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## Green public ICT procurement

ITU-T L-series Recommendations – Supplement 20

# Supplement 20 to ITU-T L-series Recommendations

# Green public ICT procurement


## Summary

Supplement 20 to the ITU-T L-series Recommendations provides technical guidance to public authorities on how to improve their procurement practices to purchase green information and communication technology (ICT) goods and services.

This Supplement collects and presents relevant standards, ecolabels and certifications from different organizations to help public authorities achieve green ICT public procurement practices.

The guidance presented here can also be used by private organizations interested in improving their green ICT procurement practice.



## History

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## FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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## Introduction

Communities all over the world are facing the consequences of climate change, depletion of natural resources, loss of biodiversity, environmental degradation and increasing poverty [b-UNDP]. In order to address these issues, all levels of society (public and private) are realizing that change is required to develop a more sustainable society and planet.

Governments can have an impact in addressing these issues through the implementation of sustainable procurement policies and practices that take into account the impact on the environment and society of the products and service they purchase. Sustainable procurement practices consider more than just the cost of acquiring a product. Sustainable procurement practices should be useful and understandable, equitable for all suppliers and viable from both an economic and environmental point of view. The price calculation should include all the costs related to the product throughout its life and eventual disposal, recycling and/or reuse.

# Supplement 20 to ITU-T L-series Recommendations

# Green public ICT procurement

## 1 Scope

This Supplement provides technical guidance to public authorities on how to improve their procurement practices when purchasing ICT goods and services.

To this end, this Supplement collects and presents relevant standards, ecolabels and certifications from different organizations to help public authorities achieve green ICT public procurement practices.

This guidance can be also used by private organizations interested in improving their ICT procurement practice.

## 2 References

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[ITU-T L.1000] Recommendation ITU-T L.1000 (2011), *Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices*.

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[ITU-T L.1340] Recommendation ITU-T L.1340 (2014), *Informative values on the energy efficiency of telecommunication equipment*.

[ITU-T L.1410] Recommendation ITU-T L.1410 (2014), *Methodology for environmental life cycle assessments of information and communication technology goods, networks and services*.

[ITU-T L.1420] Recommendation ITU-T L.1420 (2012), *Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organizations*.

## 3 Definitions

### 3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

**3.1.1 environmental procurement** [b-UN]: Environmental procurement is procuring with the goal of reducing the impact on the environment. Also often referred to as "green procurement". Can be defined as building environmental considerations into the procurement policy and the day-to-day procurement decision-making and operations. Can include both procurement of products and services that reduce the use of all materials, energy, water, noise, protected natural resources such as rain forests, etc.

**3.1.2 environmental life cycle assessment** [ITU-T L.1410]: An environmental life cycle assessment (LCA) is a systematic analytical method by which the potential environmental effects related to ICT goods, networks, and services can be estimated. LCAs have a cradle-to-grave scope where all the life cycle stages (raw material acquisition, production, use, and end-of-life treatment) are included. Moreover, transport and energy supplies are included at each stage of the life cycle assessment.

**3.1.3 green public procurement** [b-EUa]: A process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.

**3.1.4 life cycle** [b-ISO 14040]: Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

**3.1.5 life cycle assessment** [b-ISO 14040]: compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.

**3.1.6 procurement** [b-UN]: Technically, obtaining goods or services by various means such as loan, transfer and hire, as well as straightforward purchase.

**3.1.7 sustainable public procurement** [b-UK DEFRA]: A process whereby organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst minimizing damage to the environment.

**3.1.8 supply chain** [b-ITUb]: The group of planning, manufacturing and producing operations required to bring a product/service to the market is known as the supply chain, and it covers activities that range from sourcing of raw materials to the delivery of a completed product.

### 3.2 Terms defined in this Supplement

This Supplement defines the following term:

**3.2.1 green ICT**: Green ICT is about designing, manufacturing, using, procuring and disposing of ICT equipment and services efficiently with the goal of achieving reductions in energy consumption, resource consumption and end-of-life impact to the environment.

## 4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

| | |
|---|---|
| AC | Alternating Current |
| BFR | Brominated Flame Retardants |
| CA | Competent Authority (of Egypt) |
| CPU | Central Processing Unit |
| CRT | Cathode Ray Tube |
| DC | Direct Current |
| EPA | Environmental Protection Agency |
| EPEAT | Electronic Product Environmental Assessment Tool |
| EPP | Environmental Public Procurement |
| GDP | Gross Domestic Product |
| GEC | Green Electronics Council |
| GHG | Greenhouse Gas |
| GPP | Green Public Procurement |
| ICT | Information and Communication Technology |
| ICT GPP | Green Public ICT Procurement |
| IT | Information Technology |
| ITU | International Telecommunication Union |
| ITU-T | International Telecommunication Union – Standardization |
| LAN | Local Area Network |
| LCA | Life Cycle Assessment |
| LCC | Life Cycle Cost |
| LCI | Life Cycle Inventory |
| MFD | Multifunction devices |
| Mt | Metric Tonnes |
| OS | Operating System |
| PC | Personal Computer |
| PVC | Polyvinylchloride |
| R&D | Research and Development |
| SG5 | Study Group 5 |
| SPP | Sustainable Public Procurement |
| UK | United Kingdom |
| UNEP | United Nations Environmental Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |

USA United States of America

## 5 Conventions

None

## 6 Buying responsible and sustainable

Information and communication technology (ICT) is at the centre of every modern organization; as such, public authorities need ICTs for the functioning of their daily operations. The widespread use of ICT has contributed significantly to increasing economic productivity and social development. However, it has also had negative impacts on the environment (e.g., increased energy use, overuse of natural resources, and creation of hazardous electronic waste) that should not be neglected.

Governments can have an impact in addressing these issues through the implementation of eco-friendly procurement practices, without undermining cost-efficiency. The good news is that procurement costs can be reduced by purchasing products that are less harmful to the environment.

### 6.1 Objective

This Supplement aims at providing technical guidance for public authorities to improve their procurement practices to purchase green ICT goods and services.

### 6.2 Target

This Supplement is aimed at procurement officers, managers and people involved in the procurement process of green ICT goods and services for public authorities.

### 6.3 Products

This Supplement covers the purchase of information technology (IT) office equipment, including:

- personal computer (PC) products;
- network equipment and servers;
- imaging equipment;
- light current systems.

### 6.4 Environmental impacts

Environmental impacts of office ICT equipment stem from their manufacturing, use and disposal. They are not radically different from the environmental impacts of many other manufacturing industries, but pose specific problems depending on the product considered and its specific lifecycle.

Given the diversity of the office ICT equipment considered, this Supplement lists the main environmental impacts relevant to all products.

**Manufacturing**

Manufacturing activities include: acquisition, assembly and transport of raw materials and components.

Supply chain in the ICT industry is extremely complex, as ICT products are generally made of several thousands of components made up of a large variety of materials and substances.

Components including circuit boards, connector cards, graphic cards, memory cards, central processing units (CPUs), cables, hard drives and batteries contain precious metals that are rare, hazardous and dangerous to extract, process and dispose.

The availability of these metals, such as aluminium, cobalt, copper, gold, nickel, palladium, platinum, silver tantalum, tungsten, tin and zinc, is limited on earth and they may be depleted.

The mining of these metals often has detrimental consequences to the environmental health of the extraction area. Large land portions are cleaned up to allow extraction activities, resulting in large-scale deforestation thereby leading to biodiversity reduction. The use of poisonous chemicals can leak into nearby water supplies, contaminate the soil or evaporate in the air with consequences for miners, local residents and wildlife. Dangerous waste and tailings can contaminate the area, when not properly managed and disposed of [b-ICMM].

In general, mining, manufacturing and transporting activities require energy for their operations. This causes pollution and energy consumption.

**Energy consumption and carbon emissions**

Electricity is the dominant form of energy used throughout the ICT lifecycle.

ICT equipment requires electricity to run, including power used directly as well as indirect power use such as for cooling in data centres or maintenance operations. In 2012, ICT usage consumed 4.7 percent of electricity worldwide, amounting for approximately 920 TWh (1 TWh is a terawatt-hour or 1012 watt-hours) [b-ACM].

Depending on the electricity's power-generation method (e.g., geothermal, wind and hydro power, coal, natural gas, nuclear power), the quantity of carbon emissions generated by an ICT equipment can vary considerably.

**Water consumption**

Waster is used to manufacture ICT products, as well as for data centres' cooling operations. Water is also indirectly used to generate electricity.

**Noise pollution**

Office ICT equipment can generate noise when functioning. Noise is generated by motors and spinning components, such as hard drive, CPU fan, case cooling fan and power supply fan [b-EUb].

Noise pollution is often under-estimated, but has in fact consequences to wildlife and humans such as hearing problems, psychological health issues and distraction.

**Hazardous materials**

Electrical and electronic equipment contain various heavy metals and other hazardous chemicals which are harmful to health and the environment if not manufactured, used and disposed of carefully. These include [b-Greenpeace]:

- brominated flame retardants (BFR): A group of organobromine compounds which are used to prevent combustion and/or retard the spread of flames in a variety of plastics and other materials. BFRs are also found in printed circuit boards and plastic casings. They are environmentally persistent and highly bioaccumulative; they are also common contaminants in humans.
- lead: Used in electrical solder primarily on printed circuit boards, in cathode ray tubes (CRTs), as stabilisers in polyvinylchloride (PVC) formulations and in batteries. Lead is processed at high temperatures. It tends to accumulate when released into the environment. It is highly toxic to plants, wildlife and humans. Humans can be exposed by inhalation or ingestion.
- cadmium: Used in contacts, switches and batteries. Its disposal by incineration can cause releases into the environment. It is persistent in the environment and highly toxic to plants, wildlife and humans.

- mercury: Used in lighting device that illuminate earth, switches, older mainframe computer and some batteries. It can be released into the environment during dismantling by incineration or landfilling, thereby polluting air and water. Humans can be exposed by inhalation. It is highly toxic. It can damage the nervous system and increase cardiovascular and heart disease.
- polyvinylchloride: A chlorinated plastic incorporated into some electrical and electronic products, including as insulation on wires and cables. Production of PVC and its disposal by incineration can generate chlorinated dioxins and furans, which are highly resistant to the environment and toxic at very low concentration.

**End-of-life disposal, recycling and durability**

When equipment no longer satisfies the initial user's needs, it is disposed of.

According to the United Nations University (UNU), the total amount of waste that electrical and electronic equipment generated (or e-waste) in 2014 was 41.8 million metric tonnes (Mt) and is forecasted to increase to 50 Mt of e-waste in 2018. [b-UNU-IAS].

Dumping of obsolete ICT equipment in landfill sites or by incineration require energy and can be dangerous for the environment and human health if not handled with due care. During the disposal phase, some hazardous chemicals and heavy metals can be released into the environment, poisoning air, soil and water sources if not properly handled. Workers can be exposed to toxic substances by inhalation if safety measures are not in place.

Though some components cannot be reused, much of what is used to make ICT equipment can be recycled. Recycling needs particular expertise, including setting up recycling facilities and handling dangerous materials. Electronics recycling can be challenging because discarded electronic products are complex devices made of multiple components, which need to be processed and separated into clean commodity streams in order to make new products. Recycling activities are energy intensive, thereby generating carbon emissions and air pollution.

**Packaging**

Packaging materials are generated at various stages of the ICT lifecycle to transport, protect and distribute products. Environmental issues related to packaging include resource consumption, primary energy consumption, use of chemicals and waste generation [b-EUb].

### 6.4.1 Environmental life-cycle assessment

Life cycle cost (LCC) is the name of the technique used to establish the real cost of ownership of a product or service, from purchase, through usage and maintenance costs, to disposal. It is based on the concept of best value for money [b-UNOPS].

This technique is well established as a decision-making tool during procurement. However, this technique does not reflect the financial impacts that are offered by environmental considerations over the product's entire life cycle.

As described above, office IT equipment consume energy and water for their operations and additional resources are used for their disposal. These costs are easily forgotten at the moment of purchase, but will have to be paid sooner or later. Purchasing a product with reduced energy consumption or other environmental impacts will have a smaller economic impact on the total cost of purchase and should be preferred for financial and environmentally sound considerations [b-UNOPS].

The reduction of environmental impacts leads usually to economic savings in a short to medium-term time period [b-UNOPS]. In order to evaluate the potential economic gains related to the environmental sustainable performance of a product or service, an assessment of the environmental impacts of that product or service through all lifecycle stages should be performed.

Life cycle assessment (LCA) is in fact the application of the concept of life cycle to environmental impacts, such as carbon emissions, water usage, air pollution, energy consumption, use of hazardous and toxic substances, and waste amounts [b-UNOPS].

LCA became internationally standardized by the International Organization for Standardization (ISO) with the publication of the ISO 14040 series of life cycle assessment standards representing an important step to consolidate procedures and methods of LCAs [ITU-T L.1410].

In order to provide additional specifications to the ISO 14040 series for the ICT sector, the International Telecommunication Union (ITU) through its Study Group 5 (see Box 1) and the Technical Committee on "Environmental Engineering" of the European Telecommunication Standards Institute (ETSI TC EE[1]) jointly developed a methodology to perform a LCA to evaluate the environmental impact of ICT goods, networks and services through the implementation of [ITU-T L.1410].

**Box 1 – ITU-T Study Group 5**

Within the ITU Telecommunication Standardization Sector of ITU (ITU-T), ITU-T Study Group 5 (SG5) is the lead study group on ICT environmental aspects related to climate change and electromagnetic phenomena.

Under its environmental mandate, SG5 develops green ICT international standards (called ITU-T Recommendations) and promotes innovative ICT solutions to support a sustainable future, in areas such as: assessment of environmental impact of ICTs, climate change adaptation and mitigation, energy efficiency, e-waste and smart sustainable cities.

Source: [b-ITUa].

Part I, "ICT life cycle assessment – framework and guidance", of [ITU-T L.1410] deals with the LCA methodology by which the potential environmental effects related to ICT goods, networks and services can be estimated. The LCA methodology includes all the lifecycle stages: (I) raw material acquisition, (II) production, (III) use, and (IV) end-of-life. Impacts from transports and energy supplies are also considered in each lifecycle stage. In addition, the design of ICT goods shall also be addressed. Finally, the methodology provides reporting requirements to ensure that data collected are reported transparently and in a common clear way, as to facilitate additional meaningful data analysis and comparison [ITU-T L.1410].

Part II "Comparative analysis between ICT and reference product system (Baseline scenario) – framework and guidance" deals with comparative analysis between an ICT-based system and a reference product system in order to compare LCA results for different products, systems or services that offer the same or similar functions [ITU-T L.1410].

The incorporation of LCC and LCA techniques into procurement practices can provide public authorities with an opportunity to demonstrate that they make the optimum use of public money combining economic returns with social and environmental gains by means of purchasing green and more sustainable ICT equipment and services [b-IISD].

[1] This methodology was published respectively by ITU as [ITU-T L.1410] and ETSI as Standard [b-ETSI ES 203 199], which are equivalent in technical content.

**Box 2 – ITU-T standardized methodologies to assess the environmental impact of ICTs**

ITU-T SG5 is responsible, *inter alia*, for the development of a set of standardized methodologies to assess the environmental impacts of ICTs, both in terms of ICT greenhouse gas (GHG) emissions and the emissions savings created through green ICT applications in other industry sectors.

This set of globally agreed methodologies help establish the business case to go green, support meaningful reporting and comparisons, informed consumer choices and climate-friendly business procurement.

The methodologies are:

- Recommendation ITU-T L.1400 "Overview and general principles of methodologies for assessing the environmental.
- Recommendation ITU-T L.1410 "Methodology for assessing the environmental impact of ICT goods, networks and services".
- Recommendation ITU-T L.1420 "Methodology for assessing the energy consumption and GHG emissions impact of ICT technologies in organisations".
- Recommendation ITU-T L.1430 "Methodology for assessing the environmental impact of ICT GHG and energy projects".
- Draft Recommendation ITU-T L.1440 "Methodology for environmental impact assessment of ICT at city level".

The methodologies are being developed in cooperation with over 60 organizations including major ICT private sector organizations, the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Environmental Programme (UNEP).

Source: [b-ITUa].

For the purpose of this Supplement, the guidance provided only covers the following aspects of a product's life cycle:

- research and development (R&D), concept design;
- materials and supplies;
- use;
- end-of-life considerations.

## 7 Pursuing green ICT public procurement

### 7.1 Sustainable public procurement

Public procurement is generally referred to as the need of public authorities to purchase goods and services to fulfil their public functions with taxpayers' money. It has a considerable impact on the economy at both the domestic and international levels, accounting for a significant proportion of national gross domestic product (GDP).

Public authorities are accountable for their procurement decisions, as citizens want to know what their taxes are used for. They generally justify their decision based on the "value for money" criterion. Nonetheless, in order to sustain the future of society and contribute to sustainable development, purchasing practices should also be driven by social and environmental considerations other than simply economic returns.

These considerations open up to the overarching concept of sustainable public procurement. Sustainable public procurement (SPP) is defined as "*a process whereby organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst minimising damage to the environment*" [b-UK DEFRA].

The key components of the process of sustainable public procurement include [b-UNDP]:

- LCC considerations: This refers to "value for money" considerations such as, price, total cost of ownership, quality, availability, functionality, maintenance and disposal;
- environmental aspects: These refer to the possible environmental impacts of goods and services over the entire lifecycle such as carbon emissions, use of hazardous or toxic substances, energy and water consumption, other natural resources depletion, pollution, loos of biodiversity and generation of waste;
- social aspects: These refer to sustainable supply chains and the effects of issues such as labour conditions, including child labour provisions, occupational health and safety, compliance with relevant industrial regulations, human rights, local entrepreneurship, women and minorities empowerment, poverty eradication and good governance.

## 7.2 Environmental or green public procurement

Although sustainable procurement encompasses more than environmental considerations, the main focus of this Supplement is environmental or green public procurement.

Environmental or green public procurement (EPP/GPP) is defined as "*a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured*" [b-EUa].

This means that the preferred procurement choice is for products and services that have less impact on the environment.

These product may include [b-UNDP]:

- products that are energy efficient and eco-friendly;
- products that use renewable energy sources;
- products that are reduce water consumption;
- products that contain less toxic materials;
- products that have a longer life cycle or can be reused;
- products that contain materials that can be recycled;
- products that minimize or eliminate packaging or with a provision for packaging take-back;
- products that minimize the use of natural resources or have reduced environmental impacts throughout their life cycle;
- products made from recycled materials, including from recycled green organics and recycled plastic products.

### 7.2.1 Green ICT

Awareness of the possible environmental impacts of ICT equipment, though somewhat late in coming, has led more and more organizations to turn to a sustainable practice known as "green ICT." The term "green ICT" is widely used by industry and in the media, but it lacks a precise definition. Nonetheless, it includes the concepts of environmental sustainability, energy efficiency, reduced resources consumption and recycling.

Green ICT is about designing, manufacturing, using, procuring and disposing of ICT equipment and services efficiently with the goal of achieving reductions in energy consumption, resource consumption and end-of-life impact to the environment.

Green ICT play a significant role in helping the world move to a new low carbon economy. For the past several years, organizations have looked at ways to use their ICT investment in a more efficient manner and to improve the efficiency of the organization. The first result is a reduction in the energy

needed to run the ICT deployment and thereby reduce the emissions associated with an organization's ICT.

Far more interesting, and potentially more significant, is to consider how ICTs have been used to radically transform the way organizations and society operate, enable a low carbon economy, generate efficiencies and enable a more sustainable lifestyle.

Some prime examples of the roles that ICTs can play include:

- enabling remote monitoring and control of home energy use through smart energy management systems ensuring that heating or cooling use is minimized;
- enabling a more efficient electricity network through the deployment of smart meters which would enable generation capacity to match usage and allow for more localized renewal energy sources to be part of the electrical grid.

ICTs help create stronger, more localized communities. Community-based ICT communication hubs provide the basis for developing remote work locations, thereby avoiding the carbon emitted during travel to work, while at the same time ensuring that people retain the social connections that are so important to their well-being. Local virtual networks enable people to find resources, tools, equipment and other items within their neighborhoods that can then be shared instead of purchased. Bike and car sharing services globally are a prime example.

ICTs also transform the way people view travel. The massive leap forward in various virtual meeting technologies is already helping to reduce the travel required for face to face meetings. ICTs can also reduce the amount of heavy goods vehicles on roads by assisting organizations with making their logistics and transportation networks far more efficient. Pollution can also be cut be regulating traffic flows in cities and by automating motorway journeys ending the days of endless traffic jams and congestion.

Recognizing the role of ICT to enable socially, economically and environmentally sustainable growth and development for everyone, ITU Member States have committed to achieve a set of global telecommunication/ICT targets in the areas of growth, inclusiveness, sustainability, and innovation as contained in Resolution 200 "Connect 2020 Agenda for Global Telecommunication/ICT Development" that was adopted by the ITU membership in Busan, Korean at the 2014 Plenipotentiary Conference (PP-14) [b-ITUc].

Specifically, as part of the sustainability target, ITU members committed to decrease the GHG emissions generated by the telecommunication/ICT sector by 30% per device by 2020. The adoption of environmental considerations in public procurement practices will help achieve this target [b-ITUc].

### 7.3 Strategy

Green public ICT procurement (ICT GPP) can contribute to the delivery of the national policy goals of sustainable development and efficient resource usage by ensuring that suppliers and contractors, and the ICT goods and services purchased through them, achieve the optimum environmental performance [b-UNDP].

Governments should develop and adopt a national ICT GPP policy in order to maximize costs savings and sustainable performance of the purchase and to minimize risk over the product/service supply chain.

The following requirements should be included in the national ICT GPP policy:

- environment: Preference to goods and services that have less environmental impact;
- good governance: Preference to suppliers that respect environmental standards for production and work only with suppliers that do the same;
- life cycle cost: Preference to medium-/long-terms savings;

- social: Respect for human and labour rights.

The implementation of ICT GPP standardized practices will help governments enhance their reputation as "sustainability champions" and encourage private sector and other organizations to adopt similar best practices.

### 7.4 Process

Governments are encouraged to develop an internal plan that should be shared with procurers of all ministries, agencies, departments and relevant organizations at both national and local levels that need to implement the national ICT GPP strategy.

The plan should include the following steps, adapted from [b-ITUb]:

- Step 1: Identify the needs of the organization related to a specific product/service to be purchased;
- Step 2: Draft a call for tenders, including contract specifications;
- Step 3: Evaluate the tenders received performing an environmental impact assessment of the products/services according to the methodology of [ITU-T L.1440], and select the most adequate supplier that proposes the optimum cost-effective and environmentally-friendly solution against the requirements in clause 7 (Existing standards and eco-labelling schemes);
- Step 4: Sign the contract, purchase the product/service and finalize payment;
- Step 5: Manage and monitor the product/service implementation;
- Step 6: Evaluate the product/service performance against the requirements in clause 7 (Existing standards and eco-labelling schemes);
- Step 7: Audit of the public procurement expenditure.

At a national level, public authorities such as ministries, agencies, departments and relevant organizations, should jointly purchase ICT goods and services (as a single customer) to increase costs savings in delivery, maintenance and disposal phases and strengthen their negotiating power.

At a local level, public authorities are also recommended to encourage joint ICT purchases.

### 7.5 Benefits

ICT GPP practices can have positive impacts both in terms of environmental preservation and costs savings.

ICT GPP benefits include:

- when an organization looks at the cost of a product (purchase, use and end-of-life) and the environmental aspects throughout the total lifecycle, the true overall impact of that purchase can be defined and minimized;
- higher quality products may last longer and therefore provide an overall lower cost of ownership and minimize the use of natural resources;
- products designed to be recycled can have less expensive end-of-life costs, and also less impact on the environment;
- products that do not contain or minimize the use of hazardous materials can reduce overall ownership costs and environmental impact as they may be easier to recycle and may not be classified as hazardous waste thereby further reducing end-of-life costs;
- an energy efficient product will often use less energy and therefore represent a lower cost of ownership over the product's lifetime, reduce the need for energy and therefore lessen the resulting carbon emissions generated.

Table 1 summarizes the benefits derived from the implementation of ICT GPP practices.

**Table 1 – Benefits derived from ICT GPP practices, adapted from [b-UNDP]**

| Area | Description |
|---|---|
| **Efficient use of resources** | More efficient and effective use of natural resources and the reduction in the environmental effects of obtaining and disposing of those resources. |
| **Minimization of hazardous materials** | Elimination or reduction in the amount of toxic materials entering the environment thereby reducing the impact of hazardous substances on human health and the environment;<br>Reduction in the harmful impacts of pollution and waste. |
| **Durability and recycling** | Reduction in the generation of waste and use of landfills through the purchasing of products that can be recycled or reused, contain recycled components and create less waste. |
| **Reduced pollution** | Reduction of GHG emissions;<br>Preservation of biodiversity and the natural habitat for flora and fauna. |
| **Greener market and costs reduction** | Reduction of costs through long-term energy efficiency savings;<br>Expansion of the market and increased availability of green products at cost-effective prices, as well as for products with reduced packaging.<br>Encouragement of innovation for greener and more sustainable products; |
| **Greener society** | Clear demonstration of governments' social and environmental responsibility to the community at large;<br>Improved working conditions within the supply chain;<br>More efficient use of public resources. |

## 8 Existing standards and eco-labelling schemes

This clause provides information on international standards and eco-labelling schemes that are relevant to office ICT equipment.

Table 2 provides a list of international standards that can support procurers in performing the environmental impact assessment of ICT goods, networks and services and in evaluating their sustainability prior to and after purchase.

**Table 2 – International standards for green ICT (non-exhaustive list)**

| Name | Description | Focus |
|---|---|---|
| Recommendation ITU-T L.1000 (2011), Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices. [ITU-T L.1000] | This Recommendation sets out technical specifications for a universal charger compatible with a wide variety of consumer electronic devices, reducing waste and improving user convenience. | Eco-design: universal power supplies |
| Recommendation ITU-T L.1001 (2012), External universal power adapter solutions for stationary information and communication technology devices. [ITU-T L.1001] | This Recommendation establishes technical specifications for a universal power adapter (UPA) designed to serve the vast majority of stationary ICT devices. The standard substantially reduces the number of power adapters that need to be manufactured by widening their application to more devices, enabling their reuse and extending their lifetime, as well as cutting energy consumption and reducing the volume of e-waste. | Eco-design: universal power supplies |
| Recommendation ITU-T L.1005 (2014), Test suites for assessment of the universal charger solution. [ITU-T L.1005] | This Recommendation describes specific test suites applicable to the universal charger solution defined in [ITU-T L.1000] in order to assess energy efficiency, interworking, safety and electromagnetic compatibility of the universal charger solution and charger. | Eco-design: universal power supplies |
| Recommendation ITU-T L.1010 (2014), Green battery solutions for mobile phones and other hand-held information and communication technology devices. [ITU-T L.1010] | This Recommendation defines a minimum set of parameters necessary to identify green battery solutions that should be considered by developers/manufacturers to reduce the future environmental impact of battery use. The provision of so-called green batteries is to extend the lifetime of handsets, reduces global resources consumption and eliminates toxic materials. | Eco-design: green batteries |
| Recommendation ITU-T L.1100 (2012), Procedure for recycling rare metals in information and communication technology goods. [ITU-T L.1100] | This Recommendation outlines the necessity for rare metal recycling and the procedures to be employed when recycling. The recommendation details considerations in all phases of the recycling process and provides guidelines as to how organizations may fairly and transparently report on rare metal recycling. | Recycling: rare metals |

**Table 2 – International standards for green ICT (non-exhaustive list)**

| Name | Description | Focus |
|---|---|---|
| Recommendation ITU-T L.1101 (2014), Measurement methods to characterize rare metals in information and communication technology goods. [ITU-T L.1101] | This Recommendation presents measurement methods to characterize rare metals in ICT goods by using XRF (X-ray fluorescence) and ICP-MS (inductively coupled plasma mass spectrometry) measurement methods. | Recycling: rare metals |
| Recommendation ITU-T L.1300 (2014), Best practices for green data centres. [ITU-T L.1300] | This Recommendation describes best practices aimed at reducing the negative impact of data centres on the climate. The application of the best practices defined in this Recommendation can help owners and managers to build future data centres, or improve existing ones, to operate in an environmentally responsible manner. | Energy efficiency: data centres |
| Recommendation ITU-T L.1301 (2015), Minimum data set and communication interface requirements for data centre energy management. [ITU-T L.1301] | This Recommendation establishes a minimum data set necessary to manage data centres and telecommunication rooms in an environmentally responsible manner. The Recommendation specifies the communication interface and defines the parameters to be communicated depending on the equipment used in data centres, such as power systems (alternating current (AC)/direct current (DC) and uninterruptible power supply (UPS) and energy distribution), cooling systems and information and communication technology (ICT) equipment. | Energy efficiency: data centres |
| Recommendation ITU-T L.1310 (2014), Energy efficiency metrics and measurement methods for telecommunication equipment. [ITU-T L.1310] | This Recommendation contains the definition of energy efficiency metrics test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment. These metrics allow for the comparison of equipment within the same class, e.g., equipment using the same technologies. | Energy efficiency: telecommunication network equipment and small networking equipment |
| Recommendation ITU-T L.1320 (2014), Energy efficiency metrics and measurement for power and cooling equipment for telecommunications and data centres. [ITU-T L.1320] | This Recommendation contains the general definition of metrics, test procedures, methodologies and measurement profiles required to assess the energy efficiency of power and cooling equipment for telecommunications and data centres. Metrics and measurement methods are defined for power equipment, AC power feeding equipment (such as AC uninterruptible power supply (UPS), direct current (DC/AC) inverters), DC power feeding equipment (such as AC/DC rectifiers, DC/DC converters), solar equipment, wind turbine equipment and fuel cell equipment. In addition, metrics and measurement methods are defined for cooling equipment such as air conditioning equipment, outdoor air cooling equipment and heat exchanging cooling equipment. | Energy efficiency: power and cooling equipment for telecommunications and data centres |

**Table 2 – International standards for green ICT (non-exhaustive list)**

| Name | Description | Focus |
|---|---|---|
| Recommendation ITU-T L.1321 (2015), Reference operational model and interface for improving energy efficiency of ICT network hosts. [ITU-T L.1321] | This Recommendation describes a reference operational model and interface for improving energy efficiency of ICT network hosts. The operational model and interface specify network proxy operation to support IPv4 ARP and DHCP in order to promote the deployment of network proxy. | Energy efficiency: ICT network hosts |
| Recommendation ITU-T L.1330 (2015), Energy efficiency measurement and metrics for telecommunication networks. [ITU-T L.1330] | This Recommendation provides a set of metrics for the assessment of energy efficiency of telecommunication mobile networks, together with proper measurement methods. Such metrics are of extremely high importance for operators, provided that the optimization of the energy performance of single equipment does not guarantee the overall maximum energy efficiency of a complex network formed by several equipment interconnected. | Energy efficiency: telecommunication mobile networks |
| Recommendation ITU-T L.1340 (2014), Informative values on the energy efficiency of telecommunication equipment. [ITU-T L.1340] | This Recommendation provides informative values on the energy efficiency of different types of telecommunication network equipment and small networking equipment in use in both the fixed and mobile networks. These values are related to energy efficiency metrics, test procedures, methodologies and measurement profiles that have been defined in ITU-T L.1310. These informative values are intended to be a valued reference resource for those in the process of choosing the most energy-efficient technologies for network upgrade and deployment. | Energy efficiency: telecommunication network equipment and small networking equipment in use in both the fixed and mobile networks |
| Recommendation ITU-T L.1410 (2014), Methodology for environmental life cycle assessments of information and communication technology goods, networks and services. [ITU-T L.1410] | This Recommendation deals with environmental LCAs of information and communication technology (ICT) goods, networks and services. It is organized in two parts:<br>– Part I: ICT life cycle assessment: framework and guidance;<br>– Part II: Comparative analysis between ICT and reference product system (Baseline scenario); framework and guidance.<br>Part I deals with the LCA methodology applied to ICT goods, networks and services. Part II deals with comparative analysis based on LCA results of an ICT goods, networks and services product system, and a reference product system. | Environmental impact assessment |

**Table 2 – International standards for green ICT (non-exhaustive list)**

| Name | Description | Focus |
|---|---|---|
| ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework. [b-ISO 14040] | This Standard describes the principles and framework for LCA including: definition of the goal and scope of the LCA, the life cycle inventory (LCI) analysis phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements.<br>It covers LCA studies and LCI studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA.<br>The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this Standard. | Environmental impact assessment |
| ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines. [b-ISO 14044] | This Standard specifies requirements and provides guidelines for LCA including: definition of the goal and scope of the LCA, the LCI analysis phase, the LCIA phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements.<br>It covers LCA studies and LCI studies. | Environmental impact assessment |
| IEEE 1680 Standard for environmental assessment of electronic products. [b-IEEE 1680] | This Standard provides guidelines and implementation procedures for this Institute of Electrical and Electronics Engineers (IEEE) 1680 Family of Standards. This Family of Standards provides clear and consistent environmental performance criteria for the design of electronic products thereby providing an opportunity to secure market recognition for efforts to reduce the environmental impact of electronic products. | Environmental impact assessment |
| IEEE 1680.1 Standard for environmental assessment of personal computer products, including notebook personal computers, desktop personal computers, and personal computer displays. [b-IEEE 1680.1] | This standard defines environmental performance criteria for personal computer products, including desktop computers, notebook computers, and computer displays. The environmental performance criteria relate to reduction or elimination of environmentally sensitive materials, materials selection, design for end-of-life, life cycle extension, energy conservation, end-of-life management, corporate performance, and packaging. | Environmental impact assessment: personal computer products |
| IEEE 1680.2 Standard for environmental assessment of imaging equipment. [b-IEEE 1680.2] | The Standard provides a clear and consistent set of performance criteria for the design of imaging equipment, and will provide an opportunity to secure market recognition for efforts to reduce the environmental impact of these electronic products. | Environmental impact assessment: imaging equipment |

**Table 2 – International standards for green ICT (non-exhaustive list)**

| Name | Description | Focus |
|---|---|---|
| IEEE 1680.3 Standard for environmental assessment of televisions. [b-IEEE 1680.3] | This Standard provides a clear and consistent set of performance criteria for the design of televisions, and also provides an opportunity to secure market recognition for efforts to reduce the environmental impact of these electronic products. | Environmental impact assessment: televisions |
| IEEE 1680.4 Standard for environmental assessment of servers. [b-IEEE 1680.4] | This Standard defines environmental performance criteria for computer servers as defined in the ENERGY STAR server specifications, including managed servers and blade servers, relating to reduction or elimination of environmentally sensitive materials, materials selection, design for end-of-life, lifecycle extension, energy conservation, end-of-life management, corporate performance and packaging. | Environmental impact assessment: servers |

Third-party certifications verify that a product, process or service meets defined, industry-independent criteria or standards, including verification and review by an impartial agent. Examples of third-party initiatives and programmes are described in Table 3.

**Table 3 – Examples of eco-labelling schemes for ICT equipment**

| Name | Description | Product covered | Criteria |
|---|---|---|---|
| **ENERGY STAR**<br>Type: single-issue label<br>Country of origin: United Stated<br>Website:<br>www.energystar.gov/ | ENERGY STAR is a single-issue label that focuses on energy efficiency of a wide range of products.<br>It was established in 1992 by the Environmental Protection Agency (EPA) and the Department of Energy (DOE) of the United States of America (USA) as a joint voluntary program helping to save money and protect the environment through energy efficient products and practices. | ***Version 6.1 ENERGY STAR Product Specification for Computers (2014)*** | |
| | | – Desktop computers, integrated desktop computers,<br>– Notebook computers,<br>– Slates/Tablets,<br>– Portable all-in-one computers,<br>– Workstations,<br>– Small-scale servers that are marketed and sold for non-data centre use,<br>– Thin clients | – Power supply efficiency requirements,<br>– Efficiency and performance requirements,<br>– Power management requirements (system sleep mode, display sleep mode, wake on local area network (LAN), wake management)<br>– User information requirements |
| | | ***Version 2.0 ENERGY STAR Product Specification for Imaging Equipment (2014)*** | |
| | | – Copiers and fax machines;<br>– Digital duplicators;<br>– Printers,<br>– Scanners,<br>– Multifunction devices (MFD),<br>– Mailing machines | |

**Table 3 – Examples of eco-labelling schemes for ICT equipment**

<table>
<tr><th>Name</th><th>Description</th><th>Product covered</th><th>Criteria</th></tr>
<tr><td rowspan="3">Electronic product environmental assessment tool (EPEAT)<br>Type: multi-criteria label<br>Country of origin: United States<br>Website:<br>www.epeat.net/</td><td rowspan="3">EPEAT is a graded eco-labelling system that helps purchasers evaluate, compare and select personal computers and monitors based on their environmental attributes. Created in 2003 and launched in 2006, EPEAT is overseen by the Green Electronics Council (GEC), a non-profit organization based in Portland (Oregon, USA).<br>The EPEAT registration is based on the IEEE 1680 Family of Standards.<br>Products that meet the required environmental performance criteria may be registered in EPEAT by their manufacturers in 41 countries worldwide. Registered products are rated Bronze, Silver or Gold, based on the 23 mandatory and 28 optional environmental criteria.</td><td colspan="2">There are 51 total environmental criteria in EPEAT: 23 are required and 28 are optional.</td></tr>
<tr><td>– Desktop and laptop computers,<br>– Thin clients,<br>– Workstations,<br>– Computer monitors</td><td>The 23 mandated environmental criteria are in the following areas:<br>– Reduction/elimination of environmentally sensitive materials,<br>– Material selection,<br>– Design for end-of-life,<br>– Product longevity/life cycle extension,<br>– Energy conservation,<br>– End-of-life management,<br>– Corporate performance,<br>– Packaging</td></tr>
<tr><td>Imaging equipment</td><td>– Reduction/elimination of environmentally sensitive materials,<br>– Material selection,<br>– Design for end-of-life,<br>– Product longevity/life extension,<br>– Energy conservation,<br>– End-of-life management,<br>– Corporate performance,<br>– Packaging,<br>– Consumables,<br>– Indoor air quality</td></tr>
</table>

**Table 3 – Examples of eco-labelling schemes for ICT equipment**

| Name | Description | Product covered | Criteria |
|---|---|---|---|
| **Tjänstemännens Centralorganisation (TCO) Certified**<br>Type: multi-criteria label<br>Country of origin: Sweden<br>Website: www.tcodevelopment.com/ | TCO Certified is an international sustainability certification for IT products and includes a wide range of criteria ensuring that the manufacturing, use and recycling of IT products is carried out with regard to environmental and social responsibility.<br>TCO Certified combines requirements for social responsibility at the facilities where the product is manufactured, user safety and ergonomic design as well minimal environmental impact for both the product and its production during the whole life cycle.<br>The certification includes verification that the sustainability requirements are followed.<br>Conformity with TCO Certified standards is verified by an independent organization (third-party) following ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories".<br>TCO Certified is set by TCO Development, owned by the Swedish Confederation of Professional Employees. | ***TCO Certified Notebooks 4.0, TCO Certified Desktops 4.0, TCO Certified Displays 6.0*** | |
| | | – Displays,<br>– Notebooks,<br>– Tablets,<br>– Smartphones,<br>– Desktops,<br>– All-in-one PCs,<br>– Projectors,<br>– Headsets | – Socially responsible manufacturing,<br>– Environmental management system,<br>– Climate, energy efficiency,<br>– Ergonomics, work environment,<br>– Health, safety and emissions,<br>– Product lifetime,<br>– Hazardous substances in products and packaging,<br>– Product take back,<br>– Products and packaging designed for recycling |
| | | ***TCO Certified Edge*** | |
| | | – Displays,<br>– Notebooks,<br>– Tablets,<br>– Smartphones,<br>– Desktops,<br>– All-in-one PCs,<br>– Projectors,<br>– Headsets | All the requirements in TCO Certified for product category and at least one of the additional TCO Certified Edge criteria, which include:<br>– Minimum of 65% post-consumer recycled plastic,<br>– Halogen free: the product and included peripherals contain no chlorine and bromine,<br>– Outdoor readability (for notebooks),<br>– Enhanced acoustic limiting. |

**Table 3 – Examples of eco-labelling schemes for ICT equipment**

| Name | Description | Product covered | Criteria |
|---|---|---|---|
| **Blue Angel (Blauer Engel)**<br>Type: multi-criteria label<br>Country of origin: Germany<br>Website:<br>www.blauer-engel.de/en | The Blue Angel is a German environmental certification for products and services. Introduced in 1978 as the world's first eco-label, it is well known in many countries, particularly in Europe.<br>The Blue Angel is only awarded to products and services which - from a holistic point of view - are of considerable benefit to the environment and, at the same time, meet high standards of serviceability, health, and occupational protection.<br>The Blue Angel considers itself as a market-conform instrument of environmental policy designed to distinguish the positive environmental features of products and services on a voluntary basis. | ***RAL-UZ 78a Computers (2014)*** | |
| | | – Desktop computers, integrated desktop computers,<br>– Personal computers, except for tablets / slate computers and mobile thin clients,<br>– Workstations,<br>– Small-scale servers that are not marketed for use in data centres,<br>– Thin clients | – Energy consumption,<br>– Requirements for the battery in portable computers,<br>– Longevity,<br>– Recyclable design,<br>– Material requirements,<br>– Noise emissions,<br>– Consumer information/ user manual |
| | | ***RAL-UZ 78b Computer keyboards (2014)*** | |
| | | – Computer keyboards | – Longevity/ repairability,<br>– Recyclable design,<br>– Material requirements,<br>– Use of biocidal silver,<br>– Noise emissions,<br>– Ergonomics,<br>– Consumer information |
| | | ***RAL-UZ 78c Computer monitors (2014)*** | |
| | | – Computer monitors | – Harmonization with TCO Certified displays,<br>– Energy consumption,<br>– Repairability,<br>– Recyclable design,<br>– Material requirements,<br>– Ergonomics,<br>– Consumer information |

# 9 Final recommendations

## 9.1 Improving energy efficiency

Reducing power consumption begins with acquiring ICT equipment that is as energy efficient as possible while still performing the required functions. Purchasing more powerful computers, larger monitors or even more overall equipment than required leads to increased energy usage over the lifetime of the equipment. Adding this consideration to the equipment-purchasing process is the first step toward reducing energy consumption. Thin clients represent a good example.

### 9.1.1 Thin clients

A thin client is a general term for a device that relies on a server to operate. It provides a display device, keyboard and mouse and basic processing power in order to interact with the server. A thin client device contains no moving parts such as fans or hard drives (in the case of a dedicated thin client device). It does not store any of the data locally – it is very thin in features and functionality – hence the term "thin client" [b-2X Software].

A thin client often does not contain local storage and requires little processing resources. Thin client hardware can be an old converted PC, a new dedicated thin client device or simply a new low cost PC with a thin client operating system (OS) installed [b-2X Software].

Thin client computing enables increased productivity by allowing workers to work from anywhere in the world. Employees can access their personal desktop from a fat client or notebook, making it easy to telework from home or while on travel. With this system, supporting a mobile workforce simply involves updating the application software on the servers. Workers are guaranteed secure and instant access to enterprise applications and personal data, from any device and over any network speed [b-2X Software].

## 9.2 Virtualization

Virtualization is being used by a growing number of organizations to reduce power consumption and air conditioning needs and trim the building space and land requirements of data centres [b-Burger].

Virtualization is the creation of a virtual (rather than actual) version of something, such as a hardware platform, an OS, a storage device or a network resource. Simply stated, virtualization is a technique that allows more than one server to run (or another infrastructure component) on the same hardware. For example, one server is the host server and controls the access to the physical server's resources. One or more virtual servers then run within containers provided by the host server.

Virtualization provides a sustainable growth strategy for a company. It has a great number of benefits, some of which are as follows:

- more efficient use of computer processing power;
- less energy consumption, less heat generation and therefore less air conditioning;
- fewer physical servers;
- less power backup resources required;
- end of endless hardware purchases and upgrades;
- hardware is virtualized so no need to purchase controllers;
- hardware upgrades are on the software level (memory, processor, or any controller);
- no need to physically install hardware;
- safer, faster backups and restores;
- ability to take live snapshots while the OS is running;

- scheduling of snapshots of the OS;
- less time to recover the whole OS;
- reduced IT overhead;
- simplified IT management from a remote location (from anywhere in the world using an Internet connection);
- ability to use thin clients (low-cost centrally managed computers devoid of disk drives, CD players and expansion slots, and which require no hardware maintenance);
- ability to use existing computers for remote desktop connection to virtual machines located on the main server;
- faster server/client connection speed through a virtual switch.

## 9.3 Cloud computing

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

Cloud computing pools all of the computing resources that can be distributed to applications as needed – optimizing the use of the sum of the computing resources and delivering better efficiency and utilization of the entire shared infrastructure.

Cloud computing helps to reduce costs and increase energy savings.

## 9.4 Video conference systems

Videoconferencing has many uses in the academic, business and government sectors. Its use continues to grow particularly with the rise in distance learning and the goal to reduce the travel required for meetings. The technology has been used in such diverse applications as remote training, work placement supervision, interviewing, presentations and thesis defenses. For participants with mobility difficulties or other impairments, videoconferencing enables their inclusion into many areas of society that were previously inaccessible. Videoconferencing is a potential way to save energy and reduce an organization’s carbon footprint through travel reduction, which may be particularly important for colleges or universities that are relatively remote. Furthermore, virtualization techniques can be used to reduce the number of hardware components needed, overall power consumption and heat dissipation requirements. This technology can operate over the power over Ethernet (PoE) technology standard which reduces power consumption, uses the latest video compression technique (e.g., [ITU-T H.264]), gives the benefit of reduced bit rate which reduces the required infrastructure (e.g., cables, switches, storage) leading again to reduced power consumption, heat dissipation and overall foot print [b-Constable].

## 9.5 Enhancing user's behaviour

Users play a crucial role in achieving office IT equipment's energy efficient performance. A standard operating system image to be shared by computers which incorporate the best practices power settings into the image design will ensure systematic application of these settings across all computers of the organization. The use of default power efficiency best practices into each new/redeployed computer greatly increases the likelihood of their use and the potential for energy savings.

# 10 Conclusions

## 10.1 Personal computer products

Organizational needs should be studied before purchasing any ICT equipment (e.g., CPU power, storage).

It is recommended to apply a "total cost of ownership methodology" when procuring products. Consideration should be given to more than the purchase price. The total LCC over the estimated period of ownership of the device should be considered. Life cycle costs should include the purchase price, the cost of maintenance and other services, the cost of energy consumption and other consumables (e.g., paper and ink) and any disposal/recycling costs [b-EUb].

An eco-labeled product from the major ecolabels (EPEAT, ENERGY STAR, TCO and Blue Angel) should be considered when purchasing, since it is highly preferred over a non-green certified product and should be evaluated accordingly.

The EU ENERGY STAR website also provides a useful tool for calculating the possible financial savings of buying a more efficient product [b-EU_E_STAR].

New technologies such as thin clients should be highly considered when making a purchase due to its very low power consumption, lower heat dissipation and smaller foot print.

A strict computer power saving policy should be enforced along with the adoption of an organization wide campaign to raise awareness regarding power saving (i.e., turning computers, lights and air conditioning off when not in use). Purchased products should have embedded energy management functions that are compatible with any power saving policy.

Appropriate instructions should be provided to employees on how to use personal computers in order to maximize their energy efficient performance.

Care should also be taken to ensure that procurement processes take into account the availability of repair services and spare parts for the expected life span of the product.

## 10.2 Network equipment and servers

Several companies provide energy saving and more environmentally friendly versions of their products and they must be taken into consideration before purchasing. A replacement product should always be more energy efficient that the product it is replacing.

The design of the network plays a major role in cost and power saving; therefore, one must consider various technologies to take maximum advantage of the available resources.

- virtualization is a must in any data centre to make maximum usage of the available resources;
- data centre duplication and replication under one ministry must be eliminated since it's a great waste of resources;
- each ministry should have only one data centre (shared among all the entities under that ministry) connected to a main government data centre through a government cloud. An example is shown in Figure 1 below:

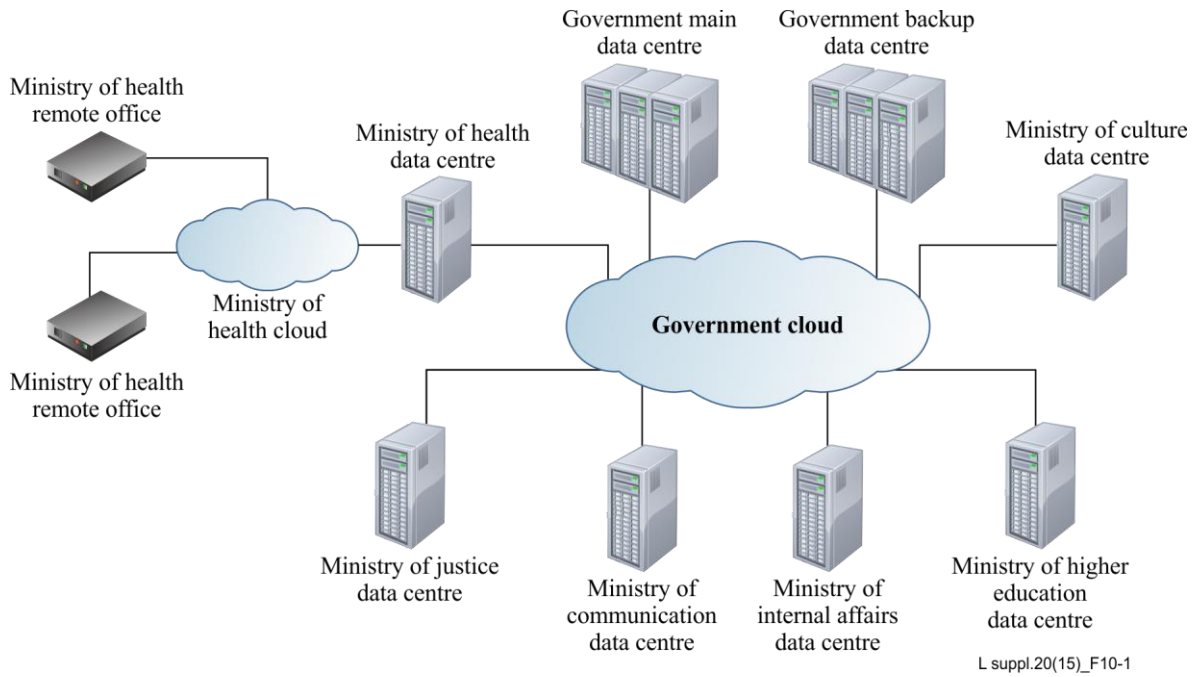


**Figure 1 – Illustration of main government data centre**

- remote offices or locations under any ministry should be supplied with a small form factor self-sustainable rack with its own air conditioning unit and uninterruptable power supply unit to eliminate the need of any unneeded external resources;
- network and server equipment's with smaller foot print and lower heat dissipation should be highly evaluated compared to larger foot print or higher heat dissipation counterparts;
- network and server equipment's that can provide logs of vital system stats (e.g., CPU temp, power load) should be highly evaluated.

### 10.3 Imaging equipment

An eco-labeled product from the major eco labels (EPEAT, ENERGY STAR and TCO) should be considered when purchasing since it is highly preferred over a non-certified product and should be evaluated accordingly.

### 10.4 Durability, disposal and recycling

A product may also be considered end-of life if its usefulness for an organisation has ended.

In response to the growing problem of excessive waste, the adoption of take-back and recycling legislation could help create a new channel for products that reached the vendor specified end-of-life cycle (recommended 5-7 years) to be recycled or eliminated in an environmentally safe way.

The primary goals of these take-back laws are to ensure that the private sector takes responsibility for the wastes that are generated by their products and that these costs are not borne by society or governments. The goals of take-back laws are to:

- encourage companies to design products for reuse, recyclability, and materials reduction;
- incorporate waste management costs into the product's price;
- promote innovation in recycling technology.

Take-back programs help promote these goals by creating incentives for companies to redesign their products to minimize waste management costs, by designing their products to contain safer materials (so they do not need to be managed separately) or designing products that are easier to recycle and reuse (so recycling becomes more profitable) as the producer will bear responsibility for these costs.

Extending the life of ICT equipment, reducing environmental impacts and making products accessible to a greater number of people through hardware repair and refurbishment programs should be a priority. Several aspects should be taken into account when assessing reuse capabilities. A few examples include the redeployment of end-of-use equipment to be considered within the organization, or if the reuse supplier accepts used equipment in part for trade, replacement equipment or a monetary rebate.

# Appendix I

## Case study: Egypt

### General overview of public procurement legislation

Public procurement in Egypt is regulated by Tender Law no. 89 adopted in 1998. Law no. 89 was modified in 2010 by amendment decree no. 33/2010 by the Prime Minister to introduce electronic means for tender process. Decree no. 33/2010 also established a government e-procurement portal that is a website where contracting entities should publish contract notices in addition to traditional means (a public tender board or newspaper) of publication [b-EBRD].

The Egyptian public procurement institutional framework is complex and involves several authorities [b-EBRD]:

- Ministry of Finance (MoF): responsible for policy making, issuing decrees and determining national public procurement policy and planning;
- Public Services Authority (PSA): a central government agency responsible for planning, regulating and monitoring public contracts; reporting on technical, financial and regulatory governmental expenditures; and, issuing guidelines to contracting entities. The PSA reports to MoF;
- Public Contracting Office (PCO): a department within MoF. It is responsible for handling complaints from suppliers. The final decision with respect to each complaint is taken by the supervising competent authority (CA);
- Central Auditing Authority (CAA): an independent authority responsible for reviewing the accounts of each public entity. The CAA takes its instructions directly from the President's office.

### Government structure

- administrative divisions: 27 governorates;
- the cabinet of ministries;
- 37 ministries.

(Source: http://www.egypt.gov.eg/English/Home.aspx)

### ICT GPP recommendations

1 Preference should be given to personal computing devices and monitors that are ENERGY STAR rated.

2 Preference should be given to personal computing devices and monitors that are listed in the EPEAT registry. Where performance and price characteristics are considered equal, a product with a higher level of EPEAT registry is preferred.

3 Preference should be given to personal computing devices and monitors that have third party certification such as TCO Certified or Blue Angel or and equivalent.

4 Preference should be given to imaging equipment that is ENERGY STAR rated.

5 The current legislative laws make it difficult for any organization to take the maximum benefit of its own resources after it reaches the end-of-life cycle. A new take-back legislation could help create a new channel for products that reached the vendor specified end-of-life cycle (5-7 years) to be recycled or eliminated in an environmentally safe way.

6 Employee awareness and the implementation of energy saving best management practices can reduce total energy consumption of ICT equipment without having to upgrade equipment. Best practices should be published to Ministry of Communications and Information Technology (MCIT) established and advertised websites. E-mail newsletters can guide interested parties to these websites, and a poster series which contains subsets of the best practices.

# Bibliography


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