Green Public Procurement

Mobile Phone Technical Background Report

Report for the European Commission – DG Environment by AEA, Harwell, June 2010

Owner, Editor: European Commission, DG Environment-G2, B-1049, Brussels.

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1 Introduction

Following on from previous work in developing GPP criteria for ten product groups[1], a further ten products and sub-products have been identified for the development of GPP purchasing criteria to add to the European Commission's GPP training Toolkit Module 3, which presents recommended GPP criteria for products and services. The process of deciding on products for which to develop criteria was achieved using a methodology that included a review of studies identifying priority product groups, taking into account those product groups for which GPP purchasing criteria have already been recommended. GPP is a voluntary instrument.

Mobile Phones and their chargers (also known as external power supplies) have been identified as a product group for criteria development. This report provides background information on the environmental impact of mobile phones and outlines the key relevant European legislation affecting this product group. It then goes on to describe existing standards and ecolabels. Finally it outlines the rationale for the core and comprehensive environmental purchasing criteria that are being proposed for consultation.

This report accompanies the associated **Product Sheet** that contains the proposed purchasing criteria and ancillary information for green tendering procedures and as such they should be read alongside one another.

The format for the purchasing recommendations comes in the form of two sets of criteria:

- The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases.
- The comprehensive criteria are for those who wish to purchase the best products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

Within the core and comprehensive criteria, the guidance follows the various stages of a public procurement procedure and explains how best to integrate environmental criteria at each stage:

- Subject matter. It means the title of the tender, i.e. a short description of the product, works or service to be procured.
- Technical Specifications. Provide a clear, accurate and full description of the requirement and standard to which goods, works or services should conform. Description of the minimal technical specifications which all bids need to comply with. Set specific environmental criteria, including hurdles and levels that need to be met for specific products.
- Selection Criteria. It is based in the capacity / ability of the bidders to perform the contract. Assist in the identification of appropriate suppliers, for example to ensure adequately trained personnel or relevant environmental policies and procedures are in place.
- Award Criteria. The award criteria on the basis of which the contracting authority will compare the offers and base its award. Award criteria are not pass/fall criteria, meaning that offers of products that don't comply with the criteria may still be considered for the final decision, depending on their score on the other award criteria.
- Contract Performance Clause - Specify the conditions that must be met in the execution of the contract, for example as to how the goods or services are to be supplied, including information or instructions on the products to be provided by the supplier.

It should be noted that the contractor is bound by the existing legal framework.

Where the verification for the criteria states that other appropriate means of proof can be used, this could include a technical dossier from the manufacturer, a test report from a recognised body, or other relevant evidence. The contracting authority will have to satisfy itself on a case by case basis, from a technical/legal perspective, whether the submitted proof can be considered appropriate.

[1] http://www.ec.europa.eu/environment/gpp

2 Abbreviations

BeO	Beryllium oxide
BFR	Brominated flame retardant
CLRTAP	Convention on Long-range Transboundary Air Pollution
EFA	Ecological Footprint Analysis
EMAS	Eco-Management and Audit Scheme
EMC	Electromagnetic Compatibility Directive
EU	European Union
EuP	Energy Using Product
GPP	Green Public Procurement
GPSD	General Product Safety Directive
IC	Integrated Circuits
IPP	Integrated Product Policy
KEPIs	Key Environmental Performance Indicators
LCA	Life Cycle Assessments
LVD	Low Voltage Directive
MIPS	Material Input per Service Unit
PBB	Polybrominated biphenyls
PBDE	Polybrominated diphenyl ether
PEC	Primary Energy Consumption
PVC	Polyvinyl chloride
PWB	Printed Wiring Board
RoHS	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive
SAR	Specific Absorption Rate
TCP	Telephone Communication Power
UNECE	United Nations Economic Commission for Europe
WEEE	Waste Electrical and Electronic Equipment

3 Definition, Scope and Background

It is important to define what is included within the scope of these criteria proposals. There are three main areas in mobile phone technology that come under consideration:

- the mobile phone itself
- the charger (external power supply)
- peripherals; including spare batteries and headsets (so called hands-free equipment).

For the purpose of this GPP Product sheet, mobile phones are defined as a portable battery powered device that is principally used for telephone communication and text messaging, but may include additional features, for example, internet capability and camera/video.

For the purpose of this GPP product sheet, a mobile phone charger is an external power supply specifically designed for charging an associated mobile phone. It will generally be supplied in the product bundle with the mobile phone, however it also includes the provision of spare chargers where these need to be purchased separately.

For the purpose of this GPP product sheet, peripherals include headsets, for example for hands free use of the mobile phone, and spare batteries only. Spare chargers are included above.

The mobile phone market has developed significantly since the 1990's, and mobile phones are now widely used throughout the individual and business sectors. In 2007 global mobile devices sales reached 1.15 billion units, an increase of 16% on 2006[2]. In recent years sales have been pushed up by the development of new markets in countries such as China and India. However in more mature markets, such as Western Europe and USA, replacement and upgrading of mobile phone handsets is an important factor.

The frequency mobile users upgrade their mobile phone handset can be influenced by a number of factors, including advances in technology and fashion. Data from 2006 showed that 27% of European mobile phone users changed there phones every year and 60% within two years[3]. This information, along with the key life cycle environmental impacts in the manufacture, use and disposal of mobile phone technology has informed the choice of criteria.

[2] http://www.reghardware.co.uk/2008/03/04/gartner_mobile_phone_sales_report/

[3] http://www.telephia.com/documents/EuroDeviceReplacementReleaseQ1065.8.06FINAL.pdf

4 Key Environmental Impacts

A 5-Stage Integrated Product Policy (IPP) Pilot Project carried out in 2005/2006 for the European Commission considered the key environmental impact of mobile phones and potential improvements for the future. The outcome was a number of environmental initiatives to 'green' the mobile phone market. These initiatives are currently being taken forward by a number of task groups lead by industry.

The Stage 1 Report[4] of the pilot study produced by Nokia provides an overview of the life cycle of a mobile phone and the key environmental impacts.

In addition to the key environmental impacts outlined in this section, we are aware that there is significant research into the health impacts of mobile phones and the associated infrastructure. In particular limits on the specific absorption rate (SAR) of mobile phones have been included in some ecolabel criteria, however they have not been considered in this research or included in the GPP criteria, which focus on purely environmental impacts and as health related impacts are dealt with in relevant legislation and recommendations, for example through the Radio and Telecommunications Terminal Directive 1999/5/EC and Council Recommendation 99/519/EC, which are outlined in Section 6 below.

4.1 Summary of Life-Cycle Phases

The life cycle of a mobile phone consists of a number of key phases, which are summarised as follows and illustrated in Appendix 1, Figure A1:

- Extraction and processing of raw materials – Mining operations, refining of ores and the manufacturing of materials and substances will result in environmental issues and impacts, these include high energy use, physical disturbance of the landscape and pollution from toxic emissions, which may affect land, water and air.

- Components manufacture – The manufacturing of components used in mobile phones has significant environmental impacts, including energy consumption, harmful emissions as a result of the use of materials with hazardous properties and the production of hazardous wastes.

- Transport of components to the assembly plant – The main environmental impact is energy consumption (fuel use) and associated emissions by the vehicles.

- Phone assembly – Energy consumption of assembly line and overheads, for example building heating, lighting etc. There will also be hazardous waste arising from the assembly process.

- Transport of phones to distribution network – again, fuel consumption by the carriers and associated emissions.

- Use - Energy consumption from network infrastructure and mobile phone.

- End of life – Environmental impact will depend on the management of the mobile phones at the end of their life; mis-management can result in increased impacts. This will result in hazardous waste arising from the components/materials used in the mobile phone manufacture process, which will need to be dealt with in an appropriate manner.

For each of the phases shown in Appendix 1, Figure A1 there will be an element of energy input, which will vary for the different phases. Each phase will also have emissions to air, land and water and result in waste, which will either be suitable for reuse or recycling or have to be sent for disposal.

[4] http://ec.europa.eu/environment/ipp/pdf/nokia_mobile_05_04.pdf

A number of different approaches have been used to assess the environmental impact of mobile phones. These include Life Cycle Assessments (LCA), Ecological Footprint Analysis (EFA), Material Input per Service Unit (MIPS) and Key Environmental Performance Indicators (KEPIs).

EFA and MIPS are currently of limited use in assessing the life cycle environmental impacts of mobile phones. EFA is a relatively new tool, which has not been used extensively in the electronics field and MIPS is limited in its use, as significant data gaps exist.

A joint study commissioned by Motorola, Nokia, Panasonic and Philips[5] looked to develop KEPIs for mobile phones. These are designed to provide a simple method for assessing life cycle performance of electronic products, and in particular mobile phones. They are a small number of product environmental performance indicators, which are considered to represent the most important environmental impacts of a particular electronic product, in this case a mobile phone.

Each of these different assessment methods have advantages and disadvantages, however the conclusion of each is broadly similar with energy consumption being identified as the most important environmental issue in various life cycle phases, with the key phases for energy consumption being in the mobile phone manufacture phase and the in-use phase.

In addition to this a number of other environmental issues are also applicable to mobile phones. These include radiation emitted from mobile phones and potential health impacts, the use of hazardous materials in their production and the waste related end of life management of mobile phones.

The sections below outline in further detail the environmental impacts identified and associated with mobile phones.

4.2 Energy Use

Primary Energy Consumption (PEC), relating to mobile phone manufacture and use is viewed as the most significant impact by the mobile phone industry[6]. This view is substantiated by a number of life cycle assessments (LCA) that have been carried out on mobile phones. These have all generally yielded similar results, which highlight manufacture and use as the two significant life cycle phases with regard to energy consumption.

The 2003 Nokia LCA of a 3G[7] mobile phone calculates that product manufacture accounts for 60% of total energy consumption for a light user scenario and 54% for a heavy user scenario. The most energy intensive component in the mobile phone was identified as the printed wiring board (PWB). The raw material acquisition and manufacture of the PWBs is approximately 40% of the total life cycle energy consumption.

An earlier study by Nokia in 1999 on 2G[8] Mobile Phones[9] also identified the component manufacture phase as having the largest energy consumption within the life cycle of the mobile. In this particular case Integrated Circuits (IC) were identified as having the largest energy consumption in the component manufacture phase.

It is difficult to set GPP criteria specifications in relation to energy use during the manufacturing phase as there are no defined benchmarks due to the complexities of the manufacturing process for mobile phones, and the different components and manufacturers involved. It is however possible to include selection criteria, which focus on the management of energy use during the manufacture phase and ensure the mobile phone manufacturer has policies and procedures in place to minimise energy use.

In the use phase of mobile phones, the standby energy consumption of phone chargers is most significant. The 1999 Nokia study calculated that total energy consumption in the use phase over the

[5] Singhal et al (2004) Key Environmental Performance Indicators (KEPIs): A new approach to environmental assessment. Paper presented at the Electronics Goes Green 2004+, Berlin.

[6] Mclaran, J., and Piukkula, N. (2004). Life Cycle Assessment of a 3rd Generation Nokia Handset. Paper presented at the Electronics Goes Green 2004+, Berlin.

[7] 3G are the third generation of mobile phone standards and technology. It includes additional features and functions when compared to a 2G mobile phone e.g. bluetooth, camera, music and video playing

[8] 2G are second generation mobile phones, which don't have the advanced features of 3G mobile phones.

[9] Wright, L. (1999). Product Life Cycle Analysis Management, EngD Thesis. University of Surrey, Guildford, UK.

average life of a mobile phone (2.5 years) was 116 MJ (the same as 32kWh), of which charger standby[10] was 101 MJ (28kWh). For comparison, a very similar amount of energy is consumed by a domestic compact fluorescent light bulb over the same time period[11]. The 2003 study also confirms the standby energy consumption of the charger as the most significant contributor to energy consumption in the use phase. The power consumption of the charger in the 2003 study was 0.3 Watts. This demonstrates that progress has been made in the development of more efficient chargers and some of the most recent developments include chargers with very low no load energy losses, for example the Nokia AC-8 charger.

There are end user behavioural elements to energy consumption from chargers that are left plugged in when not required. This is difficult to overcome and any future design of mobile phone chargers that have a significant impact on reducing energy consumption will be of great benefit. Some chargers now have alerts to remind users to turn them off, whilst others turn off automatically. Many manufacturers are already signed up to the EU Code of Conduct for Chargers, which is discussed further in Section 7. It is recommended that energy saving guidance is included in the consumer information provided with the mobile phone product with respect to the chargers e.g. switching off and/or unplugging chargers when they are not in use. Improvements (through more stringent limits and technological improvements) to the no load energy consumption of mobile phone chargers may be relatively small on an individual charger basis, however, the wide spread use of mobile phones mean that these savings could be significant on an aggregated basis.

Under the framework of the Ecodesign Directive a preparatory study has been prepared for ecodesign requirements of EuP's. Lot 7 considers battery chargers and external power supplies[12], this study includes an assessment of the average European product. These are known as base cases and they present the environmental impact assessment and life cycle cost for various EuPs, including mobile phone chargers.

Analysis carried out for mobile phone chargers calculated that total energy consumption in the use phase is split as 42 % on-mode efficiency losses and 58 % off-mode losses. An assessment of the full results highlight increased energy efficiency and reducing no load losses as key areas for the improvement of mobile phone chargers.

The report highlights that there is a degree of uncertainty when calculating energy consumption because there is limited data available on use patterns and whether end users unplug/switch off chargers once batteries are fully charged. However it is calculated that a quarter of the life cycle costs relating to mobile phone chargers comes from the electricity i.e. power losses. This is discussed further in Section 4.5 below.

The ecodesign regulation for external power supplies was published in April 2009 (Commission Regulation 278/2009)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:093:0003:0010:EN:PDF.

The focus of these measures is on the no load and active efficiency of the charger, based on the US Energy Star Version 2 requirements. These are discussed in Section 7 in more detail.

4.3 Materials

Mobile phones often consist of a number of different types of materials and substances. Some of these are restricted by the requirements of Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive), which is discussed in section 6.2 below. This Directive restricts the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) in electrical and electronic equipment. The use of these materials is restricted due to their harmful effects on human health and on the environment; ecotoxicity.

[10] The standby power consumption of the charger was 1.3 watts
[11] CFL: compact fluorescent lamp, http://whatif.mtprog.com
[12] http://www.ecocharger.org/docs/BIOconsortium_EuP_Lot_7_Final_Report.pdf

Aside from these substances restricted by the RoHS Directive, there is a wide range of other materials, substances and components used in mobile phones and their packaging, including printed circuit boards, metals, plastics, surface treatments and various packaging materials. It is important to ensure that the materials and substances used in mobile phones do not pose a risk to the environment or end-users. To meet this need it is proposed therefore to take the holistic approach of addressing the chemical characteristics of the substances in order to mitigate any potential risks arising from the use of these materials. This is best achieved by using appropriate risk phrases in the relevant criteria. By taking this more holistic approach the focus of the criteria is on the chemical and environmental properties of the substances rather than on the chemical family to which they belong and one thus does not unduly exclude any one group of chemicals. As such, risk phrases have been applied to criteria on the materials used within a phone, based on existing Ecolabel criteria on mobile phones where appropriate and aligning the approach to the outcomes and initiatives of the IPP study on mobile phones.[13]

Certain chemical substances have been included in the criteria based on the evidence base of the available ecolabels. Furthermore, the approach of using R-phrases, rather than restricting particular compounds or families of compounds is the preferred approach as recommended by the Commission on previous product group consultations. It is also the current preferred approach in the EU Ecolabel. We do recognise though that restricting substances across the entire life cycle of the product is not wholly appropriate.

In addition to the use of R Phrases, H phrases are also included as required under Regulation on the classification, labelling and packaging of substances and mixtures (CLP Regulation), further details of which are provided in Section 6 below.

Whilst these GPP proposals are meant to go beyond the legislative minima of the REACH Regulation, they are to be accessible and applicable. The risk phrases included are in line with TCO and represent the key risk phrases:

- R40(/H351) (limited evidence of a carcinogenic effect)
- R45(/H350) (may cause cancer)
- R46(/H340) (may cause heritable genetic damage)
- R48(/H372) (danger of serious damage to health by prolonged exposure)
- R50/53(/H400 and H410) (very toxic to aquatic organisms / may cause long-term adverse effects in the aquatic environment)
- R60(/H360F) (may impair fertility)
- R61(/H360D) (may cause harm to the unborn child)

The direct environmental impacts from the variety of materials used in the manufacture of mobile phones can be mitigated further by ensuring that they are properly handled in disposal, including re-use, recycling and recovery where appropriate. Section 4.4 addresses this further.

In a drive to address the ecodesign aspects of mobile phones some of the larger manufacturers are now developing and marketing phones and packaging, which are made from a percentage of recycled or renewable materials, for example covers made from more than 50% of renewable materials and packaging that consists of 60% recycled material. The number and availability of such models is limited to at present, however in future it would be reasonable to expect a wider range of mobile phones and their packaging using recycled and renewable materials to be available. These developments are addressed in the proposed criteria and explanatory notes.

Further to this approach of assessing the design of products from an eco point of view, some manufacturers are also considering alternative materials. For example Version 7 of the Greenpeace Guide to Greener Electronics (March 2008)[14] indicates that the majority of the major manufacturers

[13] http://ec.europa.eu/environment/ipp/mobile.htm

[14] http://www.greenpeace.org/raw/content/international/press/reports/guide-to-greener-elect-7.pdf

have timeframes in place to phase out the use of PVC and brominated flame retardants (BFRs) in their products and replace them with alternatives.

For mobile phones themselves, energy use in the manufacturing phase is key, whereas for mobile phone chargers the key life cycle impact is energy consumption in the use phase, as described in section 4.2. However, the Ecodesign Preparatory Study for battery chargers and external power supplies also highlights a number of other key recommendations in relation to the use of materials in mobile phone chargers, which should be taken into account. These include the following:

- Reducing weight / size of coils, transformers
- Reducing PWB size
- Reducing weight of copper and other materials in cables
- Reducing the weight / size / number of diodes
- Reducing weight / size of big capacitors

So long as reducing component size and weight does not adversely affect the performance and longevity of a device it is certainly worth considering these options at the ecodesign stage in order to reduce material consumption and associated manufacturing impacts.

Whilst these recommendations are not the most significant elements of the life cycle impacts of mobile phone chargers, they are nonetheless important to consider to some extent as part of the GPP specification. Requirements relating to this are not included in the criteria, as it is difficult to establish a baseline against which to measure reduced material use, particularly in an area where technology is developing on a relatively rapid basis. Information is however included as an explanatory note to highlight the issue to the contracting authority, should they wish to consider it further.

A further point highlighted during the finalisation of the criteria relates to material diversity and in particular the use of rare earth materials. The issue of the use of rare earth materials is not covered by the TCO label or highlighted in other sources used to research the GPP criteria for mobile phones as a key environmental impact. However, it is worth noting the point regarding materials diversity, and this may be an area worth considering in the future for criteria development, if appropriate information is available on which to base a suitable criterion.

4.4 End of Life Management

The end of life management of mobile phones is mainly regulated by the requirements of the WEEE Directive. This Directive is discussed further in Section 6. It sets out requirements for take back schemes and the removal of components for recovery where possible. In the UK for example there are now an increasing number of dedicated facilities for the recycling of mobile phones and schemes to promote their reuse.

Correct end of life management of mobile phones can result in added environmental value. The recovery of metals is key to this, and in particular any precious metals. Other materials such as plastics can also be recovered for re-use or recycling. Using appropriate marking standards, for example ISO 11469 to indicate the material type will help ensure it is dealt with in the correct manner at the end of life phase.

Mobile phones can contain precious metals, for example gold is used in the circuit boards. The recovery of these precious metals at the end of life stage can offset the environmental impacts that would otherwise occur, for example in the raw material extraction phase. By recycling these metals, the impacts of the raw material extraction phase can be reduced, as less extraction will be required. For example the recovery of gold from circuit boards in the disposal phase has the potential to offset over 83 % of the environmental impacts from the raw material acquisition phase however, this will depend on the amount of gold within the circuit board[15].

One of the IPP study's environmental initiatives is to investigate and develop incentives and actions that lead to an increased take-back rate of phones. One such way is through better consumer awareness and behaviour. As such the proposed criteria address increasing the level of old and unwanted phones returned for re-use or recycling.

[15] http://www.lcainfo.ch/df/DF27/Stutz2KEPIPaper2004.pdf

As with all electrical and electronic equipment, if mobile phones and their component materials are not properly managed at the end of their life there are possible negative environmental impacts. Therefore robust collection and treatment schemes should be in place and be effective in preventing these kinds of products from reaching landfill.

Similarly batteries can have a significant impact on the environment if not dealt with properly in the end of life management phase. Disposal in landfill sites can result in the release of contaminants, with the potential to pollute the environment, for example the underlying groundwater. Specialist collection and recycling facilities are able to recover the materials used in batteries and these facilities should be used.

One way of limiting the end of life impacts of mobile phones is to extend the length of time a mobile phone is used before being upgraded. As stated in section 3, data from 2006 showed that 27% of European mobile phone users changed their phones every year and 60% within two years[16]. It is therefore one of our recommendations that the contracting authority should consider the mobile phone renewal frequency in the service contract having regard to local business needs. It would be preferable if this can be extended or provisions included in the service contract for replacement batteries where handsets are still usable but the battery is exhausted. Upgrade periods vary, and there is not a standard baseline against which a criterion relating to upgrade periods can be assessed and verified. Therefore consideration of upgrade periods is included in the explanatory notes of the product sheet.

Mobile phone chargers have the potential to significantly increase the volume of waste from this product group. It is important that consideration is given to chargers as part of the end of life management. The plastics from mobile phone chargers can be recycled and used in a variety of ways, for example traffic cones, buckets or horse gallops[17]. The metals such as copper and precious metals on circuit boards can also be recovered from chargers for further use.

4.5 Packaging

Definitions for packaging and specific types of packaging, including primary, secondary and tertiary are included in Article 3 of Directive 94/62/EC on packaging and packaging waste and can be summarised as:

- 'packaging` shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable` items used for the same purposes shall also be considered to constitute packaging.

As outlined in below, the Packaging Directive aims to ensure packaging waste is dealt with effectively and sets targets for Member States with regard to the recovery and recycling of packaging materials. These targets were revised by Directive 2004/12/EC and are summarised below, with full details available in Article 6 of the Directive.

- no later than 31 December 2008 60 % as a minimum by weight of packaging waste will be recovered or incinerated at waste incineration plants with energy recovery;
- no later than 31 December 2008 between 55 % as a minimum and 80 % as a maximum by weight of packaging waste will be recycled;
- no later than 31 December 2008 the following minimum recycling targets for materials contained in packaging waste will be attained:
  (i) 60 % by weight for glass;
  (ii) 60 % by weight for paper and board;
  (iii) 50 % by weight for metals;
  (iv) 22.5 % by weight for plastics, counting exclusively material that is recycled back into plastics;
  (v) 15 % by weight for wood.

[16] http://www.telephia.com/documents/EuroDeviceReplacementReleaseQ1065.8.06FINAL.pdf
[17] http://www.fonebak.com/LearnRecycling.aspx

The relevance of packaging as a key environmental impact depends on factors such as product life time and the types of materials used.

In the course of this study, consultation feedback suggests that using the same packaging criterion across different product groups is not an appropriate approach. In addition, for the majority of products in this study packaging is not a key issue, given their long life times, energy consumption during manufacturing and that some use energy in the use phase.

Commentators suggest that other factors also make this approach inappropriate, these are outlined below:

- The lack of a definitive evidence base to use when setting and justifying specific criteria.
- Focussing on a single parameter e.g. recycled content, may lead to sub-optimal environmental results. For example packaging with an increased recycled content may be less robust so more may be required to protect the goods whilst in transit.
- A fixed parameter value does not allow a flexible approach to the issue and may mean few suppliers can satisfy the requirement(s).

Consequently a packaging criterion is not included in the GPP specification. However, an explanatory note highlighting relevant issues that contracting authorities may wish to consider are included. Contracting authorities can determine for themselves the importance they wish to place on packaging and the particular issues that are relevant to them depending on their existing policies and practices.

5 Cost Considerations

Energy use for the life cycle of a mobile phone in the use phase is dominated by energy used by mobile phone chargers, especially no-load power consumption. No-load power consumption of chargers has already been reduced in the past and has the potential to be reduced further resulting in additional energy savings.

It is difficult to specifically quantify these savings as end user behaviour can significantly influence no-load power consumption of chargers. However in the EuP Lot 7 Preparatory Report it is calculated that EU-25 expenditure for the 2005 stock of mobile phone external power supplies in total was in the region of 1170 million Euros. Of this total cost approximately 20% (229 million Euros) was spent on electricity, with the remainder the product price.

Whilst a number of mobile phone chargers already have low no-load power requirements, it is clear that further reductions can be made following Version 3 of the Code of Conduct, which came into force in 2009 and includes progressively more stringent no-load power consumption levels from 2011. The details and background to this Code of Conduct are outlined in Section 7 below.

A key element in savings from mobile phone chargers can be achieved through behavioural changes. This was highlighted in the Integrated Product Policy (IPP) Study and the proposed GPP criteria therefore require information to be provided on how to reduce power draw from chargers when not in use, for example unplugging them. Given the widespread use of mobile phones and the large number of chargers in use it is estimated that if just 10 % of the world's mobile phone users switch off or unplug their chargers when not in use, it would save enough energy to power 60,000 European homes annually[18].

It is important to communicate effectively with mobile phone users and influence their behaviour where possible. Effective communication of the potential energy savings, and therefore money in the form of lower electricity bills, by switching off or unplugging mobile phone chargers when they are not in use is a key factor in influencing the behaviour of mobile phone users and reducing the energy use impact of mobile phone use. This could be implemented with advice and guidance from the supplier in user manuals for example.

One of the aims of ecodesign is to use fewer types of material. In doing so for a device such as a mobile phone will be advantageous at the recycling and recovery stage as there will be fewer materials to segregate. In addition the reduction in the use of hazardous materials will potentially allow more components to be recovered and recycled or reused. This should generally result in lower costs.

Awareness of environmental issues related to mobile phones is increasing, especially from the manufacturer's perspective. Many companies[19] provide accessible information, for example on their websites, regarding the environmental characteristics of their products in the form of environmental declarations.

[18] http://www.nokia.com/A4136001?newsid=1076996

[19] Examples include Nokia http://www.nokia.com/A4211062 and Sony Ericsson http://www.sonyericsson.com/cws/corporate/company/aboutus/sustainability/environment#environmental_product_declaration

6 Relevant European Legislation and Policy

This section details EU legislation that is relevant to mobile phones, which sets the framework in which standards and labels have been developed. Contracting Authorities should be also aware of any additional local, regional or national legislation pertinent to their situation with respect to a particular product or service.

6.1 Directive on Waste Electrical an Electronic Equipment (WEEE) 2002/96/EC

The WEEE Directive[20] and RoHS Directive[21], which is discussed below, were developed and adopted to address the increasing amount of waste electrical and electronic equipment generated in Europe, therefore reducing the environmental burden on conventional disposal routes whilst closing the loop and improving resource efficiency through recycling.

Mobile Phones are listed in Annex IB of the WEEE Directive under 'IT and telecommunications equipment' and are therefore subject to the requirements of the Directive. Producers will be required to take responsibility for the treatment and recycling of their products when they become waste at the end of their life.

The requirements of the Directive are transposed into national law by individual Member States and it is important to be aware of national take back and recycling schemes and arrangements in specific Member States. The Directive requires electrical and electronic equipment to be taken to a suitable authorised treatment facility at the end of its life so that it can be treated/dismantled and materials recovered for recycling where possible. The Directive outlines minimum requirements for the treatment and recovery of WEEE.

The WEEE Directive also requires products to be labelled, in order to identify them as EEE, with the aim of minimising the inappropriate disposal of WEEE. Where it is not feasible to put the label on the actual product it should be included in the documentation accompanying the product.

This Directive therefore deals with many of the end-of-life environmental impacts of electrical and electronic equipment.

A stakeholder consultation on the WEEE Directive took place in 2008, resulting in a proposed revised WEEE Directive that sets a new binding target for the collection of electrical and electronic equipment. The Commission proposes to differentiate the targets by setting mandatory collection targets equal to 65% of the average weight of electrical and electronic equipment placed on the market over the two previous years in each Member State. The recycling and recovery targets of such equipment now include the re-use of whole appliances, and weight-base targets will increase by 5%.[22]

The recast of the WEEE Directive is still in progress. Information regarding the latest status and schedule of this recast can be found on the European Parliaments website:
http://www.europarl.europa.eu/oeil/file.jsp?id=5723502

[20] OJ L 37, 13.2.2003, p. 24–39
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0096:EN:HTML

[21] OJ L 37, 13.2.2003, p. 19–23
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0095:EN:HTML

[22] http://ec.europa.eu/environment/waste/weee/index_en.htm

6.2 Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) 2002/95/EC

The RoHS Directive, in tandem with the WEEE Directive prevents the use of certain hazardous materials in new electrical and electronic equipment (EEE) placed on the market from 1 July 2006 onwards. This will limit the impact of the EEE at the end of its life and it also ensures harmonisation of legislation on the use of hazardous materials in EEE across all Member States.

Electrical and Electronic Equipment must not contain the following substances; lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). There are some exemptions and limit values listed in the Annex to the Directive for some equipment where it is understood that one or more these substances is required for their functioning and no economically viable alternatives exist in sufficient quantity at present. Therefore, some of these substances may still be found in some electrical and electronic equipment.

The Annex has been revised on a number of occasions, altering the list of exclusions and limit values.

The recast of the RoHS Directive is currently in progress. It is proposed that the list of banned substances should apply to all electrical and electronic equipment unless specifically excluded. In addition it is proposed that a number of substances not currently restricted are evaluated further, including halogenated flame retardants and PVC.

Information regarding the latest status and schedule of this recast can be found on the European Parliaments website:
http://www.europarl.europa.eu/oeil/FindByProcnum.do?lang=en&procnum=COD/2008/0240

6.3 The Radio and Telecommunications Terminal Equipment Directive (R&TTE) 1999/5/EC

The R&TTE Directive[23] covers the majority of equipment that uses the radio frequency spectrum and requires the manufacturer to assess their products to ensure they meet the requirements of the Directive. In essence these are to promote and maintain a sustainable, competitive and worldwide market for radio and telecommunications equipment, taking account of safety and consumer protection[24]. This typically includes the following products:

- Radio terminals: GSM[25] handsets.
- Other radio equipment: GSM base stations, car-door openers and other short range radio devices.
- Fixed network terminal equipment: normal analogue telephones, ISDN terminals, cable and PC modems.

This Directive sets out restrictions through Council Recommendation 99/519/EC[26] to limit exposure of the general public to electromagnetic fields generated by radio frequency-using devices such as mobile phones. These aspects are not dealt with in the framework of GPP criteria, as the position was taken that they could best be handled in the framework of the Directive and relevant Recommendations/scientific reports.

The R&TTE Directive does not cover infrastructure equipment; this is covered by the Electromagnetic Compatibility (EMC) Directive 2004/108/EEC[27] (repealing Directive 89/336/EEC[28]) and the Low

[23] OJ L 91, 07.04.1999, P. 10 – 28 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:091:0010:0028:EN:PDF
[24] http://ec.europa.eu/enterprise/rtte/index_en.htm
[25] Global System for Mobile communications (GSM) is a cellular network and is the most popular standard for mobile phones in the world. It is estimated that 82% of the global mobile market uses this standard.
[26] OJ L 199 , 30.07.1999 P. 59 - 70 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:199:0059:0070:EN:PDF
[27] OJ L 390, 31.12.2004, P. 24 - 37

Voltage Directive (LVD) 2006/95/EC[29] (repealing Directive 73/23/EEC[30]). The safety requirements outlined in the General Product Safety Directive (GPSD)[31] apply to products that are not covered by the LVD or other EU Directives

6.4 Directive on Batteries and Accumulators and Waste Batteries 2006/66/EC

The Batteries Directive[32] was adopted on 26 September 2006, repealing the 1991 Battery Directive 91/157/EEC**.**

As with the WEEE/RoHS Directives the aim is to reduce the amount of hazardous materials that end up in the natural environment, the focus being mainly on heavy metals. It achieves this through reducing the amounts of them used in the manufacture of batteries and promoting their recovery instead of disposal, thus minimising the environmental impact at their end-of-life.

Batteries and accumulators must not have a lead, mercury or cadmium content above the fixed threshold limits of 0.004% w/w, 0.0005% w/w and 0.002% w/w respectively unless labelled in accordance with the Directive. Specific labelling requirements are outlined in the directive where these thresholds are exceeded. The Directive also ensures businesses that produce and sell batteries are responsible for collecting and recycling spent batteries, to prevent their disposal / incineration where possible. Collection rates and recycling targets are set out in the Directive.

Member States were required to bring into force laws, regulations and administrative provisions necessary to comply with this Directive by 26th September 2008.

6.5 Directive establishing a framework for the setting of ecodesign requirements for energy-related products 2009/125/EC

The original Directive (2005/32/EC) on the ecodesign of energy using products was adopted in July 2005 and focused on energy using products. This Directive has subsequently been repealed by Directive 2009/125/EC[33], which is a recast and increases the scope from energy using product to energy related products.

It provides clear EU wide rules for ecodesign, aimed at avoiding disparities in regulation amongst individual Member States, which could impede the free movement of products within the internal market.

The Ecodesign Directive does not in itself set binding requirements for specific products, however it does define conditions and criteria for setting, through subsequent implementing measures, minimum requirements regarding environmentally relevant product characteristics and allows them to be improved quickly and efficiently.

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http://eur-lex.europa.eu/LexUriServ/site/en/oj/2004/l_390/l_39020041231en00240037.pdf

[28] OJ L 139 , 23.05.1989 P. 19 - 26 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31989L0336:EN:HTML

[29] OJ L 374, 27.12.2006, P. 10 - 19 http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_374/l_37420061227en00100019.pdf

[30] OJ L 77, 26.3.1973, p. 29–33 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31973L0023:EN:HTML

[31] OJ L 11, 15.1.2002, p. 4–17 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:011:0004:0017:EN:PDF

[32] OJ L 266, 26.9.2006, p. 1–14 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:266:0001:0014:EN:PDF

[33] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

The framework provided by the Directive aims to encourage manufacturers to develop products where they have taken into account the environmental impact of the product throughout its entire life cycle.

Regulations setting binding requirements for specific product groups are gradually been developed, and would only be set for those energy related products which meet certain criteria, for example, key environmental impact and volume of trade across the internal market and only if there is clear potential for improvement of a product. Under the Ecodesign Directive, self-regulation, including voluntary agreements offered as unilateral commitments by the industry can, under certain conditions, be recognised as a valid alternative to implementing measures.

The ecodesign regulation for external power supplies (278/2009[34]) is of particular relevance and includes mobile phone chargers within its scope. This regulation has been used to inform the criteria development.

6.6 REACH Regulation (EC 1907/2006)

The REACH Regulation[35] came into force on 1 June 2007 and deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. It provides an improved and streamlined legislative framework for chemicals in the EU, with the aim of improving protection of human health and the environment and enhancing competitiveness of the chemicals industry in Europe.

REACH places the responsibility for assessing and managing the risks posed by chemicals and providing safety information to users in industry instead of public authorities, promotes competition across the internal market and innovation.

Manufacturers are required to register the details of the properties of their chemical substances on a central database**,** which is run by the European Chemicals Agency in Helsinki. The Regulation also requires the most dangerous chemicals to be progressively replaced as suitable alternatives develop.

6.7 The CLP Regulation (EC) No 1272/2008

The Regulation of 16 December 2008[36] on classification, labelling and packaging of substances and mixtures entered into force on 20 January 2009 and will ultimately replace the current rules on classification, labelling and packaging of substances (Directive 67/548/EEC) and preparations (Directive 1999/45/EC). Substance classification and labelling must all be consistent with the new rules by 1 December 2010 and for mixtures 1 June 2015.

The Regulation aims to ensure a high level of protection of human health and the environment, as well as the free movement of chemical substances, mixtures and certain specific articles, whilst enhancing competitiveness and innovation. This should be achieved by ensuring that the same hazards will be described and labelled in the same way all around the world.

6.8 UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP)

Since 1979 CLRTAP[37] has addressed major environmental issues through scientific collaboration and policy negotiation. The aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution.

The convention has been extended on eight occasions by a number of different protocols.

34 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:093:0003:0010:EN:PDF

35 OJ L 396, 30.12.2006, p. 1–849 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF

36 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF

37 http://www.unece.org/env/lrtap/

Of particular interest in relation to mobile phones is the Protocol on Heavy Metals (1998), which entered into force on 29th December 2003. This protocol targets mercury, cadmium and lead. It introduces measures to reduce emissions of these heavy metals, for example mercury in batteries and management measures for other mercury containing products, such as electrical components.

6.9 Directive on Packaging and Packaging Waste 94/62/EC and the Directive amending Directive 94/62/EC on packaging and packaging waste 2004/12/EC

The EC Packaging Directive[38] seeks to reduce the impact of packaging and packaging waste on the environment by introducing recovery and recycling targets for packaging waste, and by encouraging minimisation and reuse of packaging.[39] A scheme of symbols, currently voluntary, has been prepared through Commission Decision 97/129/EC[40]. These can be used by manufacturers on their packaging so that different materials can be identified to assist end-of-life recycling.

The Packaging Directive (94/62/EC) was amended in 2004 by Directive 2004/12/EC[41]. This amendment included a number a key revisions. These included further clarification regarding the definition of packaging, amendments to the provisions relating to prevention and revised targets for the recovery and recycling of packaging materials.

6.10 European Energy Star Programme and the European Energy Star Regulation (EC No 106/2008)

The European Energy Star Programme was initially formed by an agreement signed between the USA and European Commission in December 2000 for a period of five years. A second agreement for a further five years came into force in December 2006[42], which includes more stringent criteria.

The purpose of the programme is to co-ordinate the voluntary energy efficient labelling programmes of office equipment in Europe and the USA whilst preventing barriers to trade. In this instance office equipment includes computers, copiers, monitors, printers, scanners, fax machines and multifunctional devices. The latest agreement includes criteria for both the standby and use phase and will be developed as technology advances and markets evolve.

The European Energy Star Regulation (106/2008)[43] was published on 15 January 2008. EU Institutions and central Member State Government authorities are required to purchase office equipment, including the specific items listed above, which meet the requirements set out in the Energy Star Programme.

It is important to note that whilst details of the Energy Star Programme and Energy Star Regulation are provided above, they do not currently apply to mobile phones. However it is useful to include this information, as contracting authorities should already be taking into account energy efficiency when purchasing certain items of office equipment.

Whilst the European Energy Star Regulation does not currently apply to mobile phones and their chargers, the US Energy Star does include criteria in relation to chargers, which includes mobile

[38] OJ L 365, 31.12.1994, p. 10–23 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML

[39] http://www.defra.gov.uk/environment/waste/topics/packaging/index.htm

[40] OJ L 050, 20.02.1997 P. 28 – 31 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997D0129:EN:HTML

[41] OJ L 47, 18.2.2004, p. 26–32 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:047:0026:0031:EN:PDF

[42] OJ L 381 of 28.12.2006, p. 26 http://ec.europa.eu/energy/demand/legislation/doc/l_38120061228en00260104.pdf

[43] OJ L 39, 13.2.2008, p. 1–7 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:039:0001:0007:EN:PDF

phone chargers. The standards outlined in the US Energy Star for single voltage external Ac-Dc and Ac-Ac power supplies are discussed in more detail in Section 7.

7 Existing Standards & Ecolabels Relevant to Mobile Phones

There are a number of existing standards for both mobile phones and chargers already in existence. Although there is no EU Ecolabel for mobile phones, a number of national Type 1 Ecolabel criteria[44] for mobile phones do exist, namely TCO and Blue Angel. A number of standards have also been developed for chargers, the key ones being Energy Star and EU Code of Conduct. An outline of these different standards is provided below.

7.1 Mobile Phone Standards

There are two main sets of Ecolabel criteria currently available for mobile phones, the TCO and Blue Angel.

The Swedish mobile phone standard 'TCO'01 Mobile Phones'[45] was originally launched in 2001 and was subsequently revised in 2006 to reflect the requirements of the WEEE and RoHS Directives. Version 2 of the TCO standard, published in 2006. The focus of this standard is on emitted radiation, but other environmental aspects are also covered. In addition ergonomics are also addressed.

The current version of the Blue Angel[46] criteria (RAL-UZ 106) was published in May 2008 and covers health and environmental aspects of mobile phones.

Both of the ecolabels introduced above include limits for emitted radiation and standards for hazardous materials, which is highlighted above as a key impact from mobile phones. However, they don't cover energy consumption, (the other important life cycle impact) however this is addressed by the external power supply criteria, which is discussed in more detail in Section 7.2.

In addition to the above ecolabel standards, the IEC are also developing standards as part of TC 111 Environmental standardisation for electrical and electronic products and systems[47]. To date some initial documents have been published recently, for example, in relation to the determination of regulated substances and sampling procedures. Other work by TC 111 is ongoing and relates for example to end of life recyclability calculations for electro technical equipment. These may be useful in the future for verification or devising revised criteria as they are published and start to be used by industry or adopted by different countries. The standards developed by IEC are voluntary and countries are free to adopt them if they wish.

7.1.1 Emitted Radiation

As highlighted above, there is significant research into emitted radiation from mobile phones due to the uncertainties surrounding impacts on human health. Both the TCO'01 and Blue Angel standard set limits for emitted radiation from mobile phones.

Although SAR limits are included in the ecolabels, they have not been included in the GPP criteria, which are focusing on purely environmental impacts and are not designed to include specific health related aspects, which are dealt with in the relevant legal framework (in particular, RTT&E Directive 1999/5/EC and Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), 1999/519/EC).

[44] Type 1 Ecolabel criteria are independently verified and set in accordance with ISO14024

[45] http://www.tcodevelopment.com/tcodevelopment1200/Mobiler/TCO01_Mobile_Phones/TCO_01_version_2_0_rev_A.pdf

[46] http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-106.pdf

[47] http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_LANG_ID,FSP_ORG_ID:25,1314

7.1.2 Environmental Aspects (Hazardous Components)

The ecology criteria set in the TCO standard are set at a basic level. Firstly the manufacturing company must have an environmental management system in accordance with either ISO14001 or EMAS to demonstrate a commitment continuing environmental improvement. The Blue Angel does not include this requirement.

The environmental aspects of the materials and components used in mobile phones are key to the standards outlined in both the TCO and Blue Angel Ecolabels.

The TCO states that the mobile phone (and peripheral equipment) shall not contain mercury, cadmium and hexavalent chromium and lead (subject to limit values). The Blue Angel also limits the use of these, with the exception of hexavalent chromium, although the use of this is naturally already restricted through the RoHS Directive.

In addition the TCO Ecolabel states that plastic components that weigh more than 10g shall not contain flame retarding agents, in particular those containing organically bound chlorine or bromine. This includes PBB (polybrominated biphenyls) and PBDE (polybrominated diphenyl ethers). Again the Blue Angel also includes this requirement.

Brominated and chlorinated plastics are also prohibited from plastic components that weigh more than 10g; this includes the use of PVC. Both the TCO and Blue Angel include this requirement. The Blue Angel also requires that any product packaging does not contain any halogen-containing polymers

Finally both ecolabels state that mobile phones shall not contain beryllium oxide (BeO).

Section 4 of this report identified end of life management of mobile phones as key to the overall environmental impact of mobile phones. Limited consideration of this is given in the TCO standard by setting criteria that require plastic to be labelled as recyclable. The Blue Angel goes further than this and requires product take back and mobile phones that are designed so that they can be easily dismantled for recycling purposes at the end of their life. This aspect is covered EU-wide by the WEEE Directive though the setting up of collection systems and take-back schemes to ensure WEEE is separately collected to ensure it can be treated and recovered appropriately.

The TCO standard includes a set of criteria relating to ergonomics, which includes ease of use, material characteristics in casing and keypad, visual ergonomics, availability of accessories and instruction manual. The Blue Angel does not include ergonomics in as much detail, however it does also require clear consumer information (instructions) to be provided, which shall include amongst other information details on SAR values, product take back schemes and how to limit power consumption of chargers when not in use.

A summary of the requirements for the TCO and Blue Angel ecolabel standards is provided in Table 1 below.

Table 1: Summary of existing criteria for the TCO and Blue Angel Mobile Phone Ecolabels:

Radiation Emissions – SAR	Y	Y
Radiation Emissions – TCP	Y	N
Ergonomics (ease of use, visual, materials)	Y	N
EMS required (EMAS or ISO14001)	Y	N
Hg / Cd / Cr VI / Pb prohibited (subject to limit values)	Y	Y (But not Cr VI)
Use of flame retardants limited	Y	Y
Brominated & chlorinated plastics prohibited in plastic components that weigh more than 10g	Y	Y
Beryllium oxide prohibited	Y	Y
Preparation for Recycling – labelling plastics	Y	Y
Product Take Back	N	Y
Recyclable Design	N	Y
Packaging – No halogen containing polymers	N	Y

Clear Consumer Info/Instructions	Y	Y
Accessories	Y	Y

7.2 Mobile Phone Charger Standards

As identified above the energy consumption from chargers is a significant element of the environmental impact of the use phase of mobile phones. A charger is usually included with a mobile phone when the manufacturer supplies it.

Mobile phone chargers normally do not have an on/off switch and if left plugged in have two operating modes. These are defined by the EC Working document[48] on possible ecodesign requirements for external power supplies as

- active/load mode when the mobile phone is attached to the charger
- the no-load mode when the charger is left plugged in without the mobile phone attached

The amount of time the charger spends in these different modes will to some extent be influenced by the behaviour of the end user.

A number of standards exist for chargers; the key ones are US Energy Star and the EU Code of Conduct on Energy Efficiency of External Power Supplies. In addition there is the Regulation regarding ecodesign requirements for external power supplies (278/2009), which are largely based upon the US Energy Star requirements. There are currently no other eco-label standards specific to mobile phone chargers.

The Energy Star, EU Code of Practice and subsequent Ecodesign Regulation are the main standards that cover mobile phone chargers, however other standards have also been developed, for example Nordic Swan have ecolabel criteria for battery chargers[49] but this is not relevant for mobile phone external power supplies.

The Energy Star is a program run jointly by the US Environmental Protection Agency and US Department of Energy. It is a voluntary code that promotes energy efficiency in products by the setting of stringent standards against appropriate parameters. The range of products covered is extensive and full details are available from http://www.energystar.gov/index.cfm?c=home.index

An Energy Star standard for External Power Supplies (Version 2) is now available[50]. This covers a range of products, including chargers for mobile phones. The key product criteria are reproduced in Appendix 2. In summary the no-load power consumption should not exceed 0.5W or 0.3W for a power supply depending on its rated output and type. In the active mode standard power supply models with a power output of > 1 to ≤ 49 watts shall have a minimum average efficiency of ≥ [0.0626 * Ln (P_{no})] + 0.622. Slightly different criteria are included for low voltage models, full details are provided in Appendix 2.

The US Energy Star also has links in the EU via the EU-US Energy Star Programme[51] and the recent Regulation 2008/106, which are described in Section 6 above. This is currently limited to energy efficient office equipment, which includes computers, monitors, copiers, printers, scanners, faxes and multifunctional devices however[52], it does not currently include mobile phones.

The EU Code of Conduct on Energy efficiency of External Power Supplies is aimed at single voltage external ac-dc and ac-ac power supplies for electronic and electrical appliances. This includes mobile phone chargers. This is a voluntary code, separate to the US Energy Star and the Ecodesign Directive. It has been developed as part of the EU Stand-by initiative[53], which is aimed at improving the energy efficiency of electrical equipment while either off or in stand-by.

48 http://ec.europa.eu/energy/demand/legislation/doc/2008_02_22_working_document_external_power_supplies.pdf
49 http://www.svanen.nu/Default.aspx?tabName=CriteriaDetailEng&menuItemID=7056&pgr=30
50 http://www.energystar.gov/index.cfm?c=ext_power_supplies.power_supplies_consumers
51 http://www.eu-energystar.org/en/index.html
52 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:039:0001:0007:EN:PDF
53 http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm

Version 2 of the EU Code of Conduct[54] is available on the internet and was valid until 31 December 2008. It was superseded by Version 3, which is also available from the same website, and came into effect on 1st January 2009.

The requirements outlined in Version 3 of the Code of Conduct were largely based on the draft requirements for the US Energy Star criteria (Version 2). Version 2 of the US Energy Star criteria have now been finalised and differ slightly from the draft requirements. Therefore Version 3 of the Code of Conduct is not consistent with the current US Energy Star criteria. Version 4 of the Code is now available; however the standards are the same as those in Version 3, with minor corrections to bring it in line with the finalised Energy Star requirements.

The Code of Conduct also includes specific limits for external power supplies up to 8 W for mobile handheld battery driven applications, which includes mobile phone chargers. Nokia proposed this variation from the draft Energy Star V2.0 standards at the working group for the preparation of Version 3 of the EU Code of Practice. They proposed to have more stringent levels for no-load and less stringent levels for the active mode efficiency for external power supplies up to 8 W for mobile handheld battery driven applications.

For external power supplies up to 8 W for mobile handheld battery driven applications the EU Code of Conduct specifies that no-load power consumption shall not exceed 0.25 W from 1st January 2009 and 0.15 W from 1st January 2011.

In terms of GPP criteria development the existing standards i.e. US Energy Star and EU Code of Conduct can be used to set relevant benchmarks for active efficiency and no load power consumption.

It is proposed to incorporate the current Energy Star (Version 2) and Ecodesign Regulation requirements for the average active efficiency of the charger.

The Ecodesign Regulation requirements will become the standard requirement for products on the market two years after the Ecodesign regulation for these measures comes into force. The GPP criteria will need to be reviewed as the market responds to the Ecodesign Regulation.

No load power consumption is a key impact and as discussed above will be affected by the behaviour of the end users, for example unplugging the charger when it is not in use. It is proposed to use the limits specified in the Code of Conduct for the GPP criteria relating to the no load power consumption for external power supplies up to 8 W for mobile handheld battery driven applications. The limits are as follows:

- For external power supplies up to 8 W for mobile handheld battery driven applications the no-load power consumption shall not exceed 0.25 W from 1st January 2009 and 0.15 W from 1st January 2011. It is proposed to use these values in the core and comprehensive criteria respectively.

These go beyond the Energy Star and Ecodesign Regulation requirements, however it is felt that these will be achievable as they were proposed by industry and agreed by the working group for the development of Version 3 of the Code of Conduct. The Energy Star and Ecodesign requirements set no load criteria at 0.50 Watt and 0.3 Watt for standard and low voltage external power supplies respectively.

A full list of mobile phone manufacturers signed up to the EU Code of Conduct is available on the Internet[55].

In summary, the draft criteria relating to chargers were developed using the Energy Star, which also formed the basis of the ecodesign regulation for external power supplies. The Regulation regarding implementing measures for power supplies differs in some minor aspects, for example the rated output power divisions for the active efficiency. The GPP criteria will be updated to reflect this, to ensure it is consistent with the European legislation.

[54] Version 2 is valid until 31/12/08, Version 3 is valid from 01/01/09, both are available from the following website: http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_External%20Power%20Supplies.htm

[55] http://re.jrc.ec.europa.eu/energyefficiency/html/s_b-ParticipantsCoC.htm

The no load power requirements outlined in the GPP criteria go beyond the ecodesign regulation for external power supplies and are based on levels agreed as part of the EU Code of Conduct on Energy Efficiency for External Power Supplies. Version 4 of the EU Code of Conduct is now available (http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_External%20Power%20Supplies.htm); however the standards used in the GPP criteria from this have not changed.

7.3 Other Standards and Research

The IPP Pilot Project final report on mobile phones resulted in a number of initiatives for key areas that were identified as a result of the research undertaken. These are summarised as follows:

- Information and Communication
  - Product Environmental Facts and Communications
  - Usage and Disposal Information & Communication
- Reduce Energy Consumption (in use phase)
- Reduce/Eliminate Agreed materials of Concern
- Take back of phones
- Environmental Assessment Methods/Tools

It is clear from the initiatives identified above that the GPP criteria developed using the ecolabels and the EU Code of Conduct on Energy Efficiency of External Power Supplies outlined in Section 7.1 and 7.2 focus on the same key areas.

Any future revisions of the GPP criteria should consider developments that result from these initiatives. This may include the development of new standards and voluntary agreements resulting from technological improvements.

Following a request from the European Commission, major producers[56] of mobile phones have agreed in a Memorandum of Understanding[57], which was submitted to the Commission, to harmonize chargers for data-enabled mobile phones sold in the EU. The industry commits to provide chargers compatibility on the basis of the Micro-USB connector. The first generation of new inter-chargeable mobile phones should reach the EU market from 2010 onwards.

It is also noted that a number of manufacturers are committed to a voluntary agreement to include reminders in their phones to reduce no load power draw from chargers, by unplugging them http://ec.europa.eu/environment/ipp/pdf/ipp_voluntary_agree_summary.pdf

This may include text message alerts and on screen messages. However, it is unclear how the development of this type of feature has progressed and its availability. It is therefore felt that including GPP requirements in relation to this at the present time is not appropriate.

In future revisions of the GPP specifications this is an area that will need to be considered further taking into account developments that are currently underway.

Further developments in the mobile phone industry include a voluntary star rating for chargers. It is important that procurement officials are aware of this standard as where it is used it will provide important information and may assist with the verification process.

In addition to the standards and research already identified as directly relevant to mobile phones, there are other applicable standards that are indirectly applicable to mobile phones and the packaging used.

[56] *The following 13 companies have signed the MoU: Apple, Emblaze Mobile, Huawei Technologies, LGE, Motorola, NEC, Nokia, Qualcomm, Research in Motion (RIM), Samsung, SonyEricsson, TCT Mobile (ALCATEL mobile phones), Texas Instruments*

[57] http://ec.europa.eu/enterprise/newsroom/cf/document.cfm?action=display&doc_id=5274&userservice_id=1&request.id=0

In particular ISO 14021:2001[58] is applicable for environmental declarations made by manufacturers and suppliers in relation to a number of environmental parameters. In the GPP criteria it is proposed to use this standard in relation to the recycled content of mobile phones.

ISO 14021:2001 defines recycled content as follows:

- The proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content, consistent with the following usage of terms.

    - Pre-consumer material: Material diverted from the waste stream during a manufacturing process. Excluded is reutilisation of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

    - Post-consumer material: Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

The benefit of using ISO 14021:2001 is that it provides a standard definition for recycled content and it also considers and addresses issues when declaring the recycled content of products and packaging. Tests or methods to determine the recycled content of final products and packaging are difficult or limited[59]. Therefore this ISO standard considers the amount of recycled material fed into the manufacturing process. The use of this standard will ensure verification of the relevant criteria is undertaken in a consistent manner. However alternative means of compliance with the stated requirements should be accepted.

A further point highlighted during the finalisation of the criteria relates to the concept of Software Induced Hardware Obsolescence. This issue is not covered by the TCO label or highlighted in other sources used to research the GPP criteria for mobile phones. It was only highlighted late in the criteria development process, and has therefore not been able to be fully researched and assessed in order to develop criteria at this stage. It is an interesting point that should be investigated further when the criteria are next updated. Careful consultation with industry will be required to ensure an informed and appropriate requirement is developed, together with the relevant verification.

[58] ISO 14021:2001 Environmental labels and declarations. Self-declared environmental claims (Type II environmental labelling)

[59] http://www.ecodesign-company.com/documents/BestPracticeISO14021.pdf

8 Conclusions and Summary

During the life cycle of a mobile phone and its charger energy consumption is the key environmental impact, especially in the mobile phone manufacture and use phases. In addition the use of various materials can pose a potential risk to the environment and the focus on recycling in the end of life phase is also key to reducing the environmental impact of mobile phones. Extending the lifetime of the product will naturally reduce resource consumption and disposal burdens. Health concerns also focus highly in life cycle and associated studies, for example emitted radiation, however this is outside the scope of the GPP criteria, which focus on environmental issues only.

Therefore the core criteria focus on energy use in the mobile phone and charger system, and materials. The comprehensive criteria include further aspects of materials, ecodesign and extending product lifetimes.

For mobile phone chargers the EU Code of Conduct has been used as the basis for the core and comprehensive criteria for no load power consumption of mobile phone chargers. The no-load power consumption of mobile phone chargers is a key element of the overall life cycle impact of a mobile phone; therefore it is important that the GPP specification criteria ensure this is limited as far as reasonably possible. It is deemed appropriate to use Version 4 of the EU Code of Conduct as these set limits, which go beyond the current US Energy Star and the Ecodesign requirements for external power supplies.

The core and comprehensive criteria for the average active efficiency of mobile phone charges are based on the current US Energy Star requirements, which have also been used as the basis for the Ecodesign implementing measure.

The GPP criteria also support the outcomes of the IPP study, as highlighted in Section 7.3 above.

In addition to the core and comprehensive criteria, award criteria are proposed where applicable. Award criteria are not pass/fall criteria, meaning that offers of products that don't comply with the criteria may still be withheld for the final decision, depending on their score on the other award criteria, including the price. To stimulate further market uptake of ever improved environmental products, award criteria should be considered depending on the specific circumstances of each case.

9 Proposal for core and comprehensive criteria

It is proposed to set core and comprehensive criteria for both mobile phones and mobile phone chargers. The contracting authority should consider both sets of criteria together as mobile phones are usually supplied with a charger as part of the product bundle.

The proposed GPP criteria are designed to reflect the key environmental risks. This approach is summarised in the following table:

Key Environmental Impacts	GPP Approach
• Energy consumption, especially in manufacturing and from mobile phone chargers in the use phase • Pollution of air, land and water due to the use of hazardous materials in the manufacture and end of life stages e.g. flame retardants and components • Use / extraction of raw materials • Production of hazardous waste • Generation of waste material, including hazardous wastes and packaging and its disposal.	• Purchase energy efficient chargers • Communicate key issues to end users e.g. unplugging chargers / take back schemes • Purchase models that restrict the use of hazardous materials • Promote effective end of life management e.g. take back schemes / re-use / recycling • Purchase products designed to be easily dismantled and recycled. • Provision of replacement components / accessories to extend the life of the mobile phone • Promote use of recycled/recyclable/reusable materials in mobile phones

Please note that the order of impacts does not necessarily translate to the order of their importance.

A comparison of the two main ecolabels for mobile phones, the Blue Angel and TCO highlight a number of key similarities that focus on the main environmental impacts identified in Section 4. These include the use of certain materials, and end of life management issues.

The use of or restriction of certain materials is key in order to reduce environmental impact. Criteria in relation to these are included due to the potential environmental impact discussed in Section 4.

Specific areas that are already covered by legislation e.g. WEEE and RoHS Directives are not included in the GPP criteria. However it should be noted by contracting authorities that a press release, dated 3rd December 2008 [60] regarding the revisions to the WEEE and RoHS Directives which highlights that '*many electrical and electronic products not complying with the substance restrictions have been found in the EU'* and that '*only about a third of electrical and electronic waste is reported to be treated in line with these laws and the other two thirds is going to landfill and potentially to sub-standard treatment sites in or outside the European Union'*.

Communication to end users is also important, especially in relation to behavioural issues, for example in relation to unplugging mobile phone charges and end of life management, for example highlighting take back schemes and promoting the reuse and recovery of mobile phones instead of disposal.

In addition, a number of other criteria have been included. These are aimed at extending the working life of mobile phones where possible, by considering for example the availability of spare components. Award criteria have also been included that reflect recent developments in the market, for example the

[60] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1878&format=HTML&aged=0&language=EN&guiLanguage=en

use of recycled materials in mobile phone manufacture. It is felt that the award criteria is the most suitable in this case, until availability of mobile phones with these properties is more widely available.

As already highlighted, the initiatives identified by the IPP Pilot Project link to the GPP criteria developed for mobile phones. In particular the criteria cover key areas including energy consumption, take back schemes, provision of information and materials used, which is consistent with the IPP Study outcomes.

The criteria for mobile phone charges are based on the EU Code of Conduct (Version 3) and the US Energy Star (Version 2), the latter of which has also been used as the basis for the draft Ecodesign implementing measures for external power supplies. Energy consumption is identified in Section 4.2 as the key impact from mobile phone charger use and it is therefore the reason why the core and comprehensive criteria focus on this element.

The EU Code of Conduct has been used as the basis for the core and comprehensive criteria for no load power consumption of mobile phone chargers. The no-load power consumption of mobile phone chargers is a key element of the overall life cycle impact of a mobile phone, therefore it is important that the GPP specification criteria ensure this is limited as far as reasonably possible. It is deemed appropriate to use Version 4 of the EU Code of Conduct as these set limits, which go beyond the current US Energy Star and Ecodesign requirements for external power supplies.

The core and comprehensive criteria for the average active efficiency of mobile phone charges are based on the current US Energy Star requirements, which have also been used as the basis for the Ecodesign Regulation.

In the future as technology develops and these standards are revised, the GPP criteria will need to be reviewed and updated accordingly.

Currently there does not appear to be any non-energy environmental criteria for mobile phone chargers. However, the EuP preparatory report for battery chargers and external power supplies does include a number of recommendations in addition to energy efficiency measures. These are identified in Section 4.3 of this report and in general are aimed a reducing the materials used in mobile phone chargers. This will reduce the environmental impact at various stages throughout the chargers life cycle. For example by reducing the size of the PWB, there will be a reduced impact in number of life cycle stages, including, materials extraction and production, manufacturing and end of life management.

It is important that these aspects are, where possible considered by the contracting authority when inviting tender applications. However, because they are not addressing the most significant environmental impact posed by mobile phone chargers, it is appropriate to only include them as award criteria.

Full details of the proposed purchasing criteria are provided in the associated Product Sheet for this product group.

10 Relevant EU legislation and information Sources

10.1 European Legislation

- Directive on Waste Electrical an Electronic Equipment 2002/96/EC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0096:EN:HTML

- Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment 2002/95/EC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0095:EN:HTML

- Directive on Batteries and Accumulators and Waste Batteries 2006/66/EC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:266:0001:0014:EN:PDF http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:191:0029:0058:EN:PDF

- Directive establishing a framework for the setting of Ecodesign Requirements for Energy-related Products 2009/125/EC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

- The Radio and Telecommunications Terminal Equipment Directive (R&TTE) 1999/5/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:091:0010:0028:EN:PDF

- The Packaging Directive 94/62/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML

- Directive amending Directive 94/62/EC on packaging and packaging waste 2004/12/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:047:0026:0031:EN:PDF

- Commission Decision (97/129/EC) of 28 January 1997 establishing the identification system for packaging materials pursuant to European Parliament and Council Directive 94/62/EC on packaging and packaging waste http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997D0129:EN:HTML

- Regulation (EC 1907/2006) concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF

- The CLP Regulation (EC) No 1272/2008. The Regulation of 16 December 2008 on classification, labelling and packaging of substances and mixtures http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF

- Regulation (EC 106/2008) on a Community energy-efficiency labelling programme for office equipment http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:039:0001:0007:EN:PDF

- Regulation (278/2009) with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:093:0003:0010:EN:PDF

- Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programs for office equipment: http://ec.europa.eu/energy/demand/legislation/doc/l_38120061228en00260104.pdf

- UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) http://www.unece.org/env/lrtap/

10.2 Ecolabels and Standards

- TCO '01 – Mobile Phones: http://www.tcodevelopment.com/
- Blue Angel – Mobile Phones RAL-UZ 106: http://www.blauer-engel.de/englisch/vergabe/download_uz_e/e-UZ-106.pdf
- EU Code of Conduct on Energy Efficiency of External Power Supplies: http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_External%20Power%20Supplies.htm
- Energy Star External Power Adaptors: http://www.energystar.gov/index.cfm?c=ext_power_supplies.power_supplies_consumers
- Nordic Swan – Rechargeable batteries and battery chargers http://www.svanen.nu/Default.aspx?tabName=CriteriaDetailEng&menuItemID=7056&pgr=30

10.3 Studies and Other Sources of Information

- European Commission's GPP Training Toolkit: http://www.ec.europa.eu/environment/gpp
- News Releases relating to mobile phone use and upgrade frequency: http://www.reghardware.co.uk/2008/03/04/gartner_mobile_phone_sales_report/

  http://www.telephia.com/documents/EuroDeviceReplacementReleaseQ1065.8.06FINAL.pdf
- Fonebak: http://www.fonebak.com/LearnRecycling.aspx
- Working document on possible ecodesign requirements for external power supplies http://ec.europa.eu/energy/demand/legislation/doc/2008_02_22_working_document_external_power_supplies.pdf
- Nokia (2005) Integrated Product Policy Pilot Project: Stage I Final Report: Life Cycle Environmental Issues of Mobile Phones http://ec.europa.eu/environment/ipp/pdf/nokia_mobile_05_04.pdf
- Bio Intelligence Service (2007) Preparatory Studies for Ecodesign Requirements of EuPs – Lot 7 battery chargers and external power supplies http://www.ecocharger.org/docs/BIOconsortium_EuP_Lot_7_Final_Report.pdf
- Greenpeace (2008) Guide to Greener Electronics, Version 7, March 2008 http://www.greenpeace.org/raw/content/international/press/reports/guide-to-greener-elect-7.pdf
- National Radiological Protection Board (2004) Mobile Phones and Health 2004 – Report by the Board of NRPB http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947333240
- Scientific Committee on Emerging and Newly Identified Health Risks (2007). Possible effects of Electromagnetic Fields (EMF) on Human Health

http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf

- Mobile Telecommunications and Health Research Programme Management Committee (2007) Mobile Telecommunications and Health Research Programme – Report 2007 http://www.mthr.org.uk/documents/MTHR_report_2007.pdf

- Polyvinyl Chloride (PVC) http://ec.europa.eu/environment/waste/pvc/index.htm

- Singhal et al (2004) Key Environmental Performance Indicators (KEPIs): A new approach to environmental assessment. Paper presented at the Electronics Goes Green 2004+, Berlin.

- Mclaran, J., and Piukkula, N. (2004). Life Cycle Assessment of a 3rd Generation Nokia Handset. Paper presented at the Electronics Goes Green 2004+, Berlin.

- Wright, L. (1999). Product Life Cycle Analysis Management, EngD Thesis. University of Surrey, Guildford, UK.

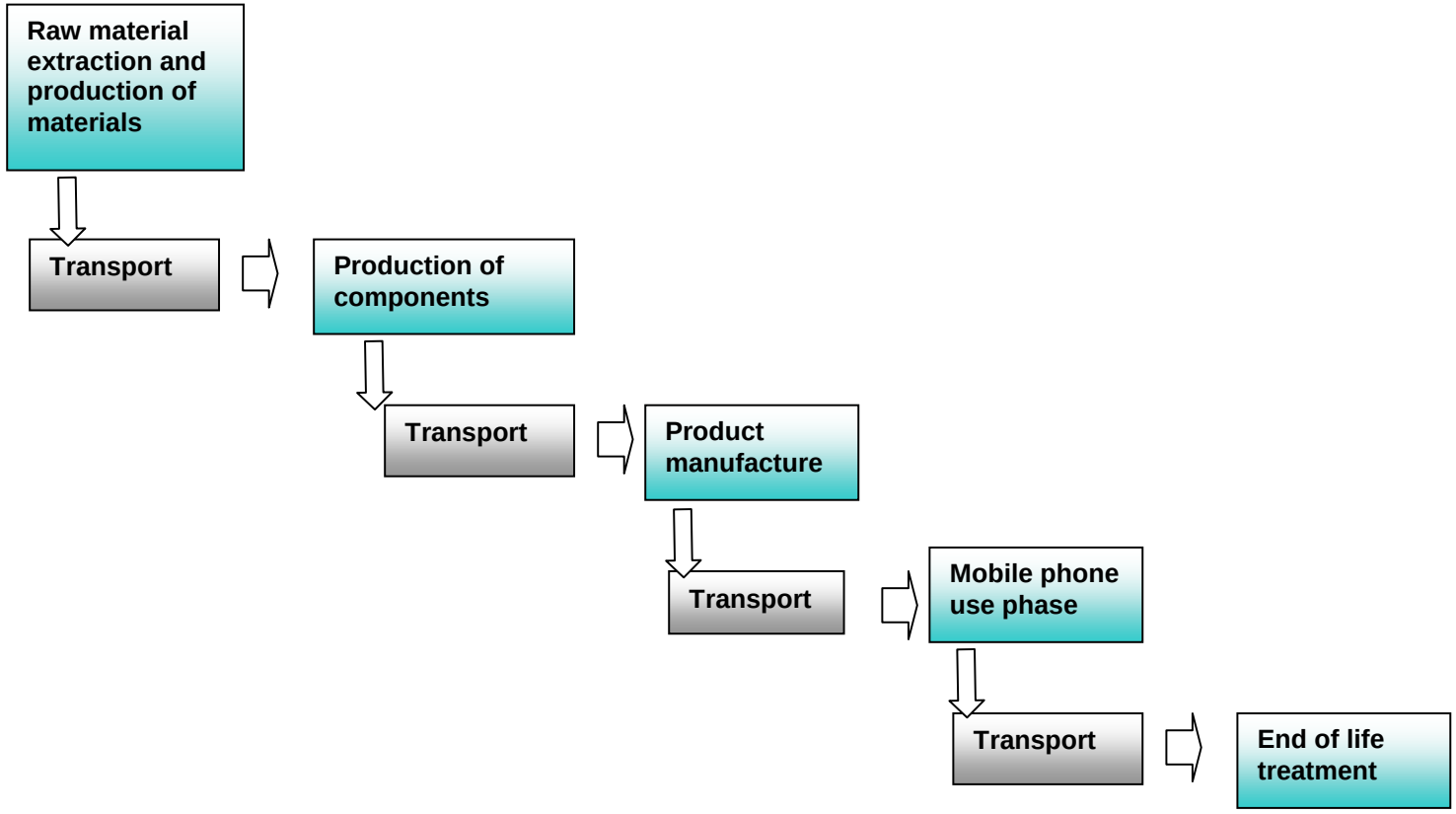
Appendices

Appendix 1: Life cycle phases for a mobile phone

Appendix 2: Energy Star: External Power Adaptors Key Product Criteria

Appendix 1 – Life cycle phases for a mobile phone

Figure A1: Illustration of life cycle phases for a mobile phone



Appendix 2

Energy Star: External Power Adaptors Key Product Criteria

Qualifying External Power Adapters must meet both Active and No-Load mode requirements below.

Criteria for Active Mode – Standard Models

Nameplate Output Power (P_{no})	**Minimum Average Efficiency in Active Mode (expressed as a decimal)**
0 to ≤ 1.0 watt	≥ 0.480 * Pno + 0.410
>1 to ≤ 49 watts	≥ [0.063 * Ln (Pno)] + 0.622
> 49 watts	≥ 0.870

Criteria for Active Mode – Low Voltage Models

Nameplate Output Power (P_{no})	**Minimum Average Efficiency in Active Mode (expressed as a decimal)**
0 to ≤ 1.0 watt	≥ 0.497 * Pno + 0.067
>1 to ≤ 49 watts	≥ [0.075 * Ln (Pno)] + 0.561
> 49 watts	≥ 0.860

Criteria for No-Load Mode

Nameplate Output Power (P_{no})	**Maximum Power in No-Load**	
	Ac-Ac EPS	Ac-Dc EPS
0 to < 50 watts	≤ 0.5 watts	≤ 0.3 watts
≥ 50 to ≤ 250 watts	≤ 0.5 watts	≤ 0.5 watts