

M.M. Khan and M.R. Islam

2ND EDITION

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Zero Waste Engineering

A New Era of Sustainable Technology
Development

Second Edition

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WILEY

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Preface

The modern age is synonymous with waste and environmental destruction. Every day, we see on television and the Internet or read in the newspaper about companies destroying natural habitats, humans creating potentially disastrous climate change, and frittering away our natural resources, all in the name of “progress.” If we are unsatisfied with this state of the earth, we should be thinking of a fundamental change in this centuries-old practice. Yet, any process that can trigger a paradigm shift has been shunned by the establishment, citing numerous excuses. How then we could come up with such a huge step that challenges engineering practices of centuries, going back to the time of Sir Isaac Newton? It needs a description of the background.

Nearly two decades ago, when western society was first looking into the prospect of 0% interest in the form of sales of cars by dealers (now known as ‘no-interest financing’), dealers faced an interesting dilemma. The computer programs would blow up by the fact that a 0% interest rate ends up with division by zero in at least one place during the calculation of the monthly payment. Thankfully, dealers did not call this an absurd concept and resorted to putting a number (often 0.1%) and give back that sum upfront to the buyer. It was remarkable that no one recalled the prediction of catastrophic failure of the Islamic banking system (that also operates at 0% interest) when the Islamic Republic of Pakistan first introduced it in our own time. Of course, both Islamic banking and 0% interest rates are quite fashionable these days even when “war on terror” rages on. On the consumer side, that computer ‘glitch’ of the 90’s dealers has been fixed and 0% interest rate, and even cash back, is a routine.

In 2001, when our research group, Energy, Environment, Communication (EEC) launched a series of ground-breaking or absurd ideas (depending on which side of the conscience spectrum one is). To us (a group of 30+ researchers from among students and professionals), it was the only conscientious to advance a theme that we saw as correct and beneficial. The theme was: long term over short-term, others over self, and intangibles over tangibles. This translates into developing technologies that in Canadian

Minister of Public Safety and Emergency Preparedness, Ralph Goodale's word (when he was the NRCan Minister) are (paraphrased): technologically innovative, environmentally appealing, socially responsible, and financially attractive. In layman's term, it meant: 0% interest for the economy, 0% waste for engineering, and 0% income tax. We published the first of them in our book: *Economics of Intangibles* (Gary Zatzman and Rafiqul Islam, Nova Science Publishers) in 2007. This work on economics had to be done before we could talk about science and engineering, because we like it or not, Economics is the driver of this society. However, we didn't talk about 0% interest, but expounded the idea in a 400 page book. However, when it came to zero-waste, we didn't hide the theme, we added the name on the title of the book and published it in 2010. Even though, the world was waking up to the concept that there is nothing better than green technology, to many the concept of zero-waste in engineering was an oxymoron. After all, we have learned about the value of waste-intensive engineering that cashes in on our wasteful lifestyle. However, the logic of the concept was impeccable and the deconstruction of Newtonian mechanics (that fueled linear thinking in the west) was flawless. By then, we have completed the science of Greening of Petroleum Operations (Scrivener-Wiley, 2010) as well as the mathematics of Intangibles (Advanced Reservoir Simulation, Scrivener-Wiley, 2010), therefore, we were able to base the engineering on a dogma-free science. Once the engineering was completed with examples of calculations and the results were matched with flawless continuity and economics of intangibles, critiques were silenced.

The central theme of the original zero-waste engineering book was that ***sustainability lies within nature, and only nature***. Any process that violates natural time frame is inherently implosive. The engineering, then, involves emulating nature. This is in sharp contrast to traditional engineering. In fact, traditional engineering starts with the assumption that there is something inherently wrong in nature that needs 'engineering' to conform to all criteria of usefulness. For instance, in Chemical Engineering there is an entire subject on how to denature natural chemicals in order to start chemically engineering the material. This principle is in the core of every engineering, including computer engineering that sees human intelligence substituted with artificial engineering or material science that sees breaking down of materials then recombining them in order to 'reinforce' original strength. So, if zero-waste engineering has to be credible, the book had to have a comprehensive selection of final products that measure up to the engineering standards. The book showed, not only the final products are equal in utility to engineered products, but often they are superior. The range of applications was also phenomenal.

Ever since the publication of the original volume, we have fine-tuned the original theory and deconstructed practically all theories of New Science (including Einstein's) as they apply to all aspects of human lives, including human intelligence and cognitive science. Soon after publishing our 'New Curriculum' book (Reconstituting the Curriculum, 2013), we launched a series of books on the 'greening of pharmaceutical engineering.' By using the theories advanced in the original zero-waste book, we were able to apply to the health related subjects. These books provided a new basis for editing the original book. It's because the original volume did not look into the human health implications. As an example, it was demonstrated in theory that CT scans or chemotherapy could be harmful and even trigger fatal conditions, but we didn't look into actual statistics of technology has taken a toll on human health. In this edition of zero-waste engineering, we added hundreds of new references and some 200 pages of new text. This made sure that whatever we said 4 years ago still holds true but more importantly how whatever we said before has much broader application than we had anticipated at the time. This book demonstrates how it is possible to acquire true knowledge, if and only if both necessary and sufficient conditions are met. These conditions include the following: 1. nature as the starting point; 2. dogma-free science as the cognition process; 3. intention is aligned with conscience. It is a simple concept, but introducing simple things are almost hazardous in a society that has prided itself in making things complicated in order to impress the audience, *viz.* - a 2000-year-old practice in Europe. If nature is recyclable and, by its condition, "perfect," in the sense that it cannot be wasteful or destructive without renewing itself, and if humans are, by their actions, responsible for the waste and devastation that we see in the world today, it seems that a return to natural pathways would be the logical way to achieve sustainability and zero-waste. We explore these issues and questions, offering mathematical models, new processes, and new, sustainable products for achieving this ultimate, desired result: Zero-Waste Engineering. This possibility can long longer be ignored.

1

Introduction

1.1 Background

Plato said, “Strange times are these in which we live when old and young are taught falsehoods. And the one man that dares to tell the truth is called at once a lunatic and fool.” Few question the notion that the ‘strange times’ are right now when it come so far as politics goes. However, fewer understand the science behind these ‘strange times’, even fewer appreciate how these ‘strange times’ have pervaded all aspects of our civilization. Practically no one sees this as a problem in the science and technology development sector. Many dislike the current system but few see the big picture and the direction that our civilization is moving and none can tell us how to fix the system.

Yet, the solutions to today’s problems are simple as long as we can be humble and be down to earth – literally accepting the premise than the mother nature is perfect. This is not a new theme. In fact, this theme as old as human civilization. Ancient Greeks tell us the story of Antaeus, who was rendered powerless only by breaking contact with the earth. In ancient India, it is the concept of representation, or life’s purpose, is founded in the notion of ‘avatar’. The word derived from the Sanskrit avatāra, meaning ‘descent,’ from ava ‘down’ + tar- ‘to cross.’ The word was used to describe believed deities or representative of gods on earth. This is not to be conflated with the notion of the reincarnation of Jesus, for example, as the

word Avatar can be used to describe pious and gurus in general—i.e., the expert practitioners of God's attributes. It in fact can signal to the fact that God's presence is in all creatures. This implies that Hinduism itself supported the notion that on an ideal level, the purpose of life is representing and practicing the attributes of God. In Islam, the purpose of life as well as the standard of a lifestyle and knowledge are explicit. The ideals of Islamic civilization tell us the virtue of pro-nature and conscientious lifestyle that will give us eternal peace. All these boil down to sustainability in the long term, with the logic that if Nature is perfect, and humans are the best creation of nature, doing good for the environment should be innate nature of humans. Pro-nature and pro-environment in its fundamental orientation, this book provides a première-quality space for research and development of sustainable technologies.

Even though claims have been to emulate nature, no modern technology truly emulates the science of nature. It has been quite the opposite: observations of nature have rarely been translated into pro-nature technology development. Today, some of the most important technological breakthroughs have been mere manifestations of the linearization of nature science: nature linearized by focusing only on its external features. Today, computers process information exactly opposite to how the human brain does. Turbines produce electrical energy while polluting the environment beyond repair even as electric eels produce much higher-intensity electricity while cleaning the environment. Batteries store very little electricity while producing very toxic spent materials. Synthetic plastic materials look like natural plastic, yet their syntheses follow an exactly opposite path. Furthermore, synthetic plastics do not have a single positive impact on the environment, whereas natural plastic materials do not have a single negative impact. In medical science, every promise made at the onset of commercialization proven to be opposite what actually happened: witness Prozac, Vioxx, Viagra, etc. Nature, on the other hand, did not allow a single product to impact the long-term negatively. Even the deadliest venom (e.g., cobra, Poisoned arrow tree frog) has numerous beneficial effects in the long-term. This catalogue carries on in all directions: microwave cooking, fluorescent lighting, nuclear energy, cellular phones, refrigeration cycles to combustion cycles. In essence, nature continues to improve matters in its quality, as modern technologies continue to degrade the same into baser qualities.

By contrast, the modern age is synonymous with waste generation. In industrialized countries, there is a direct correlation between the standard of living and generation of waste (McBean *et al.*, 1995). However, it is becoming increasingly clear that such a lifestyle is not sustainable from

economic (Zatzman and Islam, 2007), technological (Khan and Islam, 2007; Islam *et al.*, 2010; 2012; 2015), computational (Islam *et al.*, 2016a) or lifestyle and health (Islam *et al.*, 2015; 2016). Issues ranging from global warming to toxic shock continue to confirm that the 3Rs (reduction, reuse, recycling) approach is not sufficient and an alternate approach to technology development must be introduced.

Energy is the driver of this civilization of wasteful lifestyle and the amount of waste has been iconic in the energy sector. As time progressed, energy consumption per capital has sky rocketed. If our claim of progress is true, shouldn't we spend less energy for sustaining life? Figure 1.1. shows how per capita energy consumption has become the icon of civilization. The energy consumption in Qatar, for instance is over 50 times higher than that in India. Yet, India is still much poorer than Qatar. Yet, the same region is blessed with the brightest sun – the source of 'good energy'. However, that blessing has been reduced to nuisance and heat is seen as a distraction (Picture 1.1). The same region that once led the world in science for over 1000 years (7th to 18th century) has somehow become fixated to the notion 'nature is the problem and must be fixed'. In this book, we change that paradigm and introduce the notion, "Nature is perfect and must be emulated, not fought against".

When it comes to insanely obsessed with tangibles and short-term benefits, Europeans and the west in general are the leaders, but the problem of the third world countries (both affluent and poor) is that they are emulating the western wasteful habits. So, it is no surprise, it is once again the west that is calling the shot and asking the third world countries to become energy-wise, the pre-dominant theme being: Energy Efficiency Is The Most

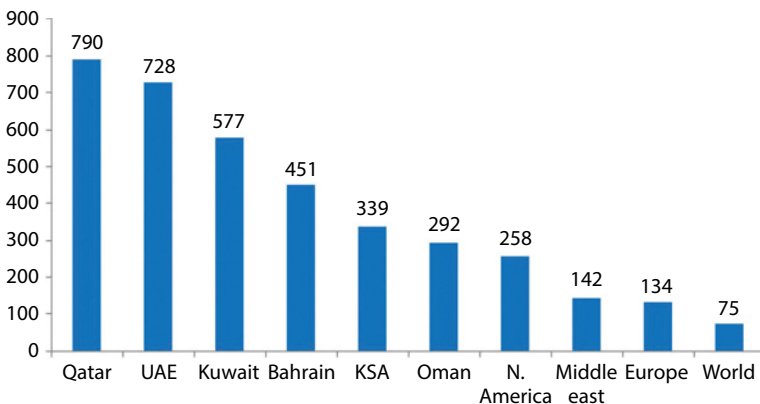


Figure 1.1 Per capita energy consumption in select countries and regions.



Picture 1.1 Kuwait City (60 C, July 3, 2016), the heat melted the rubber shades.

Important Fuel We Didn't Know We Had (Climate Progress, 2014). Here is a list of countries, ranked by their energy inefficiency, as shown in their respective *per capita energy consumption in oil equivalent*.

1. Iceland - 18,774 kg. With most of Iceland's energy coming from hydroelectric and geothermal power, Icelanders are planet's least energy-conscious, as if having non-fossil fuel energy is a ticket to becoming energy ignorant.
2. Qatar - 17,418 kg. Similar to Icelanders, Qataris are addicted to wasteful energy habits. Electricity in Qatar is called "liquid electricity" because it is often produced through desalination, a very energy-intensive process. Qatar's per capita emissions are the highest in the world, and three times that of the United States. To cap the insanity, 60% of the electricity is consumed domestically.
3. Trinidad and Tobago - 15,691 kg. Trinidad and Tobago is one of the richest countries in the Caribbean, and the region's leading producer of oil and gas; it houses one of the largest natural gas processing facilities in the Western Hemisphere. T&T is the largest LNG exporter to the United States. Its electricity sector is entirely fueled by natural gas.
4. Kuwait - 10,408 kg. Despite holding the sixth-largest oil reserves in the world, and an estimated 63 trillion cubic feet of natural gas reserves, the demand for electricity in Kuwait often outstrips supply. According to the U.S. Energy Information Administration (EIA), Kuwait is perpetually in electricity supply shortage and experiences frequent black-outs each summer. The country has become a net importer of natural gas to address the imbalance.

5. Brunei – 9,427 kg. This nation of roughly half a million has the region's highest number of cars per capita. Brunei also subsidizes both vehicle fuel and electricity, which is sold to the public at below-market prices. That obviously explains the mindset of the consumers.
6. Luxembourg – 7,684 kg. Landlocked Luxembourg is almost totally dependent on energy imports, mostly oil and gas. That doesn't prevent them from being energy-ignorant.
7. United Arab Emirates – 7,407 kg. Nothing says wasteful energy consumption like Ski Dubai. The indoor resort featuring an 85-meter-high mountain of man-made snow burns the equivalent of 3,500 barrels of oil a day. UAE is also the second (close to USA's 215 m³/year) most wasteful of water resources, consuming over 200 m³/year (550 l/day, Khaleej Times, 2016). This is remarkable considering UAE gets its nearly 99% of water through desalination – an extremely energy-inefficient process. In addition, negligible amount of this water is used for irrigation. Not surprisingly, UAE also leads in pediatric diabetes (Islam *et al.*, 2015). Figure 1.2 shows per capita water consumption of some of the countries.
8. Canada – 7,333 kg. Canada has a huge source of natural energy and that resulted in Canada becoming energy inefficient. Canada's electricity comes from hydro (some 50%), with coal the second most popular choice at 18 percent. Nuclear is third (14.6 percent), with oil and gas comprising just 6.3 percent and 1.5 percent, respectively. Yet, all politics are geared around oil sand, which can be produced naturally (Islam *et al.*, 2010).
9. United States – 6,793 kg. It has become fashionable to target USA for being the most wasteful nation on earth. However, despite annual economic growth, per-capita U.S. energy consumption has remained around the same level since the 1970s. According to the EIA, one explanation is that the U.S. has simply shifted the energy required to satisfy greater consumption to manufacturing centers offshore.
10. Finland – 6,183 kg. With over a third of its territory above the Arctic Circle, a cold climate, sparse population and a highly industrialized economy, Finland epitomizes the culture that says, 'fighting nature is engineering.'

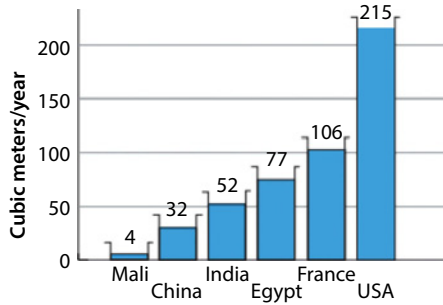


Figure 1.2 Per capita water consumption (data from Aquastat Factsheet), humans need less than 1 cubic meter year for personal consumption.

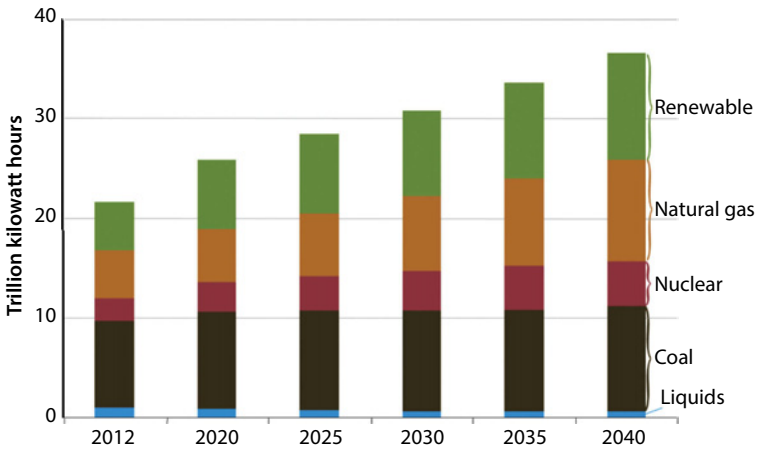


Figure 1.3 (From IEA Report, 2016).

The future also looks grim. Figure 1.3 Shows future energy needs for electrical energy. Consider the implications of the science that we discuss in this book, i.e., electricity is inherently toxic to the environment and is equally inefficient. This grim picture can be replaced with a rosy picture if direct solar energy usage is introduced. This theme is in the core of this book.

It is well known that nature produces no waste. The fundamental notion that matter cannot be created or destroyed dictates that only the transformation of materials from one phase to another phase can take place. However, the conservation of mass alone does not guarantee zero waste. Human intervention with natural processes can alter 100% of the cyclic nature of matter. Only natural processes operate zero-waste mode,

meaning that any product that is the outcome of a natural process must be entirely usable by some other process, which in turn would result in a product that is suitable as an input to the first process. Such a process will remain zero waste as long as each component of the overall process also operates within the principle of zero waste. That is why the emulation of nature is a necessary and sufficient condition that can lead us towards a truly sustainable lifestyle.

In this process, it is of the utmost importance to understand the nature of Nature. Defined as nature science, Zatzman and Islam (2007) and Zatzman *et al.* (2007a) introduced the scientific definition of truth and knowledge and ascribed them to natural traits of matter, energy, and human thought material (HTM). They stated that knowledge can only be achieved with true science. A process or an object is true only if, it has three real components, namely 1) origin; 2) process; and 3) end. For instance, for an action to be true, it must have a real origin (true intention); followed by real process (process that emulates nature); and real end (in line with nature that constantly improves with time). How can an intention be real or false? If the intention is to go with nature, it is real. Instead, if the intention is to fight nature, it is false. For a process to be real or sustainable, it must have the source real. This would eliminate all non-natural sources as the feedstock. With this analysis, genetically modified seed is automatically artificial whereas fossil fuel as the source is real. Other than the source, the process itself has to be real, which means it has to be something that exists in nature. For instance, light from direct burning of fossil fuel is real, whereas light from an electric lightbulb is artificial, hence unsustainable. Similarly, nuclear energy is artificial because it uses enrichment of uranium that is inherently anti-nature whereas fossil fuel is real because as long as the process is real (e.g. thermal combustion). This analysis forms the core of recent work of Islam *et al.* (2010; 2010a, 2012; 2015; 2016) in a number of disciplines. This series of work outlines fundamental features of nature and shows there can be only two options: natural (true) or artificial (false). They show that Aristotle's logic of anything being 'either A or not-A' is useful only to discern between true (real) and false (artificial). In order to ensure the end being real, they introduce the recently developed criterion of Khan (2006) and Khan and Islam (2007a). If something is convergent when time is extended to infinity, the end is assured to be real. In fact, if this criterion is used, one can be spared of questioning the 'intention' of an action. If any doubt, one should simply investigate where the activity will end up if time, t goes to infinity. The inclusion of real (phenomenal) pathway would ensure the process is sustainable or inherently phenomenal.

1.2 The Deficiency of Current Engineering Practices

For any cognition to be meaningful, it must proceed from a first correct premise. This premise itself has one major and one minor component. If both of these components are untrue, however, contradictions will soon arise. The key conclusion to grasp from this is that such contradictions cannot be remedied without correcting the first premise. New science, meanwhile, disconnects conscience from the cognition process, effectively taking away one's ability to change the first premise. Consequently, within Eurocentric culture, any notion of good intention required for natural cognition has gone AWOL. The parlous state of contemporary science and social science cannot be disconnected from this state of affairs.

As far as process goes, any data or facts, controlled-experimental or natural, have no meaning unless it is to support a correct theory. With Galileo's example, we demonstrated how Galileo himself fell short and couldn't go beyond his own false premise (Islam *et al.*, 2010a, 2010b). Even gravitational theory as well as light theory could have been advanced centuries ago if we didn't 'believe' in Newtonianism, then Einsteinian narration of Universe. What we have is continuous degradation in the cognition process, leading to the placement of 'belief' systems that are lot more dogmatic than the original dogma.

When it comes to larger theories (e.g., the so-called "big bang" and fundamental social and-or hard science theories), the debate becomes that of 'proving the negative'. The 'beauty' of all these theories is simply that one can never *disprove* them. This is because, no matter the evidence, the promoters will explain away all the discrepancies with dogmatic fervor. Thus for example: "New Science" starts off with the premise that no one creator created universe, nor did it have any purpose. The only theory that is tolerated in New Science is another theory that is riddled with equally absurd logic as long as the first premise that Nature created itself as a random act, devoid of purpose is kept intact. This would explain why today the 'Big chill' is plausible — but any rational theory is either a 'conspiracy theory', 'metaphysics' or religious mumbo-jumbo. This also explains why cognitive dissonance is all-pervasive, ranging from politics to medical science (Beauvois and Joule, 1996).¹ Sad to say: all these seem to form part of modern education systems' highest achievement.

¹Cognitive dissonance describes a psychological conflict resulting from simultaneously held incongruous beliefs and attitudes (as a fondness for smoking and a belief that it is harmful)

Today's engineering practices are a manifestation of what went wrong with our education system that has changed the meaning of every word and replaced with an aphenomenal one. As starter, the word 'physics' has the root meaning of 'science of nature'. In our own time, however, it has come about that the word 'physics' has come to apply to the science of artificial. For example: all recent Nobel prizes in Physics deal with theories that applicable to engineering processes. The underlying assumption of applying engineering theories to describe natural processes is that nature behaves the same way as a human-engineered process. Based on this premise, physicists have freely delved into describing natural objects, ranging from tiny quarks to large quasars. Since Newton, few scientists have attempted to explain creation (or the emergence) of the universe from nothing. Recent work meanwhile by Stephen Hawking — holder of the chair once occupied by Newton himself at Cambridge — has opened a new line of discussion in which old questions that apparently eluded modern scientists have resurfaced. Once again, age-old questions such as the ones listed below are being asked (Hawking, 2010).

1. What is the purpose of our (humans) existence?
2. What is the purpose of the existence of the universe?
3. Is time a creation, if so, when was created?
4. When did the universe begin?
5. How was the universe created?
6. How can we understand nature?

While asking questions is necessary, questions themselves are not sufficient for assuring the utility let alone the accuracy of the answers. Unfortunately, post-Newton Europe has lost the scientific cognition (Islam *et al.*, 2013; Islam *et al.*, 2015, 2016). As a result the most fundamental questions that would have any hope to invoke a paradigm shift are not even asked.

When it comes to engineering applications, however, there are often glimpses of hope and occasional silver linings. For instance, only recently, a “towering forest” was recognized as world's best building in 2015 by The Council on Tall Buildings and Urban Habitat (CTBUH), as in Picture 1.2.

However, how much forest like is this building that has all the materials made out of inherently toxic materials, equipped with inherently unsustainable energy systems? When one gathers information regarding these landmark projects be it a building or a wall (Picture 1.3), it becomes clear we have much work left to do. Figure 1.4 shows how even sustainable wall 'greening' has incorporated PVC, polyamide materials. Then there is, of



Picture 1.2 World's best building is dubbed a 'towering forest'.



Picture 1.3 Wall garden in Istanbul.

course, the other headline that undoes all the progress made, “Why Asia’s futuristic skylines just got crazier” (Chung, 2016), demonstrating again that the world remains captivated by the notion of tangible with an obsession that we haven’t seen before.

However, we have hope. This book shows, how each of the advancement in modern era can be utilized and the knowledge gathered of the past is not lost. For instance, consider replacing metal tubes with organically processed metals, PVC with natural and organic polymer, scorching sunlight



Picture 1.4 Direct solar heaters of Turkey (top figure without a tank; bottom figure with a tank).

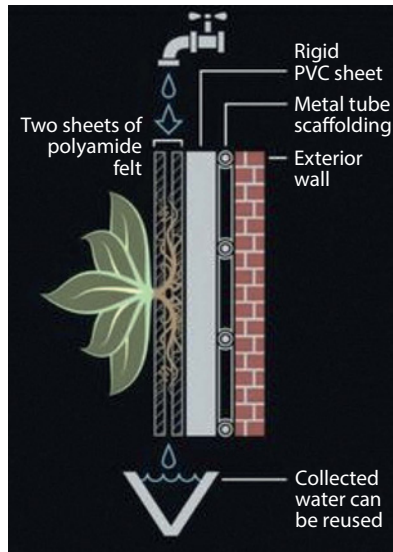


Figure 1.4 Wall gardens are a step forward toward zero waste engineering.

with a combined heating/cooling system that will produce more coolness as the sun heats up more. Imagine the possibilities when this engineering of zero waste is extended to other disciplines, such as petroleum engineering, as in Islam *et al.* (2010, 2012) or pharmaceutical engineering, as in Islam *et al.* (2015, 2016a, 2016b). How revolutionary the idea would be when we don't have to worry about global warming as an inevitable side effect of energy management or side effects that more debilitating than an ailment the medicines are supposed to cure.

The process is simple. We need to replace artificial mass and energy sources with natural ones. We need to replace artificial intention (of greed, selfishness, and short-sightedness) with natural intention (in conformance of universal order). There are no less than 20 million known chemicals. Most of them are natural, the most abundant one being water, air, and clay. I discovered that small new airplanes have no water in the bathroom. They replaced water with 100% alcohol hand sanitizer, water being available only to flush the toilet. Water is the essence of life and our civilization has come to this now! Anyway, I had to consume my favourite fruit, so how do I do that without water to wash afterward? You see, nature has solutions to every problem.

Modern engineering is not conducive to scientific research. In fact, it is entirely based on propaganda and disinformation. The worst and most damaging misinformation is in the topic replacing natural with artificial. Table 1.1. shows the list of themes presented as myth (left hand side of the table), as opposed to what the truth is (right hand side of the table).

This book debunks the fraud of new science at the fundamental premises. It recounts how the ‘enlightenment’ phase of European history made the entire process of fulfilling purpose of life travel further down the degradation route, called the HSSA (Honey-Sugar-Saccharine-Aspartame) degradation mode. The original purpose of life was perverted by the

Table 1.1 Debunking self created myths New Scientist style.

Called ‘myth’ by new scientist (Reeser, 2013)	Real science (Islam <i>et al.</i>, 2015)	Fundamental false premise of new science
Synthetic chemicals are more toxic than natural chemicals.	Natural chemicals are inherently beneficial and artificial chemicals	Nature is toxic and engineering must ‘purify’ nature
Organically grown food is better for you because it’s all natural.	Organically grown food is inherently beneficial while non-organic ones are inherently problematic in the long run	External and short-term features determine ‘goodness’ of a product/food
Synthetic copies of natural chemicals are not as good for you.	Synthetic copies are scientifically opposite to natural ones, except for time of ‘right now’	Origin and pathways have no relevance to the quality of a product