

# PLANET VERSUS PROFIT; SUSTAINABLE ENERGY SOLUTIONS CLEANING & DISINFECTION

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## Abstract

Production hygiene and cleaning are unavoidably linked. However the environmental impact of traditional cleaning is in contradiction with a global sustainable strategy. Sustainability is also about social responsibility and the global community. Creating a cleaner, healthier future for all begins at the doorstep of every producer. In order to make a public commitment to challenging, measurable reductions in the environmental impact innovative projects are required that will also drive to continuous improvement in the operational profile, the profits, the people and for the environment.

Commitments to reduce greenhouse gas emissions, leadership in water management and partnerships to protect the earth are essential elements for environmental stewardship and industry leadership.

**Key words:** *Cleaning, energy, sustainable solutions, water management, innovations.*

## 1. Introduction

Production hygiene and cleaning are unavoidably linked. However the environmental impact of traditional cleaning is in contradiction with a global sustainable strategy. Sustainability is also about social responsibility and the global community. Creating a cleaner, healthier future for all begins at the doorstep of every producer. In order to make a public commitment to challenging, measurable reductions in the environmental impact innovative projects are required that will also drive to continuous improvement in the operational profile, the profits, the people and for the environment. Commitments to reduce greenhouse gas emissions, leadership in water management and partnerships to protect the earth are essential elements for environmental stewardship and industry leadership.

## 2. Background

There is a great deal written about sustainability, much of it confusing and even contradictory. Some

even suggest that sustainability is the latest business “fad” and will soon be replaced by the next vogue. It is true that sustainability has developed from the original “green” concept, and continues to go through further iterations and definitions. Moreover, as more organisations adopt sustainability practices and offer more sustainable products and services, any competitive advantage and differentiation will diminish, requiring business to differentiate themselves in different ways.

However, two enduring considerations will ensure that sustainability, whatever its title and, to some degree, interpretation will remain core to future business operations:

- The global economic recession toward the end of the last decade demonstrated to even the most eco-sceptic business leaders that they could operate efficiently with reduced resources, hence, bolstering earnings.
- The world population will increase placing greater demands on finite resources, such as oil, with the likely consequence of reduced availability and increased cost, requiring businesses to become even more efficient and sustainable.

Exactly the same is true for Green Cleaning. At its outset, Green Cleaning essentially involved the use of environmentally preferable chemicals. Although an acceptable “first rung on the ladder” approach, Green Cleaning has gone through a number of developments to incorporate environmentally preferable tools, equipment and paper goods.

At one level, Green Cleaning is a fad inasmuch as it is not endemic across all or most organisations or countries. However, as regional legislation, such as REACH in Europe or GHS globally becomes more widely introduced, as organisations see the economic, social and environmental benefits of Green Cleaning, and competition pressures impact cleaning service providers, Green Cleaning will become more widespread and, ultimately, the norm.

## 2.1 Defining green cleaning

Green Cleaning is an integral element of sustainability and, therefore, before defining Green Cleaning, we first need to define sustainability.

There are many definitions and interpretations of what sustainability entails. Many use “sustainability” and “green” or “environmental” interchangeably; but the most widely cited and accepted definition came from the so called “Brundtland Report”.

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

The Brundtland Commission, formally the World Commission on Environment and Development (WCED), known by the name of its Chair Gro Harlem Brundtland, was convened by the United Nations in 1983. The commission was created to address growing concern “about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development.” In establishing the commission, the UN General Assembly recognised that environmental problems were global in nature and determined that it was in the common interest of all nations to establish policies for sustainable development. The whole was published in Report of the World Commission on Environment and Development (United Nations [1]).

The Brundtland definition has been further refined to the “triple bottom line”, sometimes referred to as “3BL” or “TBL”, and is currently the most common concept used by large national and international organisations. The triple bottom line of environmental, social and economic, also known as “people, planet, profit”, factors uses an expanded scale of values and criteria for measuring an organisation’s success (Figure 1).



Figure 1. Sustainable environment

Therefore, it is reasonable to expect that a comprehensive Green Cleaning programme should also encompass not only environmental considerations, but also social and economic considerations as well.

## 2.2 Defining green chemicals

There are many valid, and arguably as many invalid, interpretations or definitions of what a green cleaning element is. Many definitions/interpretations go beyond what the product should contain, and what it shouldn’t contain. Factors such as product classification and human health, rather than environmental health, and packaging amount and type are also often included. However, there is a common notion that “green” or “environmentally friendly” chemicals is denoted by a valid eco-accreditation such as the EU Eco-Label (“EU Flower”) and the Nordic Eco-Label (“Nordic Swan”) in Europe, and Green Seal and Environmental Choice in North America.

Although there are many similarities between these accreditations, there are also many differences. To illustrate this point, let us consider one environmentally contentious material, phosphorus (Table 1).

Table 1. Green label comparison

Green Seal Draft Final Revised Environmental Standard For Industrial And Institutional Cleaners, GS-37, April 18, 2008	Environmental Choice Program Standard for Household, Industrial and Institutional Hard Surface Cleaners, CCD-146 March 2007	EU Flower Criteria for All Purpose Cleaners & Cleaners for Sanitary Facilities, 23 March 2005	Nordic Eco-labelling: Eco-labelling of Cleaning Products, 15 June 2003 – 31 December 2008 Version 3.3
Product as used shall not exceed 0.5% by weight of total phosphorus	Banned	All Purpose cleaner – total phosphorus shall not exceed 0.02g/ fu*; Cleaner for sanitary facilities – total phosphorus shall not exceed 1g/fu & window cleaning products shall not contain phosphorus  (*fu = dose in g/L of water)	Maximum permitted quantity of phosphorous (gram/litre in-use solution or gram/kg in-use solution) = 0.05

Therefore, a sanitary cleaner containing 2% phosphorus which is used at 50g/L or 5% would be “green” under EU Flower and Green Seal, but “un-green” under Nordic Swan and Environmental Choice – one European eco-label “for” the product, one “against”; one North American eco-label “for” the product, one “against”.

That is not to say that one accreditation is “better or worse” than any other eco-label merely that there are differences and, as such, eco-labels are not a definitive definition of “green”.

Moreover, few, if any, eco-labels have criteria for products that have a disinfection or sanitisation function. As such, a facility that mandates “eco-label products only” would essentially eliminate the use of disinfectants and sanitizers. But what would be the human, social impact (and economic impact of employee ill-health, customer compensation and/or action by the authorities) of having unhygienic processing equipment and washroom facilities?

Apart from eco-labels, other definitions of “green” require that the product is biodegradable and/or “natural”. However, these also raise issues.

### Biodegradable

Many cleaning products claim to be “100% biodegradable”. In Europe, there are two important points to note on biodegradability:

1. Biodegradability is only defined for organic substances, that is, those substances that contain carbon. Inorganic substances that do not contain carbon, e.g. sodium hydroxide, are not biodegradable.
2. Technically, biodegradability is defined for substances (essentially single raw materials), and not for mixtures.

Given that the vast majority of cleaning products are a mixture of a number of organic and inorganic substances, including water, it would be inaccurate to claim that a product is “100% biodegradable”. Given that it has been European legislation for surfactants to be biodegradable since 1978, unless there was something unique or specific about biodegradability of the surfactants used, which should be identified by the manufacturer, a user cannot nor should not infer that one product is superior to another solely by a biodegradability claim.

### Natural

Of course the cleaning industry needs to reduce its reliance on petroleum as it is a finite resource. There are an ever growing number of products claiming to be “natural”. However, there is the very common misconception that being natural is somehow better for human and/or environmental health. In nature there are many things that are harmful - asbestos, cyanide, mercury, HIV to name but a few.

The discussion document “Meeting Natural Expectations”, published by the UK Cleaning Products Industry Association, points out that the separation of things “natural” from things that are “chemical” is

irrelevant and essentially meaningless. “All substances are just arrangements of atoms of the same 90-odd chemical elements of which the planet is made”.

Initial consideration suggests that natural materials are preferable to petroleum-based materials as they are more renewable, but at what cost. The extensively used palm oil is highly renewable but its production has resulted in the deforestation of many parts of the world, including Sumatra and Borneo.

Indeed, arguably the greatest uses of natural materials used in the majority of cleaning products are fragrances. Due to human health concerns with some fragrance ingredients, eco-labels tend to control/limit their use, and are even banned under the Environmental Choice Program Standard for Household, Industrial and Institutional Hard Surface Cleaners, CCD-146 March 2007 (Canadian Environmental Protection Agency [2]).

Moreover, it should be remembered that the vast majority of “natural” materials in cleaning products undergo some kind of chemical reaction to turn them into a useful, functional material. In essence, the raw material actually used is chemically synthesised and not found in nature. Furthermore, the synthesis process often uses materials such as ethylene oxide to produce surfactants called alcohol ethoxylates. According to the Australian Department of the Environment, “no significant natural sources of ethylene oxide are known”. As such, the ethylene oxide used in the synthesis of a “natural” surfactant is likely to come from petroleum.

Additionally, there are many potential sustainability issues with natural materials including:

- Use of pesticides and fertilisers to maximise harvest
- Genetically modified crops to increase yield?
- Is the crop/land diverted from food use or...?
- Where would we grow the additional crop?
  - Deforestation
  - Loss of CO<sub>2</sub> sink
  - Destruction of wildlife
  - Displacement of indigenous peoples
  - Child labour
  - Transportation or energy consumption
- More effort required
  - Increased health and safety issues
  - Reduced productivity
  - Staff turnover?
- Used neat or at very high concentration
  - Packaging manufacture, transportation, waste, storage
- Increased energy
  - Hot water/machinery used to achieve desired result

- Poor results - client/customer dissatisfaction?
  - Loss of turnover and jobs?

But whether or not it is an eco-label, biodegradable, natural or any other environmental claim, there is a considerable risk of greenwashing.

Greenwashing was coined by New York environmentalist Jay Westerveld in a 1986. Essentially, Greenwashing is the practice of companies disingenuously spinning their products and policies as environmentally friendly.

In December 2007, environmental marketing firm TerraChoice released a study called “The Six Sins of Greenwashing” (Schaefer [3]), which found that more than 99% of 1,018 common consumer products in North America randomly surveyed for the study were guilty of greenwashing. A total of 1,753 environmental claims made, with some products having more than one, and out of the 1,018 studied only one was found not guilty of making a false or misleading green marketing claim. According to the study, the six sins of greenwashing are:

- **Sin of the Hidden Trade-Off:** e.g. “Energy-efficient” electronics that contain hazardous materials.
- **Sin of No Proof:** e.g. Shampoos claiming to be “certified organic”, but with no verifiable certification.
- **Sin of Vagueness:** e.g. Products claiming to be 100% natural when many naturally-occurring substances are hazardous, like arsenic and formaldehyde.
- **Sin of Irrelevance:** e.g. Products claiming to be CFC-free, even though CFCs were banned 20 years ago.
- **Sin of Fibbing:** e.g. Products falsely claiming to be certified by an internationally recognised environmental standard like “EU Flower”.
- **Sin of Lesser of Two Evils:** e.g. organic cigarettes or “environmentally friendly” pesticides.

In April 2009, TerraChoice Environmental Marketing Inc. published a second report on the subject. This report noted the emergence of a seventh Sin – the “Sin of Worshiping False Labels”.

- The **Sin of Worshiping False Labels** is committed by a product that, through either words or images, gives the impression of third-party endorsement where no such endorsement actually exists; fake labels, in other words.

Furthermore, in April 2008 sustainability communications firm Futerra launched Greenwash Guide that identified 10 signs of greenwashing, many similar to TerraChoices seven sins:

1. **Fluffy language:** Words or terms with no clear meaning. E.g. “eco-friendly”

2. **Green product v dirty company:** such as efficient light bulbs made in a factory which pollutes rivers
3. **Suggestive pictures:** Green images that indicate a (unjustified) green impact, e.g. flowers blooming from a car exhaust pipe
4. **Irrelevant claims:** Emphasising one tiny green attribute when everything else is un-green
5. **Best in class:** Declaring that you are slightly greener than the rest, even if the rest are pretty terrible
6. **Just not credible:** “Eco-friendly” cigarettes – greening a product doesn’t make it safe
7. **Gobbledygook:** Jargon and information that only a scientist could check or understand
8. **Imaginary friends:** A “label” that looks like third-party endorsement... except it’s made up
9. **No proof:** It could be right but where is the evidence
10. **Outright lying:** Totally fabricated claims or data

But it’s not just a North American “problem”. Similar studies in Europe have found similar numbers and types of greenwash environmental claims. When considering the sustainability of a product, often it will only be environmental aspects that are considered. As discussed earlier, sustainability is a balance of environmental, social, and economic factors. That is not to say that every attribute or benefit of a product needs to encompass all three factors, but that all of the attributes/benefits, when combined, address all three issues. Moreover, even within a single attribute, consideration should be given to the consequences of a given feature. To take an extreme example, water is a natural, environmentally friendly, relatively inexpensive, and often an effective cleaner. So why isn’t water alone used more often? Some of the reasons include that the cleaning process is more arduous reducing productivity, hygiene results are not achieved, unless steam (or microfibers) is used, raising concerns over how the water is heated, health and safety of the operative etc. Consequently, the sustainability attributes of a product may be far broader and possibly harder to identify than would initially appear.

With all of the various environmental claims, many of which could be considered as “greenwashing”, it is difficult to understand which cleaning products are the most sustainable. Apart from the obvious price criterion, it is important to consider the total sustainability impacts of a purchasing decision. Often, this is easier if there is a “green” purchasing policy in place, but it should be noted that in this case, “green” does not specifically mean “environmental”, but also

should take into consideration social and economic factors.

Additionally, any policy should be flexible and pragmatic. For example, it may be appropriate to review monthly budgeting as the purchase of super-concentrates may exceed the monthly budget, particularly for the smaller, “one cleaner” sites. However, it is likely that the annual budget may be significantly lower. Conversely, in smaller sites, super-concentrates may take a number of years to consume, much longer than the manufacturers “shelf-life” guarantee.

Similarly, low noise equipment may be desirable for “daytime” cleaning operations in offices, but may not be wholly suitable in environments such as supermarkets where audible alarms are often used/required to alert shoppers.

The ecological “mantra” is **REDUCE-REUSE-RECYCLE**, in that order. It is much better to reduce the amount of, say, plastic waste rather than be primarily concerned about recycling that waste. At this point, it is worth clarifying what is meant by recycling. “Recycling” is concerned with taking a waste product, such as packaging, and through a relatively complex process, turning it into something else that is useful. So, taking waste plastic packaging and turning into a garden bench or a signpost is RECYCLING. Refilling empty containers following minimal processing, such as rinsing, is REUSING.

With that in mind, cleaning products should be:

1). **As concentrated as possible/practicable** as this reduces the amount of manufacturing energy, transportation to and from the manufacturer and the customer and waste packaging. Other environmental benefits of super-concentrates are that they also reduce the environmental impacts of storage and possibly inventory management, invoicing etc. Consider a 1-litre bottle of product, with all of the associated environmental impacts, used neat produces 1-litre of in-use solution; if diluted at 10% produces 10 litres of in-use solution, and at 1% produces 100 litres.

– For most cleaning and sanitation applications dilution rates of 5% or better should be achievable. For some applications, it may be necessary to use higher concentrations of product but these should be as effective as possible. For example, oven cleaners should be thickened products to cling to the oven, reducing the amount of product required. Similarly, floor coatings should be as durable as possible as this reduces not only the amount of product, packaging, transportation etc. of the finish, but also the stripper.

To illustrate this point, consider changing to the super-concentrated platform J-Flex/RTD, from Diversey, from a ready-to-use (RTU) product (Table 2).

**Table 2. Sustainable packaging**

	RTU	J-Flex/ RTU	% Saving
<b>Case Size</b>	6x750 mL	1.5 L	—
Equivalent number of cases	83.3	1	—
Total chemical shipped	375 L	1.5 L	99.6%
Waste plastic generated	37.0 kg	0.21 kg	99.4%
Waste cardboard generated	20.0 kg	0.16 kg	99.2%
Manufacturing energy required	46.9 kWh	0.2 kWh	99.6%
Total carbon dioxide equivalence	91.11 kg	0.55 kg	99.4%

2). **In the largest container as possible/practicable.**

Obviously very large containers create issues such as manual handling, storage, budgetary constraints, shelf-life etc. However, the smaller the pack size, generally the greater the proportion of packaging. For example, a typical ratio of plastic packaging to product for a 1-litre bottle is 74 g of plastic per litre of concentrate, for a 2-litre bottle it is 50 g per litre, and for 5-litres only 27 g of plastic per litre of concentrate.

3). **Products with integral dilution control measures**

not only reduces the amount of waste chemical due to over-dosing but also the resultant waste packaging, transportation etc. impacts of using too much chemical. Of course, the control measures could range from simple training supported by wall charts, but unless managed carefully, trials have indicated that even this results in an over-consumption of up to 67%. In-built portion control measures, that is, systems that are incorporated into the packaging that deliver a known quantity of concentrate are much better. These systems are particularly effective for “fixed” volumes of cleaning solution, such as trigger sprays. The best systems in terms of product waste involve dilution control. These are systems where the product is automatically mixed with water. These are particularly effective for “bucket” applications as only the required amount of cleaning solution needs to be prepared.

– It is important to note that other sustainability issues arise with over-concentrated cleaning solutions. For example, cleaning solutions that are too concentrated may require “rework” to remove smears, affecting productivity, and/or are more likely to damage the surface being cleaned. Similarly, under-concentrated cleaning solutions can create productivity issues in that extra work/effort may be required. Moreover, under-concentrated disinfection/sanitising products may lead to hygiene issues.

It may always be possible to find a “greener” or more socially acceptable and/or lower priced product, but at what cost? Is an eco-labelled, natural, non-classified, low price product the most sustainable? It may be, so long as many checks and balances are answered - has the product resulted in deforestation and/or create significant impacts due to transportation, storage and waste? Was child-labour used at any stage in the manufacturing process? Is the product difficult to train or create hazards such as manual handling or exposure to allergens? Is the process labour-intensive creating productivity issues or client dissatisfaction etc? In reality, therefore, the most sustainable/“green” product is the one that satisfies most of the sustainability criteria, most of the time.

### 2.3 Innovative solutions for food processing

No two food & beverage plants are the same. Therefore, sustainability solutions have to be tailored to that customer and, often, that site. Product safety and brand image are vital to the bottom line. That is why bottlers, food processors and dairy operators around the world have a specific need for a complete range of products and cleaning systems. Any hygiene supplier should cover a wide range of sustainable solutions - including cleaning-in-place, dry technology and water hygiene and conservation systems - improve sanitation, reduce risk and lower operational costs.

The following are some examples innovative sustainable solutions for food processors:

#### aquaCheck:

Originally developed for Food and Beverage business and now used for Institutional and Laundry markets, aquaCheck is a class-leading programme that helps customers manage their holistic water and related energy management. Through aquaCheck, total site water use is mapped identifying cost drivers. This proprietary programme measures, analyses and solves water usage problems to manage operating costs, improve operational efficiencies, save water and energy and reduce waste.

The aquaCheck service is constructed in three phases:

#### - aquaSCAN:

aquaSCAN is a benchmarking exercise comparing water use efficiency and waste water discharge with production volumes, number of diners, guest nights, rooms occupied etc. over time and against industry standards. This exercise quantifies the financial savings and indicates whether there is value in proceeding to the next phase, aquaPROBE.

#### - aquaPROBE:

aquaPROBE is a comprehensive survey of ALL water

use and recommendations for savings based on financial potential (for non-capital projects) and return on investment (for capital projects). The survey takes a significant amount of time on site from dedicated auditors and involves practical measurement of volumes using non-intrusive flow meters alongside any water meter data which the site already gathers. A full site water mass balance is compiled.

#### - aquaSOLV:

aquaSOLV is included as part of realising the savings. This is a campaign to implement the recommendations of aquaPROBE and monitor achievements against the agreed objectives. The savings are validated through the attainment of KPI objectives and a “hands on” approach.

One of the world’s largest beverage bottlers has used aquaCheck to evaluate its water use in plants around the world. Diversey conducted aquaCheck audits at several locations worldwide, representing the mix of geographical and product influences that affect the bottler’s water use for different products and processes. Cold aseptic filling, glass bottle filling and plastic soft drink bottle filling, for instance, are different processes with different demands in the bottling plants.

The aquaCheck audits identified more nearly €6 million in savings opportunities, and the potential to conserve nearly 1.8 billion litres of water - savings for the planet and savings for the bottler’s operational costs.

The customer has begun implementing the changes recommended and continues to reference aquaCheck as a preferred tool for water use efficiency improvements.

A major dairy producer in Europe implemented aquaCheck after several other audits and products from other suppliers had delivered only marginal improvements in water use. The plant manager was looking for a solution that would help the plant protect food safety, minimise downtime, provide cost savings and meet ISO 14001 environmental management goals. The further challenge: the plant uses water-based heating and cooling processes to maintain safe food handling temperatures while it produces a wide array of products, often in short batches, which requires frequent line cleaning.

An aquaCheck audit identified ways to reduce the plant’s water use by one-third, saving 3 million litres of water per year and substantially reduced the plant’s costs to pump in clean water and treat wastewater. Several of the changes recommended also reduced the plant’s energy costs for heating water and reduced the total chemical use at the plant. All told, the program helped the customers save 2.12 billion litres of water in 2009.

### Secure Check:

Food processors are constantly looking to reduce the risk of food-borne contamination that threatens public health and the reputation of their brands. When a European meat processor experienced Salmonella contamination in one of its facilities, it turned to Diversey to identify improvements to its cleaning and hygiene process and to develop a new programme to reduce risk of future contamination.

The results of the SecureCheck (Timmerman *et al.* [4]) approach not only improved the microbiological profile of the manufacturing facility, but it also helped the customer reduce its water consumption and save money.

Working closely with plant employees, a SecureCheck assessment was conducted, including a deep analysis of the company's cleaning and sanitation procedures. The results identified several deficiencies in training of the facility's cleaning staff and specific areas of the plant where cleaning procedures were inadequate.

Following the audit and training review, a completely redesigned training programme, featuring new cleaning procedures was put in place. A small cleaning in place (CIP) system was installed for areas found to require cleaning and sanitation on a more frequent basis.

The results of this partnership addressed the source of the Salmonella and overall microbiological results improved significantly. The CIP system and new employee training enabled the processor to reduce its spending on chemicals by 10%, saving €16,000. The new processes also reduced water consumption at the facility by 15% due to the more efficient processes.

### **3. Conclusions**

- Green Cleaning should be and is based on sound sustainability principles, addressing the needs of environmental stewardship, social progress and economic growth. While it may go through further iterations and refinement, the economic and legislative factors alone mean that Green Cleaning will become more prevalent in more sites and more countries.
- There are issues (and opportunities) in defining what is "green" on a personal, pan-regional or global level, and to have a consistent or at least mutually acceptable eco-label system for both products and services. Even then, there needs to be vigilance in ensuring that any environmental or sustainability claims that we make or receive from suppliers stands up to scrutiny.
- Commitments to reduce greenhouse gas emissions, leadership in water management and partnerships

to protect the earth are essential elements for environmental stewardship and industry leadership. Innovations should focus on validating these sustainable claims.

### **4. References**

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