving boiler efficiency, reducing steam demand via the installation of direct-contact water heaters, and using lower grade fuel oil for backup purposes to obtain more favourable utility rates.⁸

Clean Production and Water Reduction

Water often carries two costs. First, the water itself has to be paid for. Second, discarded water accrues expenses because most municipalities compute their sewage fees as a percentage of metered water use. Examples of water-saving practices used in clean industrial production systems include:

- Install closed-loop compressor cooling systems. Using fresh municipal water (tap water) once, then flushing it away, is both costly and a waste of good water. Close your company's wastewater loop by reusing what was previously discarded (filter what has been used and re-route it back into the production system). For example, Simon Fraser University in Burnaby, British Columbia, installed a closed system to reduce domestic water use and saw its water bills fall by \$35,000 in one year.⁹
- Consider waterless alternatives in production lines. In Australia, the owners of Spectrum Printing invested in a waterless printing process rarely used by other printers. Apart from saving water, the process also saves 40% of waste paper and eliminates the need for isopropyl alcohol, which halts the discharge of volatile organic compounds as well as the costs associated with their disposal.¹¹
- Consider using gray water (or rainwater) in production processes. If high-grade tap water is not needed for production purposes (and in many processes it is not) consider substituting it with collected rainwater or water gathered from other sources. Vam Organic Chemicals Ltd. in Gajraula, India, for example, uses spent water for dust control and incorporates effluent into its distilling operation. Combined with a system that recycles sealed water in a vacuum pump, the net savings amounted to \$33,330 per year in fresh water costs.
- Invest in water-saving practices and technologies. The Godfrey Hirst carpet manufacturing plant in Geelong, Australia has been saving the equivalent of 38 Olympic-sized swimming pools of water annually after it modified its production system to include in-line drying practices, which eliminated an entire washing and vacuuming stage. In addition, the company upgraded a fluoro-chemical application process and invested in the production of solution-dyed nylon products that do not require dyeing or drying. Meanwhile, two textile dyeing companies in Korea (Colorland and WS Dyetech Ltd) substituted water-intensive alkaline fabric scouring with more efficient enzymatic scouring and saved eight to ten tons of water per ton of fabric production (while eliminating the need for caustic soda). If 200 other dyeing companies across Korea adopted the same practice, it's been estimated that the industry's total annual water use rate would fall by 3,200,000 tons - a cost savings of \$2,133,333.¹²

It Doesn't Add Up, It Multiplies

Controlling production waste is all-too-often an after-the-fact endeavor that asks 'How can we deal with our waste?' Instead, the question should be 'What alternatives are there?' Seen in this light, cleaner, more efficient production does not create obstacles to production and growth. On the contrary, sustainable, closed-loop production practices reduce costs, conserve raw materials, help eliminate toxins and hazardous materials (and their expense), and reduce negative impacts on the environment. For more information about cleaner production, visit **www.cleanproduction.org**.

23. Motors and Pumps

Motors are ubiquitous. Virtually every business contains at least one. Some have thousands. Motors are used to drive almost everything from pumps, conveyers, refrigeration equipment, air compressors, and fans to a host of other operations too numerous to mention. In the process, they can consume up to 60% (or more) of a company's fuel costs, which translates to around 40% of the world's electricity or roughly 75% of all industrial electricity. In fact, motors use up so much electricity that the amount they consume over their lifetime always costs more than the price of the motors themselves (some motors actually consume, in electricity costs, the amount of their purchase price every week).¹ A new electric motor purchased for \$1,500, for example, can cost as much as \$13,000 a year to run and a typical 100 horsepower AC induction motor purchased for \$5,000 will use as much as \$35,000 worth of electricity in a year. Compare these figures to an older model 100 horsepower motor running continuously at full load (as many motors are designed to do), which can cost \$70,000 a year to operate – or an older 20 horsepower motor, which can consume up to \$14,000 worth of electricity annually.

Even with electricity rates as low as four-cents per Kilowatt-hour, most 20 horsepower motors (running continuously) use up to \$6,000 worth of electricity annually. That's about six times the purchase price of the motor. Diesel or gasoline motors can be even more costly. Even if diesel prices were to fall to \$0.85 for 3.78 liters, a 75-horsepower motor would still cost \$6,400 a year to operate.

Determining the True Costs of a Motor

A general assumption held by engineers and mechanics in many industries is that efficient motors are more expensive than their inefficient counterparts because heavier copper wire, thinner core laminations, higher-grade steel, and higher-grade bearings cost more. In the long-run, however, motors designed to be more efficient always end up costing less. Equally as important is that contrary to what many people believe, most motors do not become more efficient when they are given less of a load to perform. Most motors need to run at or near their designed power rating (usually 75% to 100% of their full load rating) in order for them to operate at optimal efficiency.

No matter how it's looked at, the overall financial impact a motor will have on a business's revenues should be considered long before a purchase is made. To calculate the amount of money a motor will consume (in electricity) over its lifetime, it is first necessary to find out the local cost of electricity per Kilowatt-hour. The efficiency rating and amount of time the motor will be in operation are also needed. For example, the normal lifespan of a typical 100 horsepower motor is around 40,000 hours or about five years of continuous operation (although a well-maintained motor can last much longer). Let's assume that electricity costs are \$0.05 per Kilowatt-hour, the motor in question will run 24 hours a day, seven days a week at full load, and that it's rated as 94% efficient. The formula for determining the amount of electricity that the motor will consume over five years of operation is:

$(100 \text{ horsepower} \times .746 \text{ kW/hp} \times 40,000 \text{ hours} \times \$.05 \text{ kW-hour}) / .94 \text{ efficiency} = \$158,723 \text{ electricity costs}$

Another way to compare the amount of money a motor can cost to operate is to take the difference in efficiency points (expressed as a percentage) from the efficiency rating of two similar horsepower motors and to multiply the difference by the amount of horsepower. If

electricity costs \$0.05 per Kilowatt-hour, multiply the first sum by \$50 to obtain the overall electricity costs of the motor in question.

For example, the difference between a 96% efficient 100 horsepower motor and a 92% efficient 100 horsepower motor is four percentage points. Four times 100 horsepower is 400. Assuming that electricity cost five-cents per Kilowatt-hour, multiply 400 by \$50. The total (\$20,000) shows how much extra will have to be paid in electricity over the life of the motor (assuming the motor is in continuous operation).

Reducing the Costs of Operating Electric Motors

The golden rule in reducing the cost of running a motor is to ensure that it's the right-size motor for the job. Many businesses run motors that are too big for the task under the assumption that the additional horsepower may be needed in the future. More often than not, this is expensive, costly, and unnecessary. Over-size (and therefore under-loaded) motors waste energy and cost more to run. In many cases running two smaller energy-efficient motors can actually cost less than operating one over-size motor.

Reducing the Cost of Pumps and Pumping

Up to 20% of the world's motors are used for pumping purposes and most of what they pump is water. Water and wastewater pumps consume over 50 billion Kilowatt-hours of electricity in the USA every year (about \$4 billion worth of power) – and most of the energy they consume is used to fight against the friction created when water is forced through narrow pipes, around bends, and up steep inclines.

Just as with motors, most pumps are bigger and more powerful than they need to be because in many cases production designers did not know what the exact pumping requirements were when the pumping system was being planned. The result is that valves and other devices are later installed to create intentional friction to reduce output to manageable levels. Obviously, this is not an efficient practice – particularly when the annual expense of running an over-size pump can cost several times more than the price of the pump itself. In some cases, over-size pumps can be balanced by trimming the impeller or replacing it with one of a smaller diameter (an impeller, which is similar to a propeller, transfers energy from a motor to the fluid being pumped inside a tube or pipe by directing, increasing, and pressurising the flow of liquid inside). For a pump operating at less than ten-percent of its designated flow rate, trimming an impeller can reduce electrical consumption by as much as 25%.

Improving Pump Efficiency

Thinking ahead is probably the best way to avoid the costs associated with buying an over-size pump. Try to envision the entire pumping system beforehand with an eye toward maximising efficiency -- then seek a pump that is compatible with its operation while thinking about how the entire system can be made more efficient. The authors of the book *Natural Capital*¹ (indeed, Amory Lovins is widely seen as the main pioneer in exposing motors as major energy wasters) describe how several years ago the Interface carpet company in Shanghai built a factory where the production process required 14 pumps totaling 95-horsepower. By redesigning the layout of the entire system, however, the main engineer, a man named Jan Schilham, was able to cut costs, improve efficiency, and reduce the overall pumping power

needed by 92%. Schilham's design incorporated two simple changes from which almost any pumping system can benefit. First, fatter pipes were used. By using fatter pipes less friction is created when fluid moves through them. By increasing the diameter of a pipe by 50%, friction can be reduced by 86%. The result is that less pumping energy is needed, which means that smaller, more economical pumps can be used. Traditionally, engineering students are taught that the extra cost of fatter pipes does not justify the cost of the pumping energy saved. Unfortunately, this argument does not take into account the savings that are made from the lower cost of a smaller pump, the lower costs of operating a smaller motor, and the reduced costs involved with fewer motor controls and fewer electrical components.

Schilham's second money-saving idea was to lay out the pipes first and install the pumps afterward – which is exactly the reverse of how most people construct a pumping system. Most engineers install pumps and motors in a convenient or arbitrary spot and then attach pipes to them. The pipes then have to be bent, turned, raised and twisted so their contents can be directed from one point to another. Unfortunately, each bend and turn, as well as the number of valves added, increases friction, which requires a larger pump and increases the amount of pipe needed. Conversely, the straighter the pipe, the fewer pipes are needed and the less friction is created. When fewer pipes are needed less insulating material is required to cover them, which also lowers costs. Furthermore, by using plastic or epoxy-coated steel pipes, friction can be reduced by another 40%, resulting in a proportionate savings in pumping expenses that can eliminate up to 95% of the costs of pumping.

Additional Cost and Energy Saving Suggestions for Pumps

Pumps don't just push fluids, they can also direct pressurised air from one spot to another. Whatever substance is being pumped, the following suggestions can reduce the costs involved:

- Eliminate leaks in compressed air lines and valves. Up to 20% of the work output of a compressor is sometimes needed to make up for losses from air leaks. A General Motors assembly plant in Flint, Michigan, for example, reduced its energy needs by around eight-percent after, in part, decommissioning unused air supply systems and ensuring that those that remained worked properly.²
- Eliminate leaks in steam pipes and fittings. A leak in a steam line can result in higher steam production requirements to compensate for what is lost. In addition, leaking condensate return lines bring back less condensate to their boiler, thereby forcing the boiler to use more energy to heat-up replacement water. In 2006, an Eastman Kodak manufacturing plant in Rochester, New York reduced its annual natural gas needs by 11% after improving and modifying its feed-water heat recovery system – a move that was accomplished at virtually no cost.²
- Insulate pipes and heating equipment to reduce heat loss. All pipes that transfer heated fluids or gases from one process to another should be well insulated.
- Consider using Industrial Heat Pumps (IHP's). IHP's use heat from heat-producing processes to supplement other industrial heating processes or in preheating procedures.

For more information about getting the most from pumps and pumping, visit **www.plantservices.com**.

Alternatively, browse the pump section of the Industrial Efficiency Alliance website at: **www.industrialefficiencyalliance.org**

24. Reducing Waste at Work: Getting Started

Whether you represent a business that desires to become sustainable, or you work in a business school and want to add sustainability to your curriculum, you will need to practice what you preach before trying to convince others. To get started, gather your employees together, explain what needs to be done (and why) and begin with what is commonly called ‘the low-hanging fruit’ (the easiest tasks). Displaying a process map that illustrates the inputs and outputs that flow around and through the organisation is a good idea. Along with the map, the amount of electricity every workstation or department consumes should be mentioned (perhaps with facts and figures relating their CO₂ emissions), as well as the amount and cost of materials the business swallows up (office supplies, raw materials, water...), how much waste (garbage) is created, and the types of waste being generated. This is necessary to ensure that the organisation is seen as serious in its attempts and to highlight the fact that the efforts employees make (or do not make) will be monitored.

Some businesses start their sustainability programmes by suggesting that staff transport themselves to work more efficiently. This may not alter the company’s bottom line (and managers may be told that it’s none of their business), but employee transportation is as good a place as any to begin making changes. Encouraging employees to use public transportation can significantly reduce the ecological rucksack and carbon footprint of a business. Additional waste-reduction suggestions include:

- Encourage employees to walk or bike to work (to encourage the latter, ensure that employees have a safe place to put their bicycles).
- Begin a car-pooling programme. Find out who lives on whose route to work and promote cooperation.
- Initiate a company vehicle inspection programme. Ensure that all company vehicles are both efficient and well maintained. Encourage employees to be equally as vigilant and diligent with their vehicles.
- Determine if or how employees can work from home or, work out an alternative schedule that allows employees to stagger their schedules so they can work at home part-time.
- Encourage conference calls and/or videoconferencing instead of travelling to meetings.
- Share office space and equipment rather than purchasing separate items for every employee.

Making the Most of Office Furnishings, Computers, and Equipment

- Ensure all electrical equipment (even coffee makers) is energy efficient. An Energy Star rated medium- copying machine, for example, can cut \$50 or more off annual energy bills.
- Buy remanufactured, energy-efficient computers, copiers, fax machines, etc... instead of new models whenever possible. Remanufactured or refurbished equipment provides excellent value for money.
- Use laptops in place of desktop computers. Laptops use less electricity. (Remember to unplug the power cord when the laptop is not in use.)
- Turn equipment off when it’s not needed. Computers, when left on overnight, can rack up \$75 in energy costs per unit, per year.

- Unplug all electrical items when not in use. Most electrical equipment continues to draw power when it's turned off. Even an empty mobile phone charger draws electricity if it's plugged in. Especially ensure that equipment is unplugged during weekends (vending machines are a prime target).
- Enable the power management features on desktop computers (and monitors) to switch off when not in use. This can save up to \$55 per monitor and \$45 per computer annually.
- Use smaller computer monitors. A monitor that is 5cm smaller than a larger model can reduce electricity consumption by as much as 30%.
- Don't use screen savers. Instead, switch the screen saver mode to 'blank screen' or 'none'.
- Buy used or remanufactured office furniture. Few people will note the difference.
- Invest in high quality equipment rather than cheap, shorter-life versions.

General Energy Reduction

- Insulate the building inside and out (paying particular attention to heat and cooling loss from doors, windows, and walls). Improved insulation can save hundreds of dollars or more a year in energy costs.
- Determine if the local power company provides sustainable energy alternatives. Some electricity providers invest in wind, solar, or tidal energy and provide these options to their customers so they can cut CO2 emissions.
- Set the office thermostat a few degrees lower in the winter and a few degrees higher in the summer. A 2% decrease during the day can cut energy bills by 2.5%.
- Don't heat or cool an unoccupied office (particularly during the evenings and weekends). Setting the thermostat back ten degrees at night can cut 15% off energy bills.
- Perform periodic maintenance of HVAC equipment (Heating, Ventilation, and Air Conditioning). Good maintenance can reduce heating bills by 5% and cut electrical bills by 2%.
- Replace all office light bulbs with energy efficient alternatives. This not only saves money, the resulting drop in electricity reduces greenhouse gas emissions. If all Europeans changed their standard light bulbs to energy efficient bulbs the resulting drop in carbon emissions would be equivalent to taking 70% of the continent's cars off the road.
- Turn off all lights when not needed (installing motion detectors can eliminate this problem). Keeping off unnecessary lights not only saves the money needed to power light bulbs, it also lowers cooling costs – and can shave up to 18% off an office energy bill.
- Turn off ventilation systems in unoccupied areas. This can lower HVAC costs by \$300 annually.
- Pay bills electronically. If everybody in the USA paid his or her bills online, the nation's annual paper waste would be reduced by 1.6 tons and greenhouse gas emissions would be cut by 2.1 million tons.

Reduce Paper Consumption

Roughly 3% of world industrial production is spent on the creation of paper. Paper

manufacturing also uses more water than any other industry (98 tons of water are needed to produce one ton of paper), releases the fourth most pollutants, and is considered the third most energy intensive industry on Earth. In addition, around 900 million trees are cut down annually to meet the world's paper demands. Yet only 10% of the world's paper is ever utilised in the long term. Most is used and thrown away shortly after it's bought (the average office worker uses one sheet of paper every twelve minutes). With this in mind, the city government of Seattle, Washington concluded that a 1% reduction in its \$288,218 annual paper bill (which amounts to 73,902,000 sheets of paper) will save thousands of dollars in paper costs; 62 trees; 244,553 liters of water; 136 kilograms of water pollutants; 3,208 kilograms of solid waste; 9,298 kilograms of greenhouse gases and other pollutants; and 123,662 BTU's of energy. That being said, saving trees and reducing pollutants isn't all that minimal paper usage achieves.

The Brazilian business Semco streamlined its operations years ago by, in part, reducing company paperwork. Upset with the fact that employees rarely talked to one another, company CEO Ricardo Semler decreed that all interoffice memos could be no more than one page in length. Employees therefore had no choice but to actually talk with each other. As a result, more work got done. In Australia, a business turn-around specialist once told me that virtually his entire secret to saving bankrupt companies was to 'forbid the writing of memos altogether' (for the same reason). Oticon Inc, a hearing aid manufacturer in Denmark famously cut a hole in the roof of its multi-story headquarters straight through the ceiling of the employee cafeteria and into a main collection site. A Plexiglas tube was inserted into the void and all discarded paper was continuously taken up to the roof and thrown down the tube – a powerful message directed at employees, which proclaimed that paper waste would no longer be tolerated. Paper consumption in the company subsequently decreased by 50% and the business enjoyed a dramatic increase in productivity.

Suggestions for Reducing Paper Use

- Establish a company mandate that demands paper use is reduced (then enforce the rule).
- Shorten the number of forms and papers customers must fill out (they'll love you for it).
- Store your business data (including employee manuals, policies, etc...) in an electronic format.
- Distribute memos via e-mail or display them on a single sheet of paper in a central location.
- Use both sides of a sheet of paper and set photocopiers to do the same. This practice alone can cut 10% to 40% off paper costs. Seagate Technology Inc., a computer disk drive manufacturing company in Scoots Valley, California, reduced its annual paper needs by four million sheets this way, thereby cutting its paper bill by \$45,300.
- Set wider margins on documents so more words can be placed on each page.
- Use smaller font sizes so more text can be put on a single page.
- Use chlorine free, recycled paper for all paper needs. Recycled paper requires 60% less energy to make than virgin paper. Every ton of recycled paper also saves 4,000 kilowatt-hours of electricity, 26,497 liters of water, and 17 trees (each of which has the capacity to filter 27 kilos of pollutants from the air).

- When printing or photocopying, adhere to the following: (1) always print in 'draft' mode, (2) avoid color printing whenever possible, and, (3) buy recycled toner and ink. Each of these practices saves ink.
- If recycled paper is unavailable, use paper made from sustainable sources such as ecologically treated bamboo or hemp.
- Place a paper recycling receptacle in a conspicuous place, encourage its use, and schedule a designated employee or cleaning crew member to arrange regular collection.
- Shred unwanted paper and use it as packing material.
- Reuse paper, envelopes, and boxes whenever possible. The Washington Suburban Sanitary Commission decided to replace its billing envelopes with send-and-return envelopes that could be used for both billing and receiving payments. As a result, 47 cubic meters of warehouse space immediately became available and the cost of envelope purchases was reduced by \$55,000.
- Replace paper towel dispensers in washrooms with energy-efficient air hand-dryers.

Water Reduction Measures

With offices using up to 12% or more of a nation's daily potable water, much can be done to reduce consumption without making sacrifices. For example:

- Install faucet aerators (low-flow devices) on all taps.
- Replace toilets and urinals with low-water or water-free models.
- Use filtered tap water rather than delivered bottled water – or use water straight from the tap. In many regions local tap water is better than bottled water in terms of cleanliness and quality.

Miscellaneous Tips

- Ask office cleaning crew staff to use non-toxic cleaning products.
- Buy office supplies in bulk (which can save on packaging).
- Encourage the planting of trees or other indigenous foliage outside the office building.

Vehicle Use Cost-Saving Suggestions

In 2004, the United Parcel Service (UPS) began a policy designed to reduce the number of left turns made by its drivers. Having its vehicles stop and idle at traffic lights while waiting to turn against oncoming traffic was literally costing UPS millions of dollars in fuel losses so a software programme was devised that mapped a customised route for each driver to minimise left turns. This practice not only saves the \$3 million annually, it reduced 1,000 metric tons of CO₂ emissions during the first few years of trials (Sayre, 2007). Such is what happens when positive changes in behaviour are made.

To make your company's vehicles more efficient, first measure and record the amount of fuel they consume. Determine the efficiency rating of each vehicle, as well as how much pollution it produces per year. Visit the U.S. Department of Energy website and look up the year, make and model of the vehicle to obtain this information. Next, apply as many efficiency measures as possible (see below). Record how much was saved after one or two weeks then share the results

with employees and encourage them to seek more ways to cut waste and costs. Some companies reward their most efficient drivers on a monthly basis, which instigates a healthy competition between employees. 'Just remember to keep encouraging everyone,' a shift supervisor told me, 'good ideas acquired with ease are just as easily discarded with ease.' Following are common ways a business can save fuel:

- Don't waste fuel idling. Large vehicles, like trucks and buses, consume huge amounts of fuel when idling – around 4 litres an hour. Have drivers use auxiliary power units during rest periods
- Invest in hybrid vehicles. Hybrid cars and delivery vehicles are not only more fuel efficient, they are gentler on the environment.
- Decrease the amount of time spent driving. Fill up trucks before sending them off (inform your customers how much money and CO2 emissions they can save by having shipments delayed until delivery trucks are full). Combine errands or deliveries, car pool, take public transportation... do whatever is necessary to minimise driving time.
- Don't send out a big truck when a small one will suffice. This practice cut 21 million miles from Xerox's distribution network.
- Check tire pressures. Try pushing a car with flat tires and you'll discover why this is important. Keeping tires properly inflated can increase fuel efficiency by 3% or more. According to the Rubber Manufacturers Association, 85% of people do not check their tyre pressure properly. Wal-Mart increased the efficiency of its fleet by 6% with fuel-efficient tires.
- Clean and maintain engines. Clean or change the air filter regularly (two or three times a year), change the oil as recommended by the manufacturer (usually once or twice a year), check all fluids, and clean and replace spark plugs regularly.
- Plan journeys. Know every route in advance, which saves the time and expense of unnecessary travel or getting lost.
- Don't spill fuel when filling vehicles. A drop spilled is a drop wasted – and every drop adds up.
- Eliminate unnecessary weight. Don't carry around more items or equipment than is needed.
- Load up trucks to avoid making additional trips or to eliminate the need for two vehicles. Sentinel Transportation (a joint venture between DuPont and ConocoPhillips) have reduced the number of trucks leaving one site 55% by increasing payloads by 50%.
- Make vehicles more aerodynamic. Install wind skirts. Remove luggage carriers, roof racks, and trailers when not needed (the air resistance these items create dramatically decreases fuel efficiency).
- Keep vehicle windows up. Open windows create drag and increase air resistance. Keep interior vents open instead.
- Turn off unneeded electrics. Although some manufacturers dispute it, air-conditioning can consume up to 10% of a vehicle's fuel.

- Observe the speed limit. The faster a vehicle is driven the more fuel is burned. Driving 113 kilometres an hour as opposed to 97 kilometres per hour consumes around 20% more fuel. Con-Way Freight estimates that lowering speed limits by 3 miles per hour will save the company 3.2 million gallons of fuel or \$15 million annually.
- Don't ride the brake and don't brake hard. Many drivers brake more often than necessary, particularly when switching lanes. Unfortunately, heavy braking decreases fuel efficiency by as much as 30%.
- Coast on hills. Taking your foot off the accelerator when descending a hill reduces energy consumption.
- For more information about minimising waste while maximising fuel, time, labour, and other valuable resources, please visit the EFMD website, click on 'Publications' and download the free book *Managing the New Frontiers*. Similarly, to learn more about sustainability in a macro context, don't forget to check out the book *The Performance Economy* by the man who is one of the primary founders of the field of sustainability, Walter R Stahel.

A free downloadable e-version of this publication, designed for easy and affordable distribution to employees, students, government and community officials and anyone else who you feel will benefit from sustainable long-term thinking, is available at www.efmd.org/publications

End Note

This is *Not* Going Away'

Once the easy targets have been hit it's time to lead rather than follow. Don't waste time 'greening' the wrong things. There is no point in making an unneeded production process more efficient or recycling an unnecessary packaging component. Take stock of the situation around you, delve deeper into the 7-P's, get more internal and external customers involved in improvements, and go further. Drop the assumption that sustainability is a one-time-only endeavour; there is no finish line and it's not a good idea to wait for market shifts, changes in regulations, or a return to bad habits to drive your next move. Stay ahead of the game. View oncoming laws, disruptive changes, and other seismic shifts (many of which can be seen well in advance) as an opportunity rather than a threat. After the bailouts and bonuses that followed the 2008 economic collapse, local and national governments - not to mention the public - are not in the mood to put up with managerial and financial incompetence. Likewise, governments are on the prowl for new ways to fill empty coffers and customers around the globe are wising up to the hidden costs of short-term products and production processes. What this means is that the entire risk-benefit spectrum is changing for businesses. Free rides are over. Patience is wearing thin with nations and businesses that refuse to think in the long-term and continue to cling to wasteful habits. Domestic and imported products filled with toxins are increasingly being banned, system inefficiencies are being penalised, and cities are taking back tax breaks given to companies that promise jobs, but don't deliver.¹ The message coming out of all of this is that sustainability is here to stay. Long-term thinking just makes sense. At some point, either as a manager or employee, you will have to decide whether or not to take part and thus choose how painful or painless the future of your business will be.

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Thanks to www.ecomodder.com and the students at Kozminski University (Warsaw, Poland) for supplying many of the suggestions mentioned in this section.

About the Author

About the Author

Jonathan T. Scott (www.jonathantscott.com) is a lecturer, manager, and business leader with over 25 years of work experience in eight different countries. As a manager he was recognised for tripling productivity, reducing costs by up to 40%, and increasing net profits by over 55% at the companies where he worked. In the process he conducted three separate turn-arounds (the first occurred in a war zone; the second was described as ‘the best of its kind in the country’) and pioneered multi-million dollar projects in parts of the world where they previously did not exist. Currently, Scott runs his own education business, is the founder and director of the Center for Industrial Productivity and Sustainability, and serves as a faculty member at three business schools: Kozminski University (Warsaw, Poland), the Audencia Nantes School of Management (Nantes, France) and Bradford University (Bradford, UK). He has also taught at the University of Perugia (Italy). In 2009, he was presented with an ‘outstanding achievements in teaching’ award for his research and performance as an educator and his work in sustainability and helping businesses lower their costs.

Scott’s education includes attending Brevard College (Brevard, North Carolina) before graduating with a Bachelor of Science degree from Florida State University (Tallahassee). He has also been a student at the Universite de Bourgogne (Dijon, France), earned an MBA (in management) from Western International University (at its former London, UK campus), received a teaching certification from Oxford Brookes University (Oxford, UK), and secured an MA (in management) from Kozminski University (Warsaw, Poland). His books include *Fundamentals of Leisure Business Success* (1998), *The Concise Handbook of Management* (2005), *Managing the New Frontiers* (2008), *The Entrepreneur’s Guide to Building a Successful Business* (2009) and the action/adventure novel *On Wings* (2007). His specialty subjects are management, entrepreneurship, and sustainability.

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Walter R. Stahel (www.product-life.org) is the head of Risk Management at the Geneva Association (Switzerland) as well as a respected business advisor and the founder and director of the Product-Life Institute (Geneva, Switzerland) Europe’s oldest sustainability-based consultancy and think tank. Stahel’s pioneering research and collaborative work in the field of sustainability stretch back several decades – firmly establishing him as one of the subject’s founders. He is also a visiting professor at the Faculty of Engineering and Physical Sciences at the University of Surrey (UK) and a regular guest lecturer (in the graduate department) at Tohoku University (Japan). An alumnus of ETH, the Swiss Federal Institute of Technology (Zurich, Switzerland), Stahel is the author of several prize-winning academic papers and pioneering books including *The Limits to Certainty* (1989/1993), written with Orio Giarini (published in six languages) and *The Performance Economy* (2010).

Trained as a lawyer, Hunter Lovins (www.natcapsolutions.org) is the president and founder of Natural Capitalism, Inc. and co-creator of the Natural Capitalism concept. In 1982 she co-founded the Rocky Mountain Institute and led that organisation as its CEO for Strategy until 2002. Under her leadership, RMI grew into an internationally recognised research centre, widely celebrated for its innovative thinking in energy and resource issues. She has managed international non-profits, created several corporations, and is in great demand as a speaker and

consultant. Her areas of interest and expertise include Natural Capitalism, globalisation, economic development, governance, land management, energy, water, green real-estate development and community economic development. She has taught at dozens of universities and is currently Professor of Business at the Presidio School of Management (the first accredited MBA programme in Sustainable Management). Lovins has co-authored nine books, dozens of papers and has earned numerous awards including a 1982 Mitchell Prize, a 1983 Right Livelihood Award (often called the ‘alternative Nobel Prize’), a 1993 Nissan Award, and the 1999 Lindbergh Award for Environment and Technology. She has several honorary doctorates, was named a “Hero for the Planet” by Time Magazine in 2000 and received the Loyola University award for Outstanding Community Service. In 2001 she received the Leadership in Business Award and shared the Shingo Prize for Manufacturing Research. In addition she has served on the Boards of one government, three private corporations and many public interest groups. In her spare time, Hunter is a volunteer fire fighter and an EMT. She is also President of the Nighthawk Horse Company and is active training polo-crosse horses, and competing at polo-crosse and rodeo.

Prof David Grayson CBE joined the Cranfield School of Management as director of the new Doughty Centre for Corporate Responsibility in April 2007, after a 30-year career as a social entrepreneur and campaigner for responsible business, diversity and small business development. This included the chairmanship of the UK’s National Disability Council and several other government bodies, as well as serving as a joint managing-director of Business in the Community. He is a visiting Senior Fellow at the CSR Initiative of the Kennedy School of Government (Harvard University). He has masters degrees from the universities of Cambridge and Brussels, and an honorary doctorate from London South Bank University. He has been a Visiting Fellow at several UK and American business schools. His books include *Corporate Social Opportunity: Seven Steps to make Corporate Social Responsibility Work for Your Business* (Greenleaf - 2004 www.greenleaf-publishing.com) and *Everybody’s Business* (2001) - both co-authored with Adrian Hodges. He currently chairs Housing 21 - one of the leading providers of sheltered and extra care housing and care for older people (www.housing21.co.uk)



Jonathan T Scott



Walter R Stahel



Hunter Lovins



David Grayson

About EFMD

EFMD is an international membership organisation, based in Brussels, Belgium. With more than 750 member organisations from academia, business, public service and consultancy in 82 countries, EFMD provides a unique forum for information, research, networking and debate on innovation and best practice in management development.

EFMD is recognised globally as an accreditation body of quality in management education and has established accreditation services for business schools and business school programmes, corporate universities and technology-enhanced learning programmes.

Within its scope, EFMD is committed to offer professionals and institutions involved with management learning and organisational development the opportunity to be part of a dynamic, relevant and diverse network sharing the common objective of developing effective and socially responsible leaders and managers. It is in this context that EFMD signed in 2003 a partnership agreement with the United Nations Global Compact and launched the Globally Responsible Leadership Initiative.

- EFMD has over 40 years of experience in the coordination of projects and activities that foster an active dialogue and exchange between companies and academic organisations
- In a proactive manner it contributes to a search for, and generation of, new ideas for a continual enhancement of management thinking and practices
- Maintains a series of on-going activities enabling its members to learn, share and network which helps contribute to a better understanding of the continual changes in the business and management education environments
- Initiates short events on highly topical issues bringing business executives and distinguished academics together
- Provides a context and environment that leads to professional networking and bridges the divide between the academic and business world
- Runs the European Quality Improvement System (EQUIS), which is the leading international system of quality assessment, improvement, and accreditation of higher education institutions in management and business administration. 125 schools have so far been accredited from across 34 different countries
- Manages international projects in Asia, CIS and the Arab World and has strong relationships with sister associations in Eastern Europe, Central Asia, Central America, United States, Canada & Australasia

For more information www.efmd.org

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every receipt, invoice, and bill should be properly filed and dated. This not only helps in tracking expenses but also provides a clear audit trail. The text further explains that regular reconciliation of accounts is essential to identify any discrepancies early on. It suggests a monthly routine where all bank statements are compared against the company's internal records. This process ensures that the books are balanced and that there are no unexplained differences. Additionally, the document highlights the need for transparency in financial reporting. It states that all stakeholders, including investors and creditors, should have access to up-to-date and accurate financial information. This transparency builds trust and allows for better decision-making. The second part of the document focuses on budgeting and financial forecasting. It provides a step-by-step guide on how to create a realistic budget based on historical data and current market conditions. It also discusses various forecasting techniques, such as trend analysis and regression models, which can help predict future financial performance. The document concludes by stressing the importance of continuous monitoring and adjustment. It notes that budgets are not set in stone and should be reviewed regularly to reflect changes in the business environment. Overall, the document serves as a comprehensive guide for anyone looking to improve their financial management practices.

EFMD is an international, not-for-profit, membership organisation, based in Brussels, Belgium. With more than 730 member organisations from academia, business, public service and consultancy in 82 countries, EFMD provides a unique forum for information, research, networking and debate on innovation and best practice in management development.

For more information visit www.efmd.org

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A Perfect Introduction for Understanding the Fundamentals of Sustainability in a Business Context

Recommended for managers, employees, teachers, and students, this readable and informative guide explains the importance of waste minimisation as a first step toward sustainability. Within its pages, the breadth and depth of long-term, profitable business practices are explored with an emphasis on optimising resources (including labour and markets) and maximising purchases and investments while minimising the costs of non-product (waste), unemployment, short-term thinking and environmental degradation. As proof of its potency, *The Sustainable Business* has recently been disseminated to over 1.3 million people around the globe and it is now being translated into Mandarin for distribution across China.

Bottom Line: If you're looking to gain insight on the future of business, this is it!

