



EXIN Green IT Foundation

Workbook

Nick Bakker
Michaël Gründeman
René Visser

Edition: December 2012



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Introduction

An increasing number of IT organizations are joining the movement of corporate social responsibility. They have a new perspective on how to reduce the ecological footprint of their organization and the business process supported by IT services. Green IT is the word! Green IT is about the efficient application of intelligent, energy, eco-friendly technology and techniques throughout the organization.

This workbook will help you prepare for the EXIN Green IT Foundation exam and provides you with a sound basis of Green IT.

Topics discussed are:

- Understanding Green IT: outline of the world of Green IT;
- Lifecycle management: purchase, usage and disposal of equipment, services and consumables from a Green perspective;
- Optimizing the infrastructure: greening the data center;
- IT as enabler: how Green IT reduces the ecological footprint in business supply chain and at the workplace;
- Governance and processes for Green IT: anchoring sustainability in IT service delivery aligned with corporate sustainability policy.

The exam consists of 40 multiple choice questions. In this workbook you will find several multiple choice sample questions, and to help increase your knowledge about Green IT we have also included so-called “get it” questions. You will find these questions at the end of each Chapter. The exam requirements are specified at the beginning of each Chapter, and the weight of the different exam topics is expressed as a percentage of the total.

Target audience

Everyone who wishes to prepare for the EXIN Green IT Foundation exam and everyone interested in the basics of greening IT:

- IT professionals and sustainability officers seeking to reduce costs, increase efficiency and/or reduce the organizations environmental footprint through technology.
- Managers and professionals in the IT organization who need to transform IT operations to a more sustainable and cost effective service provision model.

Understanding Green IT: exam specifications (15%)

1.1 Definition of Green IT (2.5%)

The candidate can:

- 1.1.1 Define Green IT
- 1.1.2 Describe the key features of Green IT/sustainable computing

1.2 The SMART/GREEN IT Framework (2.5%)

The candidate can:

- 1.2.1 Recognize elements of the SMART/GREEN IT Framework
- 1.2.2 Describe the benefits of the framework

1.3 Drivers and motivators for Green IT (5%)

The candidate can:

- 1.3.1 Identify internal drivers for Green IT
- 1.3.2 Identify External drivers for Green IT
- 1.3.3 Describe Carbon market mechanisms

1.4 Relationship between Corporate Social Responsibility (CSR) and Green IT (5%)

The candidate can:

- 1.4.1 Name international Green [IT] organizations and initiatives.
- 1.4.2 Describe how Sustainable computing practices impact CSR
- 1.4.3 Describe the seven sins of Greenwashing (Green sheen)

Please note that the Paragraphs in Chapter 1 do not follow the order of the above mentioned exam requirements. We refer you to Chapter 2 of the Green IT Foundation Preparation guide (available on www.exin.com) for a detailed overview of the exam requirements.

1. Understanding Green IT

In this Chapter we will discuss the world of Green IT. Where does the notion of Green IT come from and what are the drivers behind this idea? In the second part of this Chapter we will introduce a Green IT framework which gives support to organizations when it comes to the formulation and implementation of a Green IT policy.

1.1 The relationship between Corporate Social Responsibility (CSR) and Green IT

1.1.1 The triple bottom line (people, planet, profit)

How can IT be made sustainable (sustainable computing), and what role can IT play in a development of a more sustainable world (IT for Green)? These two key questions are addressed by Green IT. Before we can answer these questions we have to know more about the background of the idea of sustainable development and how it has reached such a high place on the agenda of business and public organizations worldwide.

Sustainable development

The word 'sustain' has been in the language for a long time. It comes from the Latin word 'sustenare' meaning "to hold up" i.e. to support. From there it evolved long ago to mean to keep something going or extend its duration. Sustain and its derivatives (e.g. sustainability, sustainable, sustaining) were first used in a personal context. However, in the 18th century the Germans developed a form of forestry designed to keep the forest going as productive systems over the very long term by keeping a balance between cutting down trees and the growth of new trees. In the English speaking world this was called sustainable forestry. The idea was later extended to sustainable fisheries.

In the 1960s and 1970s the term was for the first time applied to the macro context of environmental issues where there was a need to sustain the whole environment and human society. The now generally accepted definition of sustainable development goes back to the work of the World Commission on Environment and Development which was installed in 1982 by the UN second world environment conference in Nairobi. The chairman of this commission was Mrs. Gro Harlem Brundtland, a former prime minister of Norway.

In 1987 the commission published the report 'Our common future'. In this report sustainable development is described as "a development that results in the needs of the present being met without compromising the ability of future generations to meet their own needs" ('Our common future', 1987). In the report the commission acknowledges the close relationship between hunger, poverty and ecological threats. Genuine progress can only be sustained when the underpinnings of the environment, society and the economy are maintained.

Global Compact and Millennium goals

The United Nations has played a key role in putting sustainability high on the agenda of business and public organizations. An important initiative in this context is 'Global Compact', which aims to encourage businesses worldwide to adopt sustainable and socially responsible policies and report on their implementation. The Global Compact is a principle-based framework for businesses, stating ten principles in the areas of human rights, labor, the environment and anti-corruption.

Human Rights
Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights; and
Principle 2: make sure that they are not complicit in human rights abuses.
Labour
Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
Principle 4: the elimination of all forms of forced and compulsory labour;
Principle 5: the effective abolition of child labour; and
Principle 6: the elimination of discrimination in respect of employment and occupation.
Environment
Principle 7: Businesses should support a precautionary approach to environmental challenges;
Principle 8: undertake initiatives to promote greater environmental responsibility; and
Principle 9: encourage the development and diffusion of environmentally friendly technologies.
Anti-Corruption
Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

Figure 1.1: Ten Principles of the Global Compact. (Source: unglobalcompact.org)

The Global Compact was officially launched at UN Headquarters in New York on July 26, 2000. The Global Compact is the world's largest corporate citizenship initiative and has more than 5,300 participating businesses from over 135 countries. As a voluntary initiative it has two objectives: "Mainstream the ten principles in business activities around the world" and "Catalyze actions in support of broader UN goals, such as the Millennium Development Goals (MDGs)".

The Millennium Development Goals (MDGs) are eight international development goals that all 193 United Nations member states and at least 23 international organizations have agreed to achieve by the year 2015.

UN Millennium goals

1. Eradicating extreme poverty and hunger,
2. Achieving universal primary education,
3. Promoting gender equality and empowering women,
4. Reducing child mortality rates,
5. Improving maternal health,
6. Combating HIV/AIDS, malaria, and other diseases,
7. Ensuring environmental sustainability, and
8. Developing a global partnership for development.

Figure 1.2: Millennium goals. (Source: United Nations - un.org)

Triple Bottom Line (3BL)

For enterprises, the idea of sustainable development has found a translation in the Triple Bottom Line concept which is based on the idea that the responsibility of an enterprise lies with its stakeholders rather than with its shareholders. This means that the traditional reporting framework should take into account social and environmental performance in addition to financial performance. People, planet and profit succinctly describe the triple bottom line and the goal of sustainability. The phrase, "people, planet, profit", was coined by John Elkington in 1995 in his book 'Cannibals with Forks: the Triple Bottom Line of 21st Century Business'.

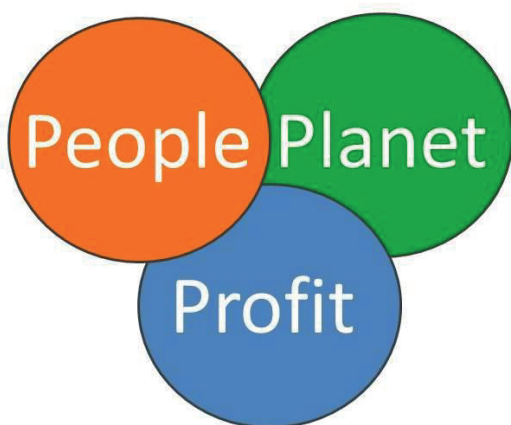


Figure 1.3: The triple bottom line. (Source: Elkington, 1995)

The triple bottom line approach means that organizations should behave in profitable, social and environmental responsible way. What corporate social responsibility (CSR) really means is clarified by the International Organization for Standardization standard ISO 26000. The ISO 26000 standard, offers guidelines for (corporate) social responsibility. The current version of this standard is ISO 26000:2010 (source: www.iso.org).

According to ISO 26000, the objective of social responsibility is to contribute to sustainable development. In the standard it is stated that: "The essential characteristic of social responsibility is the willingness of an organization to incorporate social and environmental considerations in its decision-making and be accountable for the impacts of its decisions and activities on society and the environment. This implies both transparent and ethical behavior that contributes to sustainable development, which is in compliance with applicable law and consistent with international norms of behavior and is integrated throughout the organization and practiced in its relationships and takes into account the interests of stakeholders." (ISO 26000:2010).

Complementary to ISO 26000 organizations can make use of other standards to help them act in a social and environmental responsible way. An example of a relevant standard in this context is ISO 14001. ISO 14001 is a standard for environmental management systems that is applicable to any business, regardless of size, location or income. The main aim of this standard is to assist companies in continually improving their environmental performance, whilst complying with any applicable legislation. The current version of this standard is ISO 14001:2004/Cor 1:2009 (source: iso.org).

To help them report on the triple bottom line, organizations can use the guidelines of the Global Reporting Initiative (GRI). GRI is an independent organization which collaborates with the center of United Nations Environmental Program (UNEP) and works in cooperation with the United Nations Global Compact. Its vision is that reporting on economic, environmental, and social performance by all organizations should be as routine and comparable as financial reporting. GRI has developed a set of core metrics intended to be applicable to all business enterprises, sets of sector-specific metrics for specific types of enterprises and a uniform format for reporting information integral to a company's sustainability performance.

1.1.2 The impact of Sustainable computing practices on CSR

Sustainable (Green) computing practices can contribute to corporate social responsibility in several ways. For example, IT is a big consumer of electricity; worldwide data center electricity use doubled from 2000 to 2005. A recent study by J.G. Koomey (2011) on energy demand from data centers indicated that, due to the economic downturn and continued energy efficiency and performance improvements, global energy demand from data centers from 2005-2010 increased by 56%. That is less than the worst case scenario (100%) that was previously estimated, but a 58% increase in energy consumption in a period where global electricity consumption is otherwise essentially flat due to the global recession is still a very substantial rate of growth (Greenpeace, 2012). The total electricity use by data centers in 2010 is about 1.3% of all electricity use for the world, and 2% of all electricity use for the US (Koomey, 2011).

Based on current projections, the demand for electricity will more than triple to 1,973 billion kWh by 2030, an amount greater than the combined total demands of France, Germany and Canada (Greenpeace, 2012).

The amount of energy which is needed by the IT industry has as a consequence that the IT sector is also responsible for a large amount of CO₂ and other greenhouse gas (GHG) emissions. According to Gartner this amounts to 2% of the total worldwide emissions of greenhouse gasses.

This is about as much as the aviation industry (SMART 2020, 2008).

The figures in the SMART 2020 report indicate that there is room for improvement, and it also means that IT can contribute in a positive way to CSR goals by:

- Lowering energy usage and thereby lowering electricity bills. Organizations can gain much by improving the cooling and temperature control in data centers which can lead to lower energy usage.
- Using energy from sustainable resources (sun, water, wind, and biomass) as much as possible.
- Containing the growth of IT. Current trends show data center capacity needing to double every 5 years. Green IT can slow the need for expansion as well as reduce the demand for electricity, floor and rack space, and air conditioning by:
 - Making use of virtualization techniques;
 - Using data management software for efficient use of servers;
 - Using compression techniques;
 - Making IT systems and components more energy efficient;
 - Implementing and forcing policies in relation to power management of PC's and notebooks, use of printers etc.

In Chapter 3 you can read more about this topic.

The energy required for the manufacturing of all this electronic equipment (including consumer appliances), the so called embedded energy is also of importance. The energy used to produce electronic devices is considerably higher than the energy used during their operation. The embodied energy of the memory chip alone already exceeds the energy consumption of a laptop during its life expectancy of 3 years (De Decker, 2009).

Apart from energy, a lot of other resources are needed during the manufacturing phase of IT and other electronics devices:

- Oil (plastics are being made from oil);
- Substances used in large quantities such as epoxy resins, fiberglass, PCBs, PVC (polyvinyl chlorides), thermosetting plastics, lead, tin, copper, silicon, beryllium, carbon, iron and aluminum;
- Elements used in small amounts such as cadmium, mercury, and thallium and rare earth elements like neodymium and europium;
- Water which is in large amounts necessary in the production phase.

According to Kuehr and Williams (2003), the rule of thumb for the manufacturing of an average desktop computer and monitor is that the manufacturing uses more than 10 times the weight of an average desktop computer in fossil fuels and chemicals. The construction of an average 24-kilogram computer and 27" monitor requires at least 240 kilograms of fossil fuel, 22 272 kilograms of chemicals and 1,500 kilograms of water – or 1.8 tons in total, the equivalent weight of a rhinoceros or sports utility vehicle. This means that computer manufacturing relatively is much more materials-intensive than making a car or refrigerator, which need only one or two times their weight in fossil fuels.

At the same time the lifecycles of equipment is 3-5 years, which is rather short. Although there is strict regulation since 2006 on the disposal of electronic waste in Europe (the WEEE directive), a lot of IT equipment still ends up on landfills as e-waste or is incinerated at the end of its lifecycle.

According to the Environmental Protection Agency (EPA) Americans generated about 3 million tons of electronic waste in 2007. Out of all that waste only 13.6 percent was recycled — the rest ended up in landfills or was shipped to developing nations like Ghana, Nigeria, Vietnam, India, China and the Philippines. In these countries e-waste creates a lot of health and environmental problems due

to very primitive recycling methods, and by the harmful toxins within e-waste like lead, cadmium and mercury.

When it comes to embedded energy and use of resources, Greening IT will have a very positive impact on sustainable development and corporate social responsibility (CSR) goals, by:

- Designing IT devices which need at least as possible scarce resources and energy to manufacture it;
- Extending the lifespan of computers (e.g. through re-use reselling, upgrading, refurbishing and recycling);
- Designing IT devices and components which can either be fully recycled or are biodegradable.

Green IT as part of the CSR policy will also have positive effects on the good will of employees, customers, business partners, and people in general. You can read more on this topic in Paragraph 1.2: Drivers and motivators for Green IT.

1.1.3 The seven sins of Greenwashing

Companies can only reinforce their reputation when they are seen as a true Green company, and not one that is engaged in Greenwashing. Greenwashing is generally used when significantly more money or time has been spent advertising being Green (that is, operating with consideration for the environment), rather than spending resources and effort on environmentally sound practices.

According to a report by Terrachoice on environmental claims made in the North American consumer market there are seven sins related to Greenwashing (Terrachoice 'The Sins of Greenwashing', 2010):

1. Sin of the hidden trade off. A claim suggesting that a product is 'Green' based on a narrow set of attributes without attention to other important environmental issues. Companies are eager to tout reductions in energy use of their computers. Any energy saving is good, but research shows that more than 80% of the energy consumption over the lifecycle of the computer occurs in production – before it even gets used. So these claims are misleading people into thinking the products have low energy impacts when really the energy used in making them is still very high. Even worse, they encourage people to buy new, "more energy efficient" computers. But considering the energy needed to make the new ones, hanging on to the old one a little longer clearly has the lower overall carbon footprint.
2. Sin of no proof. An environmental claim that cannot be substantiated by easily accessible supporting information or by a reliable third-party certification.
3. Sin of vagueness. A claim that is so poorly defined or broad that its real meaning is likely to be misunderstood by the consumer. 'All-natural' is an example. Arsenic, uranium, mercury, and formaldehyde are all naturally occurring but poisonous. 'All natural' isn't necessarily 'Green'.
4. Sin of worshipping false labels. A product that, through either words or images, gives the impression of third-party endorsement where no such endorsement exists; fake labels, in other words.
5. Sin of irrelevance. An environmental claim that may be truthful but is unimportant or unhelpful for consumers seeking environmentally preferable products. 'CFC-free' is a common example, since it is a frequent claim despite the fact that CFCs are banned by law.
6. Sin of lesser of the two evils. A claim that may be true within the product category, but that risks distracting the consumer from the greater environmental impacts of the category as a whole. When flat panel TVs began to replace tube TVs (which contain several pound of lead) the new TVs were sometimes marketed at "lead-free." Lead is a toxic chemical, so lead-free must be good. But the companies failed to mention that they were now using lamps containing mercury, a highly toxic chemical.

7. Sin of fibbing. Environmental claims that are simply false. The most common examples were products falsely claiming to be ENERGY STAR certified or registered.

1.1.4 International Green (IT) organizations and initiatives

A number of organizations can help organizations with Green IT objectives, and can offer business and organizations support and advice for:

- Developing a greener IT strategy and management;
- Making responsible IT purchases;
- Managing the reuse and proper disposal of electronics and technology products.

In the reference pages on organizations you can find more information.

Green Computing Impact Organization

A U.S. based organization dedicated to supporting the sustainable transformation of IT-infrastructures by providing education, audits, strategy, advocacy, and network for IT organizations and Green technology vendors.

Green Grid

The Green Grid is an industry consortium based on improving energy efficiencies in data systems and computing environments. The Green Grid is working to define metrics, models, measurement methods, and new technologies. They have a worldwide membership. Some of the topics the Green Grid covers are:

- Organizational behavior issues in operating IT and facilities for energy efficiency;
- Metrics for data center infrastructure efficiency;
- Ways to reduce data center server power consumption and data center power efficiency metrics;
- Guidelines for energy efficient data centers.

An organization that joined the Green Grid in 2012 is the Climate Savers Computing Impact initiative (CSCI). The Climate Savers Computing Impact initiative is a non-profit group of consumers, businesses and conservation organizations dedicated to promoting smart technologies that improve power efficiency and reduce energy consumption of computers.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

ASHREA is an organization created to 'serve humanity and promote a sustainable world'. As cooling is of major concern to data centers and is a huge consumer of power, ASHRAE has been invaluable in its efforts to define standards and to provide insight and guidelines.

Alliance to Save Energy (ASE)

ASE is a worldwide organization supporting the adoption of energy efficient strategies by providing information and support to consumers, policy makers, private industry, and educators.

The Global e-Sustainability Initiative (GeSI)

GeSI aims to further sustainable development in the Information and Communications Technology (IT) sector. GeSI works with the United Nations Environment Program (UNEP) and the International Telecommunication Union (ITU) to support business and organizations. In 2008 the Climate Group on behalf of GeSI, published the SMART 2020 report. This report details how changes in business use of IT technology could reduce annual human generated global GHG emissions by 15 percent in 2020. You can read more on this topic in Chapter 4.

The Electronics TakeBack Coalition

The Electronics TakeBack Coalition (ETBC) promotes Green design and responsible recycling in the electronics industry. Their goal is to protect the health and well-being of electronics users, workers, and the communities where electronics are produced and discarded by requiring consumer electronics manufacturers and brand owners to take full responsibility for the lifecycle of their products, through effective public policy requirements or enforceable agreements.

The Basel Action Network

The Basel Action Network (BAN) is a global organization that addresses environmental injustice and toxic trade. This organization is a partner of the Electronics TakeBack Coalition. BAN has created criteria to credential 3rd party-audited recyclers. These criteria include no toxic e-waste dumped in landfills or incinerators, exported to developing countries, or sent to prison labor operations and no release of private data.

International Association of Electronics Recyclers (IAER)

IAER is an international trade organization that offers membership to private, public, and non-public entities of all kinds that are involved in the recycling of electronic products and materials.

ENERGY STAR

ENERGY STAR was created by the U.S. Environmental Protection Agency and the U.S. Department of Energy in 1992, helping us all save money and protect the environment through energy efficient products and practices. It has now been adopted by several countries around the world, including Australia and the European Union.

1.2 Drivers and motivators for Green IT

1.2.1 Internal drivers for Green IT

The needs for cost reduction, new business opportunities and employee demands are important internal drivers for Green IT (Baroudi et al., 2009).

1. Rising costs

The costs of energy, transport, waste disposal and raw materials are still going up. As is explained in Green IT for Dummies, Green IT can help the business in several ways to reduce their costs:

- Energy costs: IT uses a lot of energy and greening IT can dramatically reduce energy consumption. In Chapter 2, 3 and 5 you can find more on this subject;
- Equipment costs: Greening IT optimizes the IT-infrastructure by consolidating servers and storage, which often results in needing less equipment;
- Business process optimization: Optimizing business processes including supply chain management represents a huge opportunity for lowering carbon emissions with such solutions as shipping logistics, planning, among others.
You can read more on this topic in Chapter 4.

2. New business opportunities and reputation

New markets, knowledge and technologies enabling for example businesses to cut their carbon emissions while increasing productivity and developing new products and services. For example:

- Developing compact and eco-Green packaging;
- Creating products that require less or no water, as compared to similar products that are water intensive;
- Creating products and services service that enable customers, suppliers and partners to manage energy in radically improved ways.

3. Employees

According to research on this topic a CSR policy often results in:

- Enhanced employee attraction and retention;
- Empowered and motivated employees;
- Enhanced employee satisfaction;
- Increased attraction to new employees.

1.2.2 External drivers for Green IT

Business and public organizations also have to take care of laws and regulations and the pressure from their external stakeholders like non-governmental organization (NGO's), trade unions, business partners and investors. This gives an external push to develop sustainable (Green) practices, products and services.

1. Laws and regulations

Some examples of laws and regulations regarding the use of hazardous materials and e-waste are:

- The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment, commonly referred to as the Restriction of Hazardous Substances Directive or RoHS). The RoHS directive took effect on July 1st 2006, and is required to be

enforced and become law in each member state. This directive restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. RoHS is often referred to as the lead-free directive, but it restricts the use of the following six substances: lead, mercury, cadmium, hexavalent chromium and two flame retardants (PBB and PBDE).

- The Waste Electrical and Electronic Equipment Directive (WEEE) which sets collection, recycling and recovery targets for electrical goods and is part of a legislative initiative to solve the problem of huge amounts of toxic e-waste. The WEEE directive is closely connected to the RoHS directive.
- REACH, Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals. It entered into force on June 1st 2007. It streamlines and improves the former legislative framework on chemicals of the European Union (EU). The main aims of REACH are to ensure a high level of protection of human health and the environment from the risks that can be posed by chemicals, the promotion of alternative test methods, and the free circulation of substances on the internal market and enhancing competitiveness and innovation. REACH makes industry responsible for assessing and managing the risks posed by chemicals and providing appropriate safety information to their users. REACH is considered one of the strictest regulations given its impact on the way manufacturers, retailers and IT organizations do business and function day-to-day.
- International treaty on carbon emissions, the Kyoto Protocol. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. This amounts to an average of five per cent against 1990 levels over the five-year period 2008-2012.

2. External stakeholders

- Consumers and consumer organizations. Sustainable products and services have a greater appeal to customers who prefer sustainable products and services. Green IT as part of the broader CSR policies and initiatives can lead to improved brand reputation and increased competitive advantage (Baroudi et al., 2009).
- Business partners. Green product leadership will have a positive appeal on business partners and will help to create a Green value chain. Purchasers are increasingly obliged to Green purchasing (see Chapter 2).
- Trade unions. Representing workers, trade unions are vital actors in facilitating the achievement of sustainable development. They have extensive experience in addressing industrial change, give extremely high priority to the protection of the working environment and the related natural environment and promote socially responsible and economic development.
- Non-governmental organizations (NGO's), for example Greenpeace, who are campaigning against dumping e-waste in developing countries.
- Investors, especially the group of Socially Responsible Investors (SRI) who encourage corporate practices that promote environmental stewardship, consumer protection, human rights, and diversity. Some avoid businesses involved in alcohol, tobacco, gambling, pornography, weapons, and/or the military. The areas of concern recognized by the SRI industry can be summarized as environment, social, and corporate governance. In addition to stock ownership either directly or through mutual funds, other key aspects of SRI includes shareholder advocacy and community investing.
- Local communities. Green IT reduces the negative environmental impact of IT to a minimum and will contribute to a more healthy environment for the people to live in.

1.2.3 Carbon market mechanisms

A greenhouse gas (often abbreviated as GHG) is a gas in the atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The greenhouse effect is the natural process by which the atmosphere traps some of the sun's energy, warming the earth enough to support life. However since about 1750 human activity (especially burning coal for heating and the production of electricity) has increased the concentration of carbon dioxide and other greenhouse gases. Measured atmospheric concentrations of carbon dioxide are currently more than 10 times the level of 1900.

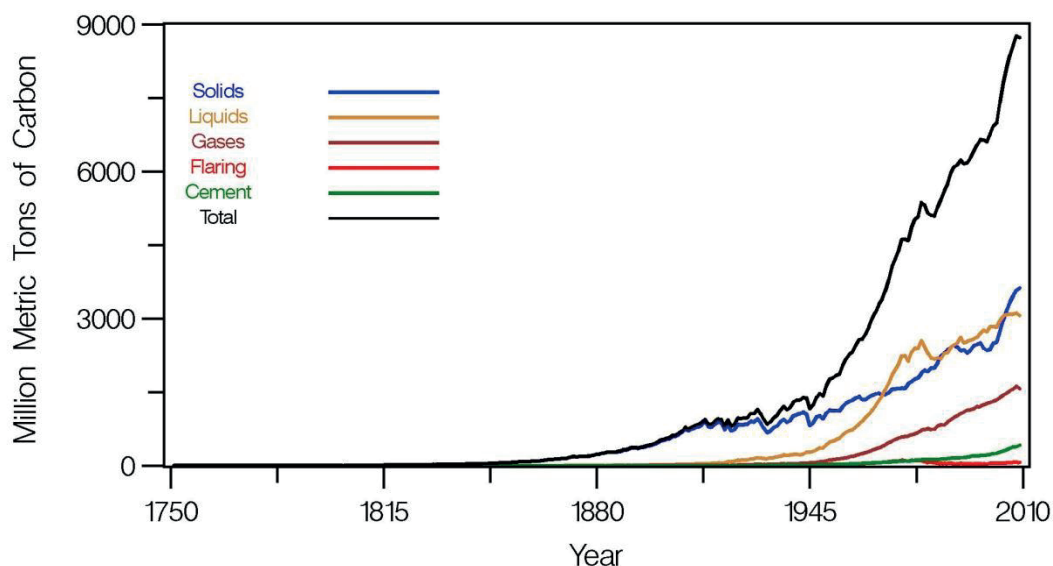


Figure 1.4: CDIAC Global Fossil-Fuel Carbon Emissions. (Source: cdiac.ornl.gov)

The concerns about the effect of man produced GHGs like CO₂ on the climate led in 1988 to the foundation of the Intergovernmental Panel on Climate Change (IPCC) by two United Nations organizations, the World Meteorological Organization(WMO) and the United Nations Environment Program (UNEP), and was later endorsed by the United Nations General Assembly. Its mission is to provide comprehensive scientific assessments of current scientific, technical and socio-economic information worldwide about the risk of climate change caused by human activity, its potential environmental and socio-economic consequences, and possible options for adapting to these consequences or mitigating the effects. The Fourth Assessment Report was completed in early 2007.

The key conclusions of this report were that:

- Warming of the climate system is unequivocal;
- Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely (>90%) due to the observed increase in anthropogenic (human) greenhouse gas concentrations;

- Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values over the past 650,000 years (Climate Change, 2007).

The work of the IPCC was an important stimulus for the realization of the Kyoto Protocol (see Paragraph 1.2.2), which had led to worldwide CO₂ reduction policies in different regions and countries. Against this background companies face the pressure to reduce their carbon footprint and manage their carbon emissions. A carbon footprint is according to the UK Carbon Trust:

- The total set of greenhouse gas (GHG) emissions caused by an organization, event, product or person;
- For simplicity of reporting, it is often expressed in terms of the amount of carbon dioxide, or its equivalent of other GHGs, emitted.

Carbon footprints can be reduced in a direct way by making use of Green power, which is generated by renewable sources. An indirect way to reduce the carbon footprint of an organization is by carbon offsetting which means the mitigation of carbon footprints through the development of alternative projects, such as solar or wind energy or reforestation. Carbon offsets can be bought. They are certificates, similar to stocks and bonds that represent the payment for some activity that reduces greenhouse gas emissions. This activity is something that would not have occurred otherwise; a concept known as 'additionality'.

A carbon sink is a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period. The process by which carbon sinks remove carbon dioxide (CO₂) from the atmosphere is known as carbon sequestration. The main natural sinks are:

- Oceans which absorb carbon dioxide by physicochemical and biological processes;
- Terrestrial plants by photosynthesis. Photosynthesis is the biochemical process where CO₂ + water are converted into sugar and oxygen under influence of sunlight.

Natural sinks are typically much larger than artificial sinks. The main artificial sinks are:

- Landfills;
- Carbon capture and storage proposals.

Public awareness of the significance of CO₂ sinks has grown since passage of the Kyoto Protocol, which promotes the use of artificial sinks (especially underground storage of CO₂) as a form of carbon offset.

CO₂ emissions rights can also be traded (also known as cap and trade). The limit or cap is allocated or sold to firms in the form of emissions permits which represent the right to emit or discharge a specific volume of the specified pollutant, and organizations are required to hold a number of permits (or carbon credits) equivalent to their emission.

Cap and trade is:

- A market-based approach;
- Used to control pollution by providing economic incentives;
- Used for achieving reductions in the emissions of pollutants.

A problem with this trading of CO₂ rights is to determine a right price. If the price is too low there are not enough stimuli to reduce the amount of carbon emissions.

1.3 Definition of Green IT

Sustainable IT means many things to different people. There are too many definitions, resulting in a lack of clarity. However, these definitions have some common elements. The elements are an emphasis on the efficient use of sustainable generated power and the idea of looking at IT from a lifecycle perspective.

1.3.1 Defining Green IT

According to Green IT for Dummies (Baroudi et al., 2009) Greening IT is about greening the IT ecosystem, which includes networks, the Web and an interconnected and dynamic relationship map that shows how various components influence and impact other components.

“The Green IT ecosystem represents a way of thinking holistically about what, and why IT operates and about who and what their operations impact.

The components of the IT ecosystem include:

- All computer hardware, software, and networks used inside an organization;
- Management strategy responsible for purchasing, implementing, running, and disposing of hardware when no longer needed;
- The people and the organizational culture that makes all the infrastructure and activities in the preceding bullets possible;
- The systems and networks that connect with the organization’s suppliers, customers and partners.

The EXIN Green IT Foundation exam uses a definition for Green IT which is developed by Ian Tolond from the organization E2Readiness. “Green IT is the efficient application of intelligent, energy, eco-friendly technology and techniques throughout the organization” (Tolond, 2012).

1.3.2 Key features of Green IT

According to the white paper “SMART/Green ICT framework” (Tolond, 2012) the key features of Green IT are:

Efficient application refers to utilizing ‘systems’ in a manner that is ‘right-sized’ for the business, service or organization and operating at their optimum capacity (‘load’). The principles of efficient application are in opposition to ‘over-provisioning’.

Potential benefits are:

- Optimize energy consumption, reduce operational costs and emissions per unit of business value;
- Reduce embodied carbon/energy;
- Capital expenditure, operational management costs when compared to ‘traditional’ provisioning methods;
- Reduce or eliminate sources of waste (energy, cooling and materials waste).

Intelligent energy sensitive (technology) refers to software, systems and hardware that intelligently manage energy consumption whilst performing their respective function/s. May be a combination of hardware, software electro- mechanical equipment and/or system processes.

Potential Benefits are:

- Optimize business value per unit of energy;
- Reduce waste and administration via autonomous (intelligent) energy management;

- Optimize energy management throughout the [service] supply chain;
- Limit GHG emissions from non-renewable energy sources;
- Reduce risk exposure and align with CSR policy / regulatory emissions restrictions.

Intelligent eco-friendly (technology) refers to IT hardware & devices that have been designed to minimize the environmental impact over their lifecycle. Examples of these are: highly recyclable modular equipment design, recycled or contain post-consumer materials, absent of hazardous substances ('fit for disposal') and manufacturing / lifecycle management processes which have less socio-environmental impact than traditional methods.

Potential Benefits are:

- Reduce end of life/disposal administrative overheads;
- Align with CSR policy / Environmental regulations;
- Reduce ecological impact of physical assets;
- Increase the air quality of the indoor (office) environment.

Intelligent earth/energy sensitive (techniques) refers to the business processes, operations and the people ('techniques') required supporting SMART Green strategies, which are augmented by technology. Examples of these are business processes/ supply chain optimization, energy measurement, SMART transport systems, building environmental automation, lifecycle management and E-working. Extensions of this concept are strategies to reduce overall footprint of the organization through processes underpinned by technology. This is also known as Green by IT. Information technology is an 'enabler' for efficiency initiatives.

A potential benefit is the alignment of operational processes with the principles of resource conservation and operational expense restrictions.

1.4 The SMART/GREEN ICT Framework

The SMART /GREEN ICT framework provides an overview of the main elements of Green IT and their interrelationships. EXIN has adopted this framework for Green IT foundation.

1.4.1 Elements of the SMART/GREEN ICT Framework

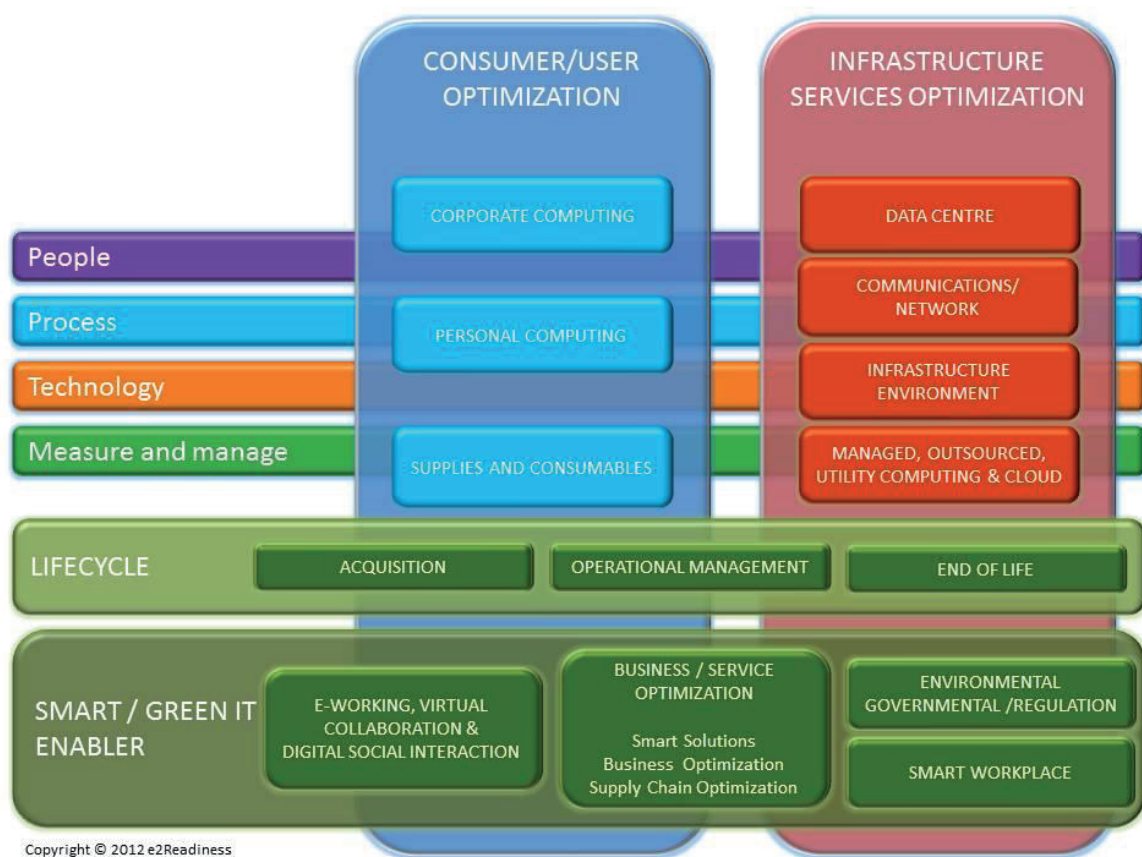


Figure 1.5: Smart Green ICT Framework (Source: Tolond, 2012)

The SMART/GREEN ICT Framework consists of two vertical pillars: Consumer/User optimization and Infrastructure services optimization which represent the main areas where IT is widely adopted. These are overlaid by two lateral elements: Lifecycle and Smart/Green IT enabler.

The Lifecycle element represents the management of technology assets from acquisition to disposal. The Smart/Green IT element represents the application of IT to increase efficiency and reduce the overall environmental impact of the organization. The vertical pillars are underpinned by 'People', 'Process', 'Technology' and 'Measure and Manage' which represent key instruments in organizational transformation and the application of SMART and sustainable IT practices.

1.4.2 The benefits of the framework

The 'SMART/GREEN ICT' framework enables meaningful communications between IT services, Human resources.

The framework offers the following benefits:

- Non-Technical reference (IT and non-IT teams understand, collaborate and communicate on initiatives);
- Simple graphical layout (easy to illustrate concepts and presentation friendly);
- Agnostic resource (Compliments other frameworks from Technology vendors, system integrators and solution providers);
- Common reference framework (Streamline communication with external parties and assist in classifying the 'Green' features of products or services).

Exam preparation: Chapter 1

To help prepare for the exam, we have included multiple choice and so-called 'get it' questions (the answer key can be found at the end of this workbook). Additionally you are provided with an overview of terms with which you should be familiar.

Sample questions

1. Utilizing 'systems' in a manner that is 'right sized' for the business, service or organization and operating at their optimal capacity.

What does this define?

- A. Efficient application
- B. Energy sensitive technologies
- C. Earth sensitive application
- D. Earth/energy sensitive technologies

2. Which benefit of the SMART/GREEN IT Framework assists Technology vendors in classifying the 'Green' features of a product or services?

- A. Agnostic Resource
- B. Common reference framework
- C. Non-technical reference
- D. Simple graphical layout

3. Which factor accelerates a need to adopt Green/sustainable IT practices?

- A. hardware drawing less power
- B. increasing demand for IT services
- C. IT budgets increasing
- D. regulations which limit power consumption

4. What is a worldwide organization supporting the adoption of energy efficient strategies by providing information and support to consumers, policy makers, private industry, and educators?

- A. Electronics TakeBack Coalition (ETBC)
- B. Basel Action Network (BAN)
- C. Green Grid
- D. Alliance to Save Energy (ASE)

5. How do sustainable computing practices (Green IT) support Corporate Social Responsibility (CSR) policies?

- A. Sustainable computing practices advocate social, financial and environmental value of IT services.
- B. Sustainable computing practices advocate only financial corporate governance of IT services.
- C. Sustainable computing practices value only the financial performance of IT services.
- D. Sustainable computing practices value social and financial performance of IT services.

6. Economic and Environmental factors are two of the three considerations for Triple bottom line (3BL) accounting.

What is the third factor?

- A. Ecological
- B. Equitable
- C. Social
- D. Sustainable

'Get it' questions

- 1 How can sustainable development be described?
- 2 How much electricity is used by data centers worldwide in 2010?
- 3 In which way has Green IT in relation to embedded energy and use of resources, a very positive impact on sustainable development?
- 4 Name the seven sins of Greenwashing.
- 5 Name some international Green (IT) organizations.
- 6 Name some external drivers for organizations to embrace Green IT.
- 7 Name the key features of Green IT.

Exam Terms

Agnostic resource

Business drivers (Internal business drivers)

Business Process Optimization

Cap and Trade

Carbon dioxide emissions

Carbon emission

Carbon emissions management

Carbon offset

Carbon reduction

Carbon sinking]

Carbon trading

Climate savers computing impact initiative (CSCI)

Corporate social responsibility (CSR)

Environmental Protection Agency (EPA)

Global Compact

Global Reporting Initiative (GRI)

Green Computing Impact Organization

Green Grid

Green House Gas Emissions

Green IT
Greenwashing
ISO14001
ISO 26000
IT as a low carbon enabler
IT for Green
Kyoto Protocol
Low carbon economy/society
Millennium goals
Socially Responsible Investing
Socio-Environmental drivers
Socio-environmental value
Sustainability
Sustainable computing
Toxins
Triple Bottom Line (3BL):People, Planet, Profit