

Integrated Product Policy Pilot on Mobile Phones

Stage III Final Report:

Evaluation of Options to Improve the Life-Cycle Environmental Performance of Mobile Phones



NOKIA

Espoo, Finland, April 2006

With contributions from:

**AMD, BEUC, DEFRA, Epson, France Telecom / Orange, Intel, Motorola,
Panasonic, SYKE, TeliaSonera, Umicore, Vodafone and WWF**

This IPP Pilot Project was initiated & facilitated by the European Commission.

Pranshu Singhal

Project Manager, IPP

NOKIA CORPORATION

P.O.Box 407, FI-00045 NOKIA GROUP, Finland

Fax: +358 (0)7180 37128

Email: pranshu.singhal@nokia.com

© Copyright Nokia Corporation 2006

Disclaimer: The views expressed in this document reflect the discussion among the pilot project participants. The report must not be regarded as stating an official position of the European Commission services or any of the participating organisations separately.

Acknowledgements

This report was written and edited by Pranshu Singhal (Nokia) except for the chapter 6 on policy tools which was co-edited with Sean Krepp (Nokia). The report was written in discussions with Kirsi Sormunen (Nokia), Tapio Takalo (Nokia), Olli-Pekka Mäkirintala (Nokia), Markus Terho (Nokia), Outi Mikkonen (Nokia) and Salla Ahonen (Nokia). Several other Nokia colleagues had advised on the issues discussed in the report.

The participants in the Stakeholder Group of the Nokia IPP pilot had contributed to the various analyses of improvement options in this report and the report had significantly benefited from the advice of the group members:

- Ms. Orsolya Csorba (DG Environment, European Commission), Mr. Bengt Davidsson (DG Environment, European Commission), Mr. Marc-Andree Wolf and Dr. David Pennington (DG Joint Research Centre, European Commission)
- Mr. Saul Jamieson and Mr. Gareth Rice (Panasonic)
- Mr. Markus Stutz (formerly with Motorola) and Mr. Siegfried Pongratz (Motorola)
- Mr. Matti Tommiska (formerly with AMD) and Ms. Silke Hermanns (AMD)
- Mr. Julian Lageard (Intel)
- Ms. Anne Marij van der Meulen and Mr. Eelco Smit (Epson)
- Ms. Elisabeth Beche and Ms. Zubaria Lone (France Telecom / Orange)
- Mr. Kari Vaihia (TeliaSonera)
- Ms. Lucy Connell and Mr. Ramana James (Vodafone)
- Mr. Christian Hagelueken (Umicore)
- Mr. Bob Ryder (DEFRA)
- Mr. Jyri Seppala (Finnish Environmental Institute - SYKE)
- Mr. Matthew Wilkinson (WWF) and Mr. Jonathan Quigley (formerly with WWF)
- Ms. Vivian Mikalsen (BEUC).

Executive Summary

Introduction

The Integrated Product Policy (IPP) pilot project of Nokia was initiated as a part of European Commission's (EC) effort to work together with stakeholders to further develop the IPP approach. The objective of the EC's IPP approach is to “reduce the environmental impacts from products throughout their life-cycle, harnessing, where possible, a market-driven approach, within which competitiveness concerns are integrated”. This pilot project on mobile phones is being carried in five stages. Presently the pilot is in the stage IV. This report was developed in stage III of this pilot.

Stage I

In stage I, environmental issues in all the life-cycle phases of mobile phones were identified and evaluated. The use phase and components manufacture phase were identified as the biggest contributors to the life-cycle environmental impacts, and energy consumption was identified as the most significant environmental aspect. The most important life-cycle environmental issues as identified in stage I¹ report include energy consumption in the components manufacturing phase, no-load power consumption of the charger in the use phase, presence of some materials of concern in the mobile phones², collection of unwanted mobile phones and their recycling. From the perspective of a mobile system³, the energy consumption of radio base stations during the use phase was identified as most significant. The lack of appropriate methods for carrying environmental assessments to assist companies in practical eco-design work was also identified.

As the IPP pilot project was planned to be completed in a year's time, the scope of the project was narrowed down to address selected most significant aspects of the mobile phones after the stage I. Three focus areas were selected for further work: Energy consumption during the life-cycle of mobile phones; Material related environmental issues in the life-cycle, and Methods/Tools for assessing life-cycle environmental performance/impacts. The pilot comprehensively covers the life-cycle environmental issues and improvements for the mobile phones but for the network infrastructure, only improvement options for reducing the impacts from energy consumption in use phase are identified and analysed.

Stage II

In this stage⁴ numerous improvement options were identified under eight themes in discussion with the participating stakeholders that can lead to improvements in the environmental performance in various life-cycle phases of mobile phones especially in the focus areas. These solutions encompass all technological, behavioural and policy solutions and require actions by several stakeholders in various life-cycle phases.

¹ See Nokia's stage I final report at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

² These materials do not present any environmental or human health hazard when the phone is in use but they might be released into the environment from landfills, incinerators or recycling facilities if the end-of-life processes are not managed properly.

³ The mobile system consists of mobile phones, a radio network with radio base stations and radio network control equipment, and a core network with switches, routers, servers and workstations.

⁴ See stage II final report at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_st_II_final_report.pdf

Stage III

In this stage, all the improvement options identified by the stakeholders in stage II were analysed and then screened/classified to identify those that can be further analysed and worked upon. The options are analysed for economic, environmental and social impacts, feasibility, geographic reach of improvements, time required for implementation and the related ongoing initiatives in the sector⁵. The participating stakeholders have analysed the improvement options relevant for them based on their expertise, experiences and judgements.

The improvement options are classified as Qualified, Ongoing and Disqualified, on the basis of the brief analysis. In all 50 different options were analysed. Of these, 21 are classified as qualified, 24 as ongoing and 5 as disqualified. The options have also been assigned an environmental priority status - High, Medium and Low - based on their anticipated life-cycle environmental benefits.

Qualified: Options estimated to be (most likely) feasible and which will yield environmental benefits in an economically efficient way and without having adverse social impacts. However, most of these options need further in-depth analysis before they can be implemented.

Ongoing: Options for which similar/related activities are already ongoing. These options are ongoing either as a part of normal business activities at least for some companies/organisations or there are, for e.g., voluntary project groups working on them.

Disqualified: Options that cannot be implemented as of now, according to the stakeholders, who carried out the analysis. These options are either not feasible yet or they have insignificant/unknown environmental benefits or adverse social impacts. The options may become feasible to implement in the future, as more information and better solutions become available.

The following table lists down the results of the brief analysis of all improvement options identified in stage II.

| Improvement Themes | Improvement Options | Focus Area | Environmental Priority | Classification |
|-------------------------------|---|------------|------------------------|---------------------|
| Improvements in Mobile Phones | Equip the phones/chargers with sound or visual reminders that go on if the chargers are left connected to the power supply after the phone batteries are charged. | Energy | High | Qualified |
| | Eliminate the use of chlorinated, brominated, and antimony trioxide based flame-retardants in PWBs, components, modules and parts. | Materials | High | Qualified / Ongoing |
| | Eliminate the use of certain phthalates (used as softeners) in plastics. | Materials | High | Qualified / Ongoing |
| | Standardise the battery chargers (interfaces) for mobile phones. | Materials | Medium | Qualified |
| | Reduce the use of beryllium and its compounds in the components. | Materials | Medium | Qualified / Ongoing |
| | Reduce/Eliminate the use of halogen containing polymers in the plastics used for product packaging. | Materials | Low | Qualified |

⁵ See appendix B for the various aspects considered for analysing the improvement options.

| | | | | |
|--|--|-------------------|--------|------------------------|
| | Reduce the no-load power consumption of the charger. | Energy | High | Ongoing |
| | Reduce the amounts of precious metals in the components. | Energy, Materials | High | Ongoing |
| | Optimise the number and characteristics of the high impact components like Printed Wiring Board (PWB), Integrated Circuits (ICs) and Liquid Crystal Display (LCD) with respect to their environmental impacts. | Energy, Materials | High | Ongoing |
| | Provide possibilities for upgrading the phone software and downloading applications from remote locations. | Energy, Materials | Medium | Ongoing |
| | Integrate more functions in the phones so that they can substitute other products. | Energy, Materials | Medium | Ongoing |
| | Increase environmental criteria in the technical specifications to select providers of mobile phones. | Energy, Materials | Medium | Ongoing |
| | Use bio-based materials in the phones. | Materials | Low | Ongoing |
| | Reduce the size and mass of the product packaging. | Materials | Low | Ongoing |
| | Develop chargers that use different energy sources like kinetic, solar and make them main stream products. | Energy | Medium | Disqualified / Ongoing |
| Optimisation of In-Use Life-Span of Phones | Identify and analyse the key drivers for the fast replacement of the phones. | Energy, Materials | High | Qualified |
| | Research the need and drivers for subsidising the prices of new mobile phones. | Energy, Materials | High | Qualified |
| | Declare the material composition of components to the phone manufacturers. | Materials | High | Ongoing |
| | Analyse the aspects of refurbishment of old phones. | Energy, Materials | High | Ongoing |
| | Make provisions for availability of spare parts and accessories of old mobile phones. | Energy, Materials | Medium | Ongoing |
| | Develop a modular structure for mobile phones to enable upgrading of hardware as long as technically possible. | Energy, Materials | Medium | Disqualified |
| | Untie the mobile phones from the network. | Energy, Materials | Medium | Disqualified |
| Reduction in Energy Consumption and Use of Environmentally Relevant Chemicals during Component Manufacture | Use Environment Management System (EMS) like ISO 14001 based to reduce the environmental impacts in the manufacturing phases. | Energy, Materials | High | Ongoing |
| | Collect data on the health and environmental effects of process chemicals used in manufacturing and the substances embedded in the components. | Materials | High | Ongoing |
| | Implement a system for assisting suppliers to lower their environmental impacts. | Energy, Materials | Medium | Ongoing |
| | Provide a preferential supplier status to suppliers with low environmental impacts. | Energy, Materials | Medium | Ongoing |
| Influencing Buying, Usage and Disposal Patterns of Consumers | Inform consumers on the environmental aspects of the mobile phones to influence their buying patterns using an effective eco-information tool. | Energy, Materials | High | Qualified |
| | Inform and educate the consumers on sustainable behaviour. | Energy, Materials | High | Qualified/Ongoing |
| | Study consumer behaviour from the perspective of buying, usage and disposal patterns. | Energy, Materials | High | Qualified |

| | | | | |
|--|--|---------------------------------------|--------|-----------------------|
| | Develop consumer guides to advise the consumers on sustainable behaviour in use and disposal phase. | Energy, Materials | High | Qualified |
| | Research what incentives to consumers like money back system, loyalty card reward points, ring tones, games, screen savers etc. could attract significant quantities of used/unwanted mobile phones. Also assess the potential of deposit-refund scheme for mobile phones. | Materials | High | Qualified/ Ongoing |
| | Provide incentives, based on research findings, to consumers to return their unwanted mobile phones for recycling. | Materials | High | Qualified/ Ongoing |
| | Explore the potential benefits of using Product Service System (PSS) model for mobile phones. | Materials | Medium | Qualified |
| | Stimulate demand for environmentally superior phones by providing cheaper tariffs for them. | Energy, Materials | Medium | Disqualified |
| Reduction in Impacts from Energy Consumption of Network Infrastructure | Share base stations with other service providers to reduce the energy consumption and ensure that they are used up to their peak capacities. | Energy | Medium | Ongoing |
| | Use renewable energy sources for powering network infrastructure. | Energy | Medium | Ongoing |
| End-of-Life Management of Disposed Mobile Phones | Exchange information on materials and substances in the phone that may cause environmental or OH&S concerns during recycling operations with recyclers. | Materials | High | Ongoing |
| | Ensure that the collected used/unwanted phones are sent to appropriate recycling plants and are properly treated. | Materials | High | Ongoing |
| | Carry research on what end-of-life management techniques may yield most environmental benefits. | Materials | Medium | Ongoing |
| | Develop guidelines on best available technology (BAT) & best environmental practices (BEP) for recycling mobile phones. | Materials | Medium | Ongoing |
| Development of Environmental Assessment Methods/ Tools | Further develop and standardise the KEPIs approach for environmental assessment. | Assessment Methods / Tools | High | Qualified |
| | Develop tools for assessing the environmental and social impacts of different materials and substances. | Assessment Methods / Tools, Materials | High | Qualified |
| | Provide life-cycle inventory data to phone manufacturers in line with the requirements of agreed environmental assessment methods/tools. | Assessment Methods / Tools | High | Qualified |
| | Develop transparent criteria for identifying the environmentally superior products and front-runners. | Energy, Materials | High | Qualified |
| | Develop an assessment system for IPP purposes where the key business related factors are taken into account. | Assessment Methods / Tools | Low | Qualified |
| | Develop in-house competence to identify the key areas where efforts should be directed. | Assessment Methods / Tools | Low | Disqualified |
| Other Options | Drive the work of environmental front-runners in industry by acknowledging them publicly, and encourage the laggards to improve. | Energy, Materials | High | Qualified |

| | | | | |
|--|--|-----------------------|--------|---------|
| | Provide scientific inputs to the public authorities on key environmental areas, and key industrial sectors where major environmental improvements can be made. | Depends on input | High | Ongoing |
| | Assist public authorities in identifying areas: - where voluntary measures could be promoted - where legislation may be needed. | Depends on results | Medium | Ongoing |
| | Develop cooperation with industry to develop environmental technologies. | Depends on technology | Low | Ongoing |

The participating stakeholders have also discussed the policy measures that can be used to drive environmental improvements in all the life-cycle stages. Using the IPP process, the stakeholders have identified policy proposals ranging from improvements in information flow strategies to market-based instruments and regulatory tools.

The strengthening of information-based instruments is strongly supported to create consumer demand for environmentally sound products and steer consumer behaviour to be more sustainable. Information flows on in the various life-cycle stages can help all stakeholders - suppliers, manufacturers, consumers and recyclers - to understand the environmental impacts of products and ways to reduce them.

The report calls upon public authorities to initiate education and awareness activities on sustainable consumer behaviour. The ability of stakeholders like NGOs and consumer organisations to communicate relevant environmental information in a trustworthy way is also identified to have a significant impact on the behaviour of the consumers.

For information flow on complex products like mobile phones to consumers, the report explores the benefits and challenges of Type I, II and III information schemes and proposes a hybrid scheme - Product environmental facts - by taking the best from each approach to ensure relevant, timely and high impact environmental information to influence the consumers' buying patterns.

This study provides support for an expanded usage of Voluntary Agreements (VAs) as a complementary policy instrument to accelerate environmental improvements across the product life-cycle. Successful reduction in no-load power consumption of the mobile phone chargers has been made through the use of a voluntary code of conduct on external power supplies. This bodes well for the use of VAs and encourages the EC to recognise and further promote the usage of VAs as a viable policy instrument. However, some recommendations, including the acknowledgement of relevant VAs by public authorities and raising their status and visibility for increasing their adoption and effectiveness are made.

Recognition and support at the EU level of relevant VAs could help expand the number of signatories and could provide an opportunity for a particular industry or product sector to concentrate on significant environmental issues. The Commission could encourage establishing VAs, when possible, before a regulatory process is initiated and could develop standards and regulations based on acknowledged VAs. This report, in Appendix C, contains examples of voluntary agreements in the electronics industry. For mobile phones, voluntary agreements could be discussed for elimination/reduction of agreed materials of concern in the phone, and for providing product environmental facts to the consumers in an agreed way.

The report recognises that the environmental regulations have led to significant reduction in potential human health and environment impacts, have raised the awareness and stimulated the environmental thinking in the industry. However, it also identifies challenges with some regulations in relation to mobile phones from the mobile phone manufacturers' perspective. The report looks at recent experiences and recommends regulators to take a proportional, product flexible, balanced and an eco-efficient approach to regulation.

Experience with legislation has highlighted the need for regulators to take into account the complexity of the products. According to the mobile phone manufacturers, regulators will need to further deepen and advance their engagement with stakeholders as products are increasingly getting complex due to convergence (e.g. Nokia N Series phones which deliver far more functions than just voice and data transfer). Leveraging the use of scientific knowledge will help to create compliance targets which are achievable and appropriate. It is important that legislation is proportional to ensure that it targets the sector and product areas, which have the greatest environmental impacts. Results from research projects like EIPRO can provide useful inputs for this. The companies should also further improve their knowledge of the existing EU legislation and European Commission procedures.

In keeping with the life-cycle principle, it is important to ensure that regulations are balanced, in other words, they aim for cumulative environmental improvements rather than shifting the impacts from one category to the other.

It is also very important to leave room and create incentives for innovation in environmental performance which can drive eco-efficiency. According to mobile phone manufacturers, this means that regulations should prescribe an overall goal rather than proposing detailed requirements on how to reach goals. Furthermore, goals need to be attainable with consistent procedures, avoiding potential overlaps or contradictions such that they are as administratively as light as possible.

For all stages of the life-cycle, the report emphasises the need to create incentives for all stakeholders to create supply and demand for products with lower environmental impacts. Policy-makers can stimulate this work by further working on appropriate incentives. The report identifies many incentive opportunities such as Green Public Procurement, recognition for industry front-runners and the promotion and raising the status of voluntary agreements.

Public authorities could also support in cooperation with the industry and research institutes the development of practical assessment methods/tools like Key Environmental Performance Indicators (KEPIs) which can be used for day to day eco-design.

Most Relevant Technical, Behavioural and Policy Solutions

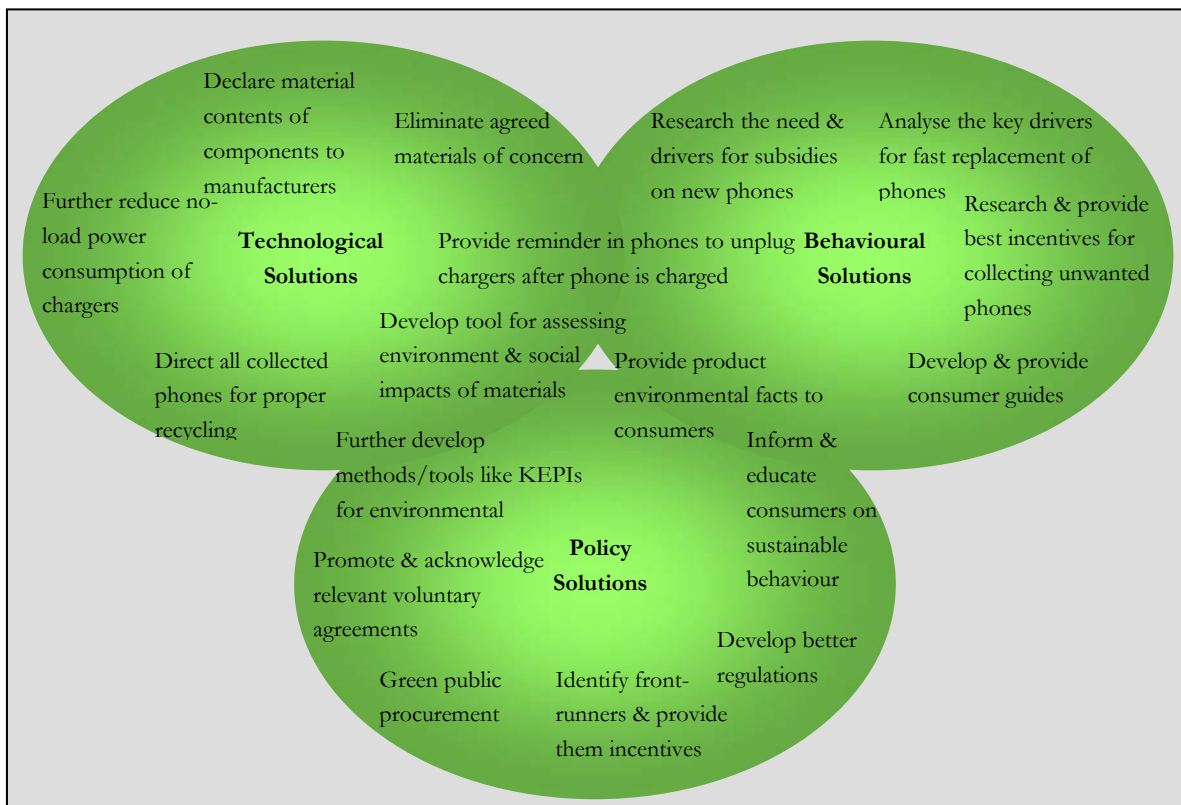
Based on the brief analysis of the options, the following figure identifies the most relevant technical, behavioural and policy solutions (options/measures). The most relevant technical solutions include provision of reminders in the chargers for unplugging the chargers after use, and elimination/reduction of the materials of concern. In addition to the technical measures the group lays emphasis on the behavioural solutions as the consumers have a substantial influence on the overall environmental performance of a particular product.

In a market driven economy the consumers' demand for products with better environmental performance can have a profound effect on steering the environmental improvements in products. It is thus, important to encourage the consumers to consider the environmental aspects when purchasing new products. However, it is recognised that consumers will only be

able to make environmentally rational decisions if they have reliable information to differentiate between two products on the basis of environmental performance. Provision of environmental facts on the products to the consumers which are clear, easy to understand, accessible and comparable is, thus, necessary.

The behaviour of the consumers on the product usage and disposal also significantly influences the life-cycle impacts of the product. For e.g. a consumer can reduce a major part of life-cycle impacts of a phone by unplugging the charger from the power supply after the batteries of a mobile phone are charged, and by disposing the unwanted phone at appropriate collection/recycling centres. Provision of relevant information to consumers about the actions they can take to minimise the impacts from these phases is required.

At present the collection rate of mobile phones is low. To ensure proper treatment of used phones in the end-of-life phase, measures are needed to increase the collection rates and to ensure that the collected phones are recycled appropriately. There should also be a mechanism to provide used phones, which are shipped out of Europe, with proper recycling treatment at the end of their life. According to the participating recycler, this could involve moving them back to countries which have appropriate recycling infrastructure. If reuse does not lead to final recycling of the product, then the usual waste hierarchy - reuse is “better” than recycling - is not valid.



Stage IV

This report feeds into the present stage IV of the pilot wherein new initiatives are being selected and set with the participation of the relevant stakeholders for further in-depth analysis and implementation of most of the ‘Qualified’ options. Many of the improvement options have some overlapping elements. The related and overlapping qualified options will be regrouped under the new initiatives set by the stakeholders in the stage IV. In the stage IV

NOKIA

there will be a final report summing up – the action plans for the new initiatives that are set by the stakeholders and experiences from and suggestions of this stakeholder group.

Stage V

The new initiatives set in stage IV will be monitored in stage V to assess their implementation and effectiveness. The task forces working on the new initiatives shall at regular intervals submit progress reports.

Table of Contents

List of Figures

List of Tables

| | |
|---|-----------|
| 1. INTRODUCTION | 1 |
| 1.1 INTEGRATED PRODUCT POLICY PILOT PROJECT ON MOBILE PHONES..... | 1 |
| 1.2 SCOPE OF THE PILOT..... | 2 |
| 1.3 OBJECTIVES IN STAGE III | 2 |
| 1.4 METHODOLOGY IN STAGE III | 2 |
| 1.5 LIMITATIONS IN STAGE III..... | 3 |
| 1.6 DEVELOPMENT OF THE STAGE III REPORT | 3 |
| 2. CLASSIFICATIONS OF THE IMPROVEMENT OPTIONS | 5 |
| 3. IMPROVEMENT OPTIONS FOR FURTHER CONSIDERATION - QUALIFIED..... | 15 |
| 3.1 HIGH ENVIRONMENTAL PRIORITY OPTIONS..... | 15 |
| 3.2 MEDIUM ENVIRONMENTAL PRIORITY OPTIONS | 27 |
| 3.3 LOW ENVIRONMENTAL PRIORITY OPTIONS | 29 |
| 4. IMPROVEMENT OPTIONS UNDERWAY - ONGOING | 31 |
| 4.1 HIGH ENVIRONMENTAL PRIORITY OPTIONS..... | 31 |
| 4.2 MEDIUM ENVIRONMENTAL PRIORITY OPTIONS | 39 |
| 4.3 LOW ENVIRONMENTAL PRIORITY OPTIONS | 46 |
| 5. IMPROVEMENT OPTIONS CURRENTLY DISCOUNTED - DISQUALIFIED | 49 |
| 5.1 MEDIUM ENVIRONMENTAL PRIORITY OPTIONS | 49 |
| 5.2 LOW ENVIRONMENTAL PRIORITY OPTIONS | 50 |
| 6. POLICY TOOLS | 53 |
| 6.1 POLICY TOOLS FOR ENERGY | 54 |
| 6.1.1 <i>Voluntary Environmental Agreements</i> | 55 |
| 6.1.2 <i>Other Voluntary Measures</i> | 55 |
| 6.1.3 <i>Recommendations</i> | 55 |
| 6.2 POLICY TOOLS FOR MATERIALS AND SUBSTANCES | 56 |
| 6.2.1 <i>Voluntary Environmental Agreements</i> | 56 |
| 6.2.2 <i>Regulatory Instruments</i> | 56 |
| 6.2.3 <i>New developments in the EU product related environmental legislation</i> | 59 |
| 6.2.4 <i>Recommendations</i> | 59 |
| 6.3 POLICY TOOLS FOR END-OF-LIFE | 59 |
| 6.3.1 <i>Regulatory Instruments</i> | 60 |
| 6.3.2 <i>Voluntary Environmental Agreements</i> | 62 |
| 6.3.3 <i>Recommendations</i> | 62 |
| 6.4 INFORMATION FLOWS..... | 62 |
| 6.4.1 <i>Supply Chain Information</i> | 62 |
| 6.4.2 <i>Information for Consumers</i> | 63 |
| 6.4.3 <i>Educational & awareness activities</i> | 65 |
| 6.4.4 <i>Information for Recyclers</i> | 65 |
| 6.4.5 <i>Recommendations</i> | 66 |
| 6.5 ENVIRONMENTAL ASSESSMENT METHODS/TOOLS..... | 66 |
| 6.5.1 <i>Working Arrangements and Standards</i> | 66 |
| 6.6 OTHER SIGNIFICANT POLICY MEASURES..... | 67 |
| 6.6.1 <i>Green Public Procurement (GPP)</i> | 67 |
| 6.6.2 <i>Incentives for Front-Runners</i> | 68 |

6.6.3 *Harmonisation of Legislation* 69

6.6.4 *Improvements for Voluntary Environmental Agreements*..... 69

6.7 SUMMARY..... 70

7. CONCLUSIONS AND OUTLOOK.....73

BIBLIOGRAPHY.....77

ABBREVIATIONS.....79

APPENDIX A: LIST OF STAKEHOLDERS PARTICIPATING IN NOKIA'S IPP PILOT PROJECT ON MOBILE PHONES81

APPENDIX B: GUIDELINES FOLLOWED FOR ANALYSING THE IMPROVEMENT OPTIONS83

APPENDIX C: VOLUNTARY AGREEMENTS IN THE ELECTRONICS INDUSTRY85

APPENDIX D: ANALYSIS OF TYPE I, TYPE II AND TYPE III ECO-INFORMATION SCHEMES IN CONTEXT OF MOBILE PHONES89

APPENDIX E: ISSUES WITH USING LCA FOR COMPLEX PRODUCTS LIKE MOBILE PHONES 91

APPENDIX F: EU REGULATIONS MOST RELEVANT TO ENVIRONMENTAL ASPECTS OF MOBILE PHONES.....93

List of Figures

| | |
|---|----|
| Figure 1-1: Stages in Nokia’s IPP Pilot on Mobile Phones | 1 |
| Figure 4-1: Effects of miniaturisation and integration on mobile phones over the years..... | 32 |
| Figure 4-2: Trends in digital convergence | 41 |
| Figure 4-3: Development of smallest Nokia standard package size and volume (cc)..... | 47 |
| Figure 4-4: Development of smallest Nokia standard package weight (grams)..... | 47 |
| Figure 6-1: Tools and Instruments for Environmental Policy..... | 54 |
| Figure 7-1: Prioritised solutions to improve environmental performance..... | 74 |

List of Tables

Table 2-1: Classifications of all the improvement options based on the analysis.....8

Table 3-1: Aspects of standardising the chargers (to decrease their consumption/production levels)27

Table 6-1: Attributes of a good scheme for informing consumers on the environmental aspects of products64

1. Introduction

1.1 Integrated Product Policy Pilot Project on Mobile Phones

The Integrated Product Policy (IPP) pilot project of Nokia was initiated as a part of European Commission’s (EC) effort to work together with stakeholders to further develop the IPP approach. The objective of the EC’s IPP approach is to “reduce the environmental impacts from products throughout their life-cycle, harnessing, where possible, a market-driven approach, within which competitiveness concerns are integrated”⁶.

This pilot project on mobile phones is carried in five stages as shown in the figure. Presently the pilot is in the stage IV. This report was developed in the previous stage III.

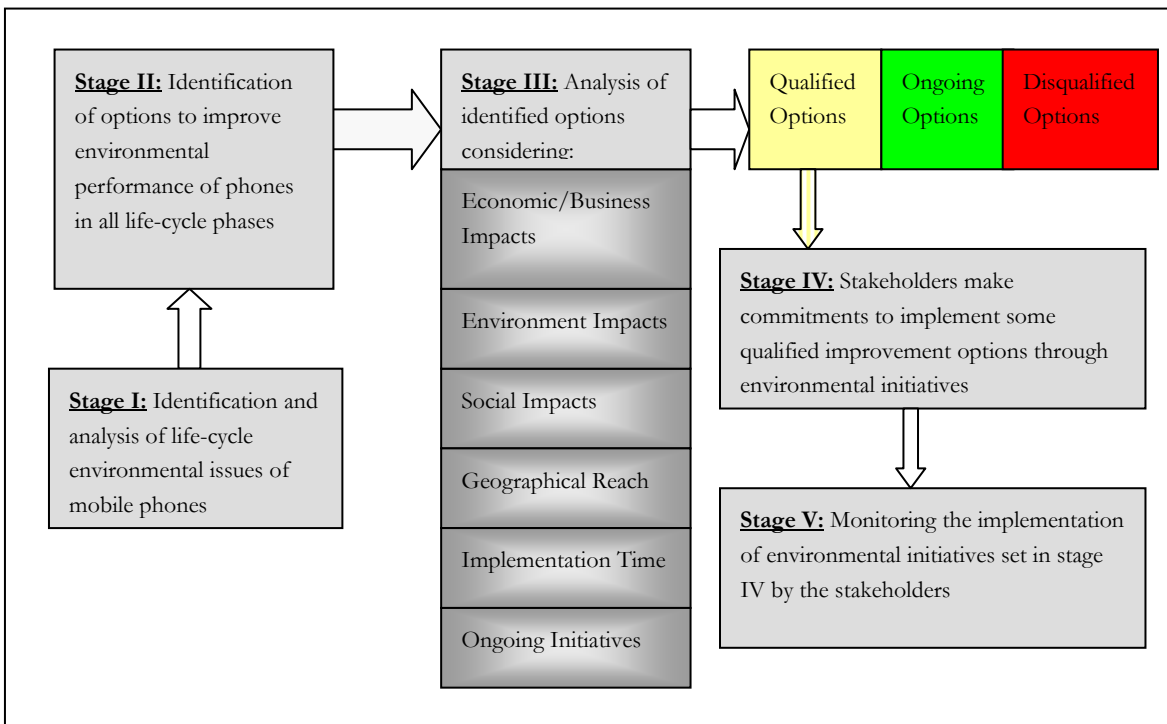


Figure 1-1: Stages in Nokia’s IPP Pilot on Mobile Phones

In the stage I of the pilot, environmental issues during the various life-cycle phases of mobile phones were identified and analysed. The stage I report⁷ was discussed with the participating stakeholders⁸ and three focus areas were selected for further work: Energy consumption during the life-cycle of mobile phones; Material related environmental issues in the life-cycle, and Methods/Tools for assessing life-cycle environmental performance/impacts. These areas are not exclusive with regard to the environmental impacts, but the project was limited to these areas they are most significant for mobile phones and the pilot is running for a limited time period.

⁶ See the IPP webpage of European Commission at: <http://europa.eu.int/comm/environment/ipp/home.htm>

⁷ See Nokia’s stage I final report at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

⁸ See appendix A for the list of stakeholders participating in this pilot. Umicore (a recycling firm) has joined the stakeholder group in the stage III.

In the stage II, numerous improvement options were identified in discussion with the participating stakeholders that can lead to improvements in the environmental performance of phones especially in the focus areas.

In the stage III, a brief analysis of these improvement options was done to identify the ones that can be further analysed and worked upon. The improvement options are classified in three categories: 'Qualified', 'Ongoing' and 'Disqualified', on the basis of the analysis. In the stage IV of the pilot, new initiatives are set with the participation of the relevant stakeholders to further work on and implement many 'Qualified' options. These initiatives will be monitored in stage V to assess their implementation and effectiveness.

1.2 Scope of the Pilot

Nokia's IPP pilot project is focused on mobile phones and its life-cycle, and has a global dimension. The pilot comprehensively covers the life-cycle environmental issues and improvements for the mobile phones but does not cover all the life-cycle phases of the network infrastructure. For the network infrastructure, only improvement options for reducing the impacts from energy consumption in use phase are identified and analysed. Improvements options during the production and end-of-life (EoL) phase of the network infrastructure are not in the scope of this pilot. As the IPP pilot project was planned to be completed in a year's time, the scope of the project was narrowed down to address selected significant aspects of the mobile phones after the stage I.

1.3 Objectives in Stage III

The main objective in stage III was to do brief analyses and then screen/classify the improvement options identified in the previous stage. Another objective was to discuss the policy tools that can be used to drive the improvements in the environmental priority areas of mobile phones.

The improvement options are analysed on the basis of their economic, environmental and social impacts, feasibility, geographic reach of improvements, time required for implementation and the related ongoing initiatives in the sector⁹. The brief analysis had certain limitations which are discussed in section 1.5. Considering the results from the analysis the options are classified as – Qualified, Ongoing and Disqualified. The qualified improvement options will be considered for further analysis and implementation in the stage IV of the pilot. In addition, an environmental priority status – High, Medium and Low is also assigned to all the options.

The classification status is based on many aspects including the economic, environmental and social impacts of the options whereas the prioritisation status considers just the anticipated environmental benefits from the implementation of the options.

1.4 Methodology in Stage III

To briefly analyse the improvement options, Nokia, in consultation with the stakeholders, developed a common analysis guideline. This guideline identifies all the aspects considered for the analysis. The guideline can be seen in the appendix B of this report. Communication

⁹ See appendix B for the various aspects considered for analysing the improvement options.

from the Commission on Impact Assessment (Commission of the European Communities, 2002) and Impact Assessment Guidelines from Commission (European Commission, 2005) were referred for developing it.

The task of analysing the improvement options was discussed and distributed among the stakeholders participating in this pilot. Groups of organisations: Mobile phone manufacturers - Nokia, Motorola and Panasonic; Component Manufacturers – AMD, Epson and Intel; Network Operators – France Telecom / Orange, TeliaSonera and Vodafone; Public Authorities – European Commission and Department of Environment, Food and Rural Affairs (DEFRA), UK; Non-Governmental Organisations (NGOs) – The European Consumers’ Organisation (BEUC) and WWF, have analysed the improvement options relevant for them. Finnish Environment Institute (SYKE) has analysed most of the options relevant for research institutions and Umicore has analysed the options relevant for the recyclers. All the stakeholders have used the guideline for conducting the analysis of the options.

1.5 Limitations in Stage III

As discussed in section 1.3, the main objective of the brief analysis was to classify/screen all the options and identify those which can be further analysed and implemented. The brief analysis of the improvement options has been conducted by Nokia and the stakeholders **on the basis of their expertise, experiences and judgements**. It should be noted that detailed quantified analysis was not carried for all the options mainly due to the time limitations for analysing the improvement options (over 50). All the options were analysed within a period of two months during this stage. Results from previous related studies, the expertise and the experiences of the participating stakeholders were considered wherever applicable. For some options, when little/no information/data was available for conducting the analysis, logical estimations were made.

1.6 Development of the Stage III Report

Nokia has developed this report in consultation with the participating stakeholders. The first version of this report was discussed in the third stakeholder meeting in Brussels on 7 December, 2005. The discussions with the participating stakeholders during the meeting have been considered for the development of this final version. Stakeholders who are not directly participating in this project are welcome to submit their proposals/comments on this report.

2. Classifications of the Improvement Options

This chapter provides the summary of classifications of improvement options. These classifications are based on the brief analysis conducted in this stage III. No details on the analysis itself are provided in this chapter. The readers should look at chapters 3, 4 and 5 for the summaries of the analysis of the options. Most of improvement options for the public authorities are also not covered in this chapter and are mainly discussed in the chapter 6 on policy tools.

The improvement options, which are either technological, behavioural or policy solutions, were identified under eight themes in stage II report:

- *Improvements in mobile phones*: Options to manage the energy and material related environmental issues of phones.
- *Optimisation of in-use life-span*: Options to optimise the in-use life-span of mobile phones, which have a fast turnover rate.
- *Reduction in energy consumption and environmentally relevant chemicals used during components manufacture*: Options to reduce the critical impacts from the component manufacturing phase.
- *Influencing the buying, usage and disposal patterns of consumers*: Options to increase the demand for products (in this case mobile phones) with superior environmental performance, to influence the consumer behaviour when phones are in use, and to increase the collection rate of unwanted mobile phones.
- *End-of-life management of disposed mobile phones*: Options to properly manage the collected old/unwanted phones.
- *Reduction in environmental impacts from energy consumption of network infrastructure*: Options to reduce the impacts of the mobile system¹⁰, excluding phones, when in use. Options to reduce impacts from mobile phones are already covered in the first theme.
- *Development of suitable environmental assessment methods/tools*: Options to develop the right set to methods/tools which can be used for practical eco-design purposes in industry, and by governments for policy making.
- *Creation of a favourable policy environment*: Options for policy makers to further improve the existing policies, and to create an environment which stimulates the demand for environmentally superior products, provides incentives to the environmental front-runners and lays foundation for environmentally sound behaviour by consumers.

The improvement options have been classified as Qualified, Ongoing and Disqualified based on the brief analysis and estimation of their economic, environmental and social impacts, feasibility, geographic reach of improvements, time required for implementation and the

¹⁰ The mobile system consists of mobile phones, a radio network with radio base stations and radio network control equipment, and a core network with switches, routers, servers and workstations.

related ongoing initiatives in the sector. Appendix B provides additional details on the various aspects considered for the analysis.

- **Qualified:** Options estimated to be (most likely) feasible and which will yield environmental benefits in an economically efficient way and without having adverse social impacts. However, most of these options need further in-depth analysis before they can be implemented.
- **Ongoing:** Options for which similar/related activities are already ongoing. These options are ongoing either as a part of normal business activities at least for some companies/organisations or there are, for e.g., voluntary project groups working on them.
- **Disqualified:** Options that cannot be implemented as of now according to the stakeholders who carried out the analysis. These options are either not feasible yet or they have insignificant/unknown environmental benefits or adverse social impacts. The options may become feasible to implement in the future, as more information and better solutions become available. Some of the qualified and ongoing options are likely to provide these solutions and thus the status of the disqualified options can be reviewed again after the implementation of some qualified options.

Many ‘Qualified’ and ‘Ongoing’ options are considered by the participating stakeholders in the present stage IV of the pilot for further in-depth analysis and implementation by setting up new initiatives. Many of the improvement options have some overlapping elements. The related and overlapping qualified options will be regrouped under the new initiatives set by the stakeholders in the stage IV.

Some of the options have been given two classifications i.e. either ‘Qualified/Ongoing’ or ‘Disqualified/Ongoing’. ‘Qualified/Ongoing’ means that some participant companies/organisations in this pilot are already working on the options and these options are feasible to implement. Further work, however, is possible to be carried for improving these options. Disqualified/Ongoing suggests that activity on these options is ongoing for some participants but there are feasibility issues.

The options have also been assigned an environmental priority status - High, Medium and Low - based on the significance of anticipated life-cycle environmental benefits for mobile phones. These statuses have been assigned mainly considering the results from different environmental assessments carried by Nokia and the experiences of the stakeholders as described in the IPP Stage I report.

- **High:** The options may yield significant environmental benefits in the select focus areas of this pilot or are needed as the basis/starting point for other improvement options or for assessing the possible benefits. The focus areas in this pilot are – Energy consumption during the life-cycle of mobile phones; Material related environmental issues in the life-cycle, and Methods/Tools for assessing life-cycle environmental performance/impacts.
- **Medium:** The options may yield some environmental benefits in the select focus areas of this pilot, but the environmental benefits are not seen as big as in the category ‘high’.
- **Low:** The options may yield little/uncertain environmental benefits.

More research and development of methods/tools is needed in to carry comprehensive and reliable assessments of the environmental benefits of the improvement options. Any improvements options that aim at providing better possibilities for assessing the environmental impacts of the improvement options are thus given high priority.

The analyses are not perfect due to lack of reliable information on some environmental, social or economical aspects and classification/priority may change as more information becomes available.

The improvement options under the different groups of priority status (high, medium, low) are not listed in accordance of the environmental benefits they bring as an in-depth scenario analysis of all the options would be required to do so. Moreover, as discussed in the stage I report there is a lack of suitable environmental assessment tools/methods for conducting an in-depth analysis of certain options due to data and time constraints.

Table 2-1: Classifications of all the improvement options based on the analysis

| Improvement Themes | Improvement Options | For | Focus Area | Environmental benefits in Life-cycle Phases ¹¹ | | | Environmental Priority | Classification |
|-------------------------------|---|--|------------|---|-----|-----|------------------------|---------------------|
| | | | | Production ¹² | Use | Eol | | |
| Improvements in Mobile Phones | Equip the phones/chargers with sound or visual reminders that go on if the chargers are left connected to the power supply after the phone batteries are charged. | Phone Manufacturers | Energy | - | X | - | High | Qualified |
| | Eliminate the use of chlorinated, brominated, and antimony trioxide based flame-retardants in PWBs, components, modules and parts. | Phone Manufacturers, Component Manufacturers | Materials | X | - | X | High | Qualified / Ongoing |
| | Eliminate the use of certain phthalates (used as softeners) in plastics. | Phone Manufacturers, Component Manufacturers | Materials | X | - | X | High | Qualified / Ongoing |
| | Standardise the battery chargers (interfaces) for mobile phones. | Phone Manufacturers, Network Operators | Materials | X | - | X | Medium | Qualified |
| | Reduce the use of beryllium and its compounds in the components. | Phone Manufacturers, Component Manufacturers | Materials | X | - | X | Medium | Qualified / Ongoing |
| | Reduce/Eliminate the use of halogen containing polymers in the plastics used for product packaging. | Phone Manufacturers, Network Operators | Materials | X | X | X | Low | Qualified |
| | Reduce the no-load power consumption of the charger. | Phone Manufacturers | Energy | - | X | - | High | Ongoing |

¹¹ Please note that only those life-cycle phases where the benefits are deemed greatest have been highlighted in this table. Some improvement options will/may also have an influence on other life-cycle phases of the phone.

¹² The production phase covers raw material acquisition, components manufacture and product assembly.

| | | | | | | | | |
|--|--|---|-------------------|-----------|---|---|--------|------------------------|
| | Reduce the amounts of precious metals in the components. | Phone Manufacturers, Component Manufacturers | Energy, Materials | X | - | - | High | Ongoing |
| | Optimise the number and characteristics of the high impact components like Printed Wiring Board (PWB), Integrated Circuits (ICs) and Liquid Crystal Display (LCD) with respect to their environmental impacts. | Phone Manufacturers, Component Manufacturers | Energy, Materials | X | - | - | High | Ongoing |
| | Provide possibilities for upgrading the phone software and downloading applications from remote locations. | Phone Manufacturers | Energy, Materials | X | - | X | Medium | Ongoing |
| | Integrate more functions in the phones so that they can substitute other products. | Phone Manufacturers | Energy, Materials | X | - | X | Medium | Ongoing |
| | Increase environmental criteria in the technical specifications to select providers of mobile phones. | Network Operators | Energy, Materials | X | X | X | Medium | Ongoing |
| | Use bio-based materials in the phones. | Phone Manufacturers | Materials | Not known | - | X | Low | Ongoing |
| | Reduce the size and mass of the product packaging. | Phone Manufacturers, Network Operators | Materials | X | - | - | Low | Ongoing |
| | Develop chargers that use different energy sources like kinetic, solar and make them main stream products. | Phone Manufacturers | Energy | - | X | - | Medium | Disqualified / Ongoing |
| Optimisation of In-Use Life-Span of Phones | Identify and analyse the key drivers for the fast replacement of the phones. | Network Operators, Research Institutions, Phone Manufacturers | Energy, Materials | X | - | X | High | Qualified |
| | Research the need and drivers for subsidising the prices of new mobile phones. | Network Operators, Research Institutions | Energy, Materials | X | - | X | High | Qualified |
| | Declare the material composition of components to the phone manufacturers. | Component Manufacturers, Phone Manufacturers | Materials | X | - | X | High | Ongoing |

| | | | | | | | | |
|--|--|--|-------------------|---|-----------|-----------|--------|--------------|
| | Analyse the aspects of refurbishment of old phones. | Research Institutions, Recyclers, Phone Manufacturers, Network Operators, Consumer Organisations, Environmental NGOs | Energy, Materials | X | Not known | Not known | High | Ongoing |
| | Make provisions for availability of spare parts and accessories of old mobile phones. | Phone Manufacturers | Energy, Materials | X | - | X | Medium | Ongoing |
| | Develop a modular structure for mobile phones to enable upgrading of hardware as long as technically possible. | Phone Manufacturers | Energy, Materials | X | - | X | Medium | Disqualified |
| | Untie the mobile phones from the network. | Network Operators | Energy, Materials | X | - | X | Medium | Disqualified |
| Reduction in Energy Consumption and Use of Environmentally Relevant Chemicals during Component Manufacture | Use Environment Management System (EMS) like ISO 14001 based to reduce the environmental impacts in the manufacturing phases. | Phone Manufacturers, Component Manufacturers | Energy, Materials | X | - | - | High | Ongoing |
| | Collect data on the health and environmental effects of process chemicals used in manufacturing and the substances embedded in the components. | Phone Manufacturers, Component Manufacturers, Research Institutions | Materials | X | - | X | High | Ongoing |
| | Implement a system for assisting suppliers to lower their environmental impacts. | Phone Manufacturers, Component Manufacturers | Energy, Materials | X | - | - | Medium | Ongoing |
| | Provide a preferential supplier status to suppliers with low environmental impacts. | Phone Manufacturers | Energy, Materials | X | - | - | Medium | Ongoing |
| Influencing Buying, Usage and Disposal Patterns of Consumers | Inform consumers on the environmental aspects of the mobile phones to influence their buying patterns using an effective eco-information tool. | Phone Manufacturers, Network Operators | Energy, Materials | X | X | X | High | Qualified |

| | | | | | | | | |
|---------------------------|--|---|-------------------|---|---|---|--------|-------------------|
| | Inform and educate the consumers on sustainable behaviour. | Phone Manufacturers, Network Operators, Recyclers, Public Authorities, Environmental NGOs, Consumer Organisations | Energy, Materials | X | X | X | High | Qualified/Ongoing |
| | Study consumer behaviour from the perspective of buying, usage and disposal patterns. | Research Institutions, Consumer Organisations, Phone Manufacturers, Network Operators | Energy, Materials | X | X | X | High | Qualified |
| | Develop consumer guides to advise the consumers on sustainable behaviour in use and disposal phase. | Consumer Organisations, Phone Manufacturers, Network Operators | Energy, Materials | - | X | X | High | Qualified |
| | Research what incentives to consumers like money back system, loyalty card reward points, ring tones, games, screen savers etc. could attract significant quantities of used/unwanted mobile phones. Also assess the potential of deposit-refund scheme for mobile phones. | Network Operators, Phone Manufacturers, Research Institutions, Consumer Organisations | Materials | - | - | X | High | Qualified/Ongoing |
| | Provide incentives, based on research findings, to consumers to return their unwanted mobile phones for recycling. | Network Operators, Phone Manufacturers | Materials | - | - | X | High | Qualified/Ongoing |
| | Explore the potential benefits of using Product Service System (PSS) model for mobile phones. | Network Operators | Materials | - | - | X | Medium | Qualified |
| | Stimulate demand for environmentally superior phones by providing cheaper tariffs for them. | Network Operators | Energy, Materials | X | X | X | Medium | Disqualified |
| Reduction in Impacts from | Increase the energy efficiency of the network infrastructure | Network Operators | Energy | - | X | - | High | Ongoing |

| | | | | | | | | |
|--|---|--|---------------------------------------|---|---|---|--------|-----------|
| | Share base stations with other service providers to reduce the energy consumption and ensure that they are used up to their peak capacities. | Network Operators | Energy | - | X | - | Medium | Ongoing |
| | Use renewable energy sources for powering network infrastructure. | Network Operators | Energy | - | X | - | Medium | Ongoing |
| End-of-Life Management of Disposed Mobile Phones | Exchange information on materials and substances in the phone that may cause environmental or OH&S concerns during recycling operations with recyclers. | Phone Manufacturers, Recyclers | Materials | - | - | X | High | Ongoing |
| | Ensure that the collected used/unwanted phones are sent to appropriate recycling plants and are properly treated. | Network Operators, Phone Manufacturers, Public Authorities | Materials | - | - | X | High | Ongoing |
| | Carry research on what end-of-life management techniques may yield most environmental benefits. | Recyclers, Research Institutes, Phone Manufacturers | Materials | - | - | X | Medium | Ongoing |
| | Develop guidelines on best available technology (BAT) & best environmental practices (BEP) for recycling mobile phones. | Recyclers, Research Institutes | Materials | - | - | X | Medium | Ongoing |
| Development of Environmental Assessment Methods/ Tools | Further develop and standardise the KEPIs approach for environmental assessment. | Research Institutions, Phone Manufacturers, Component Manufacturers, Public Authorities, Standardisation Bodies | Assessment Methods / Tools | X | - | X | High | Qualified |
| | Develop tools for assessing the environmental and social impacts of different materials and substances. | Research Institutions, Phone Manufacturers, Component Manufacturers, Recyclers, Environmental NGOs, Public Authorities | Assessment Methods / Tools, Materials | X | - | X | High | Qualified |

| | | | | | | | | |
|---------------|--|--|----------------------------|--------------------|--------------------|--------------------|--------|--------------|
| | Provide life-cycle inventory data to phone manufacturers in line with the requirements of agreed environmental assessment methods/tools. | Component Manufacturers, Recyclers | Assessment Methods / Tools | X | - | X | High | Qualified |
| | Develop transparent criteria for identifying the environmentally superior products and front-runners. | Research Institutions, Phone Manufacturers, Component Manufacturers, Network Operators, Environmental NGOs, Consumer Organisations, Public Authorities | Energy, Materials | X | X | X | High | Qualified |
| | Develop an assessment system for IPP purposes where the key business related factors are taken into account. | Research Institutions | Assessment Methods / Tools | - | - | - | Low | Qualified |
| | Develop in-house competence to identify the key areas where efforts should be directed. | Environmental NGOs, Consumer Organisations | Assessment Methods / Tools | - | - | - | Low | Disqualified |
| Other Options | Drive the work of environmental front-runners in industry by acknowledging them publicly, and encourage the laggards to improve. | Environmental NGOs, Consumer Organisations, Public Authorities | Energy, Materials | X | X | X | High | Qualified |
| | Provide scientific inputs to the public authorities on key environmental areas, and key industrial sectors where major environmental improvements can be made. | Research Institutions | Depends on input | X | X | X | High | Ongoing |
| | Assist public authorities in identifying areas: - where voluntary measures could be promoted - where legislation may be needed. | Research Institutions | Depends on results | Depends on results | Depends on results | Depends on results | Medium | Ongoing |
| | Develop cooperation with industry to develop environmental technologies. | Research Institutions, Public Authorities | Depends on technology | Depends on results | Depends on results | Depends on results | Low | Ongoing |

3. Improvement Options for Further Consideration - Qualified

This chapter provides a summary of the brief analysis of improvement options that are classified as “Qualified”. These options are estimated to be (most likely) feasible and may yield environmental benefits in an economically efficient way and without having adverse social impacts¹³. However, most of these options need further in-depth analysis before they can be implemented.

Stakeholders participating in this pilot will consider these qualified options for further in-depth analysis and implementation by setting up new initiatives in the subsequent stage. Many of the improvement options have some overlapping elements. The related and overlapping qualified options will be regrouped under the new initiatives set by the stakeholders in the stage IV.

3.1 High Environmental Priority Options

1. Equip the phones/chargers with sound or visual reminders that go on if the chargers are left connected to the power supply after the phone batteries are charged

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The no-load power consumption of the charger may account for over 30% of the life-time energy consumption of a mobile phone (if the use period is assumed as 2 years and charger is left plugged in) as identified in the stage I report. Significant environmental benefits may be achieved if the consumers unplug the chargers from the socket after the phone is fully charged and save the energy which is wasted as no-load power. The possibilities of having a) Sound reminder in the charger, which for example beeps several times/continuously, and b) Visual message, which for example blinks on the screen of the phone when it is fully charged, to remind the consumers to unplug the chargers, were analysed. This option aims at changing behaviour of the consumers globally and would be in addition to the already ongoing activities to reduce the no-load power consumption of the chargers as discussed under option 1 in section 4.1.

Sound reminder in charger: A sound reminder requires addition of a few components like speaker, small circuit etc. in the charger, which may cause an increase in the environmental load (in raw material acquisition and component manufacture phase) as well as an increase in the costs of the charger. This added environmental load of few components may offset some of the environmental benefits achieved from saving energy (in use phase). The sound of the reminder may also be annoying for some consumers especially if they put the phone to charge before going to sleep.

Visual reminder in phone: In this case, the phone may, after the battery is charged, for e.g. give a beep once and then flash a message for some time on its screen like - Phone is full charged;

¹³ See the list of different aspects considered in the analysis in appendix B.

please unplug the charger from the socket. This option will require a few changes in the software but no additional components need to be added. The environmental gains will be higher in this case as compared to addition of a sound reminder in the charger.

Implementation of this solution may require a time period of 6 months – 1 year and a voluntary agreement between the phone manufacturers could drive its implementation.

2. Eliminate the use of certain chlorinated, brominated, and antimony trioxide based flame-retardants in PWBs, components, modules and parts

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola, Panasonic, Intel, AMD and Epson

Summary: The environmental issues related to the flame-retardants were discussed in the stage I report. A detailed analysis of this option, which may yield global and significant benefits, was not possible in the limited period of this third stage. However the brief analysis by phone manufacturers suggests that within a timeframe of 3-5 years it will be possible to eliminate/reduce agreed materials like certain flame retardants from all components in the mobile phones with support from the component manufacturers. Component manufacturers are in the key role in the process of elimination/reduction of these materials as they have the direct control over the component design and manufacturing phase.

For any material reduction or replacement options, the analysis must include an evaluation of the replacements to the materials. Without evaluating the alternative materials and their respective life-cycle impacts, it is difficult to state the net environmental benefits or to judge the priority of implementing this option for example all the possible alternatives to brominated flame retardants are not environmentally preferable. A preliminary report on the subject by the High Density Packaging User Group (HDPUG) found mixed-results when evaluating bromine-free flame retardant compounds for printed circuit boards¹⁴. However, it seems that viable alternatives can be found, but more research is still needed.

A voluntary agreement, between the phone and component manufacturers, to reduce/eliminate these flame-retardants by identifying suitable alternatives may help in driving this option. A globally accepted definition of products free of these substances will be needed for this purpose so that verification can be done.

3. Eliminate the use of certain phthalates (used as softeners) in plastics

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: Stabilisers containing heavy metals (lead and cadmium) compounds were earlier used in certain plastics. This use had been reduced by voluntary steps and regulatory restrictions. However, the use of certain phthalate softeners, in plastics for mobile phones, is currently as a softener for charger cables and some accessory cables.

¹⁴ See: <http://www.hdpug.org/public/4-papers/2004/2004.htm#DFE>

Global environmental benefits can be realised from the implementation of this option. The significance of the environmental benefits achieved will depend on the life-cycle environmental impacts of the alternative materials. The brief analysis suggests that these materials could be eliminated within a time-frame of 1-3 years¹⁵. A voluntary agreement between the phone and component manufacturers may drive this option. A globally accepted definition of products free of these substances is required for this option so that verification can be done.

4. Identify and analyse the key drivers for the fast replacement of the phones

For: Network Operators, Research Institutions and Phone Manufacturers

Analysed by: France Telecom / Orange, Nokia and Finnish Environmental Institute (SYKE)

Summary: The main objective of this aspect is to identify the issues which have a critical influence on the in-use life-span of a mobile phone. The commonly held view is that mobile phones are replaced after 1 - 2 years. Research needs to be carried for:

- identifying key drivers which have an impact on replacement decisions;
- understanding the degree of influence operators and manufacturers have over such drivers;
- determining the life-time of a phone from an environmental perspective, from a functional perspective, and from a quality and performance perspective;
- identifying feasible options for optimising the life span of phones.

The research would be informed by the marketing experience of the individual operators and industry knowledge gained through Global e-Sustainability Initiative (GeSI), Mobile Manufacturers Forum (MMF), GSM Association (GSMA) and Mobile Phone Partnership Initiative (MPPI). SYKE has proposed a plan for identifying the optimal in-use life span of a phone.

SYKE's Proposal of determining optimal life-time. Identifying optimal life-span requires analysis of full LCA studies of mobile phones conducted with reliable impact assessment tools. The research should be carried out as a study in which different functions of mobile phones are taken into account. The technical developments of mobile phones and the behavioural aspects of consumers also need to be considered and scenario and uncertainty analyses should be done. In practice, the work also includes the development of an assessment methodology. The detailed research may require the costs of 2-5 person working years. This could be closely coordinated with the effort in the “European Platform for LCA” project of the Commission.

5. Research the need/drivers for subsidising the prices of new mobile phones and reduce the subsidies

¹⁵ Nokia is working to eliminate PVC from its mobile phones. PVC is used in the cables of mobile phone accessories and chargers.

For: Network Operators and Research Institutions

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: The in-use life-span of a phone can be increased by discouraging the consumers from changing their phones very frequently. The consumers may make environmentally rational decisions when buying new phones if the unsubsidised prices are reflected and they have information on their environmental aspects¹⁶.

There are several aspects related to the subsidy issue of mobile phones. On one hand the subsidies are blurring the real price of the mobile phones for the consumers and encourage them to replace their phones very frequently whereas on the other hand they help in bridging the digital divide by providing access to the mobile services for everyone. There are also several aspects of trade and competition related to this option. Presently, most of the network operators subsidise the sales of mobile phones in many regions, therefore if one network operator would reduce the subsidies this would create disadvantage for them on the market. Thus, further research on this area should be done according to the network operators before actions can be taken.

This option needs further detailed analysis to understand the need and the drivers for the subsidies and the related environmental and social impacts. A time frame of 1-3 years may be needed for this research and it could be led by the network operators.

6. Inform consumers on the environmental aspects of the mobile phones to influence their buying patterns using an effective eco-information tool

For: Phone Manufacturers and Network Operators

Analysed by: Nokia, Motorola, Panasonic, BEUC and WWF

Summary: The consumers need information which can assist them in making environmentally rational decisions. For most consumers environmental facts are not yet a major part of the main purchasing priorities, therefore any information provided would need to be clear, easily understandable and accessible.

Significant environmental benefits in all the life-cycle stages could be achieved if strong enough demand for environmentally superior products could be created as it shall stimulate environmental innovations and improvements in the products.

The manufacturers and operators can inform the consumers about the environmental aspects of the phones by using several kinds of eco-information tools. However most of the present tools, like current eco-labels and declarations do not seem to be very appropriate especially for complex and rapidly developing ICT products like mobile phones according to the phone manufacturers. In context of mobile phones, the present eco-information tools are discussed in detail in the section 6.4.2 and appendix D. In the same section, a new approach for providing information on the environmental aspects of phones to consumers is also discussed.

¹⁶ It is assumed that many consumers replace their existing phones frequently because new phones are available at cheap subsidised prices.

Consumers/buyers should be able to easily access and understand information on the environmental aspects of the phone. It is also important that the information is reliable and the consumers develop a trust in it. The most significant environmental facts for mobile phones, such as no-load power consumption of the charger and the material contents should be disclosed in the information.

This option can be implemented within a period of 1 – 3 years for mobile phones. The phone manufacturers and operators can get in a voluntary agreement to use an agreed upon scheme for providing information on environmental aspects of phones to consumers.

7. Informing and educate consumers on sustainable behaviour

For: Phone Manufacturers, Network Operators, Recyclers, Public Authorities, Environmental NGOs and Consumer Organisations

This option has been analysed by two groups. Phone manufacturers, network operators and recyclers have analysed this option as an activity to inform consumers on sustainable behaviour regarding mobile phones. The NGOs and Consumer organisations have analysed it from the view of initiating education programmes and issue specific campaigns to increase the consumer awareness on sustainable behaviour

Analysed by: Nokia, Motorola, Panasonic, France Telecom/Orange, TeliaSonera and Vodafone

Summary: The consumer behaviour has a significant influence on the environmental impacts of the product during its life cycle. For example, energy consumption in the use phase accounts for a major part of the life-cycle environmental impacts and is heavily dependent on the consumer behaviour. Consumers can significantly reduce the environmental impacts by making environmentally sound purchasing decision, by using products efficiently and by disposing the products at the end of their in-use life at proper collection centres.

Most companies are already providing information to the consumers on environmental issues. These issues are generally communicated through channels like web-site, product papers, verbal communication etc. For example, Nokia provides environmental information on its products through eco-declarations on its website¹⁷. Eco-declarations provide information on energy consumption, material use, packaging and documentation, battery and chargers, and disassembly and recycling issues. Information on environmentally efficient use of phones is also provided on Nokia's website¹⁸ and Nokia assists the consumers with information on the nearest sites where to return used phone and accessories through a recycling map¹⁹.

However, more efforts need to be put in this regard. Efforts coordinated with other stakeholders like NGOs, consumer organisations, retailers, recyclers, public authorities may yield significant environmental benefits.

Analysed by: BEUC and WWF

¹⁷ See Eco-declarations for Nokia's products at <http://www.nokia.com/A402834>

¹⁸ See <http://www.nokia.com/A402833>

¹⁹ See Nokia Recycling Map at <http://www.nokia.com/A4100012>

Summary: The background work initiating education programmes and issue specific campaigns requires the identification of focus issues. The communication on these issues should involve use of innovative ways in order to compete with other messages delivered all the time. To provide information on this is important from an early age.

BEUC: Education programmes on environmental awareness may have a positive effect, on consumer preferences, usage and disposal patterns, if the information reaches many consumers. The key issue for this option is ‘reaching’ the consumers.

Further research is needed into how this information should be delivered, where consumers want to get it, from whom and in what format, especially for consumers who are not really interested in environmental issues. It is also a challenge to get the information out to a vast geographical area, and to others than the already enlightened consumer. The education can be done in the form of awareness campaigns, special events like ‘recycling day’ where proper disposal is encouraged. The best effect will be accomplished when NGOs and the industry cooperate.

Important issues for awareness campaigns are 1) energy efficiency of the chargers 1) the environmental impacts of standby/no-load energy consumption of electronic products, and 2) benefits from recycling of phones²⁰ and proper treatment of materials of concern. It is possible to run these campaigns in the regions and countries where resources are available. Funds dependent on the scope of the work will be needed by BEUC to initiate this work.

WWF: According to WWF, whilst this is a feasible improvement option, there are potential short-comings with this kind of approach. ‘Increasing awareness’ is a nebulous target and very difficult to achieve with any lasting effects. The information will only reach a certain proportion of consumers within a country and will influence fewer. In addition, NGO activity would have limited geographic coverage, probably limited to national boundaries. The majority of consumers in the world are in countries without recognised NGO influence, this would seriously constrain the geographic reach of the potential improvements.

Reaching a wide geographic audience also requires significant investment of money. A period of at least 1 year may be required to develop a single initiative. Since consumer behaviour is usually influenced only for a short period of time, an ongoing commitment and continuous follow-up would be required to ensure maximum effectiveness of any initiative. The effectiveness of an initiative would also depend upon the availability and visibility of realistic solutions so that raised awareness could be translated into actions.

The success of any initiative would be magnified if done with agreement of, and in association with, phone manufacturers and network operators. Efforts would also be needed to coordinate with the marketing and retailing of mobile phones.

To get NGO commitment to such an initiative, the industry would need to demonstrate their long-term commitment to the environmental objective. This would include significant funding contributions so that an NGO could allocate its scarce resources. Even so, NGO involvement in such an initiative would most likely occur, only if it was part of a NGO’s current priority. It is emphasised that NGOs should not be considered as a resource to deliver on other people’s initiatives.

²⁰ Significant environmental benefits can be achieved from the recycling and recovery of precious metals from the mobile phones. For more details see stage I final report at:
http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

8. Study consumer behaviour from the perspective of buying, usage and disposal patterns

For: Research Institutions, Network Operators, Phone Manufacturers and Consumer Organisations

Analysed by: SYKE and Nokia

Summary: This option is related to the options 6, 7, 9, 10 and 11 in this section. It aims to study the behaviour of consumer and identify solutions on how it can be influenced so that the consumers buy products with better environmental performance, and use and dispose them in environmentally efficient ways. Presently there is a lack of research in this area.

The research could provide insights on how to influence consumer behaviour, what kind of information do the consumers actually need, how to provide this and in what form so that it is most effective. A time-frame of 1-3 years may be required for this research and the results may help in identifying and implementing solutions that yield some environmental benefits.

9. Develop consumer guides to advise the consumers on sustainable behaviour during use and disposal phase

For: Consumer Organisations, Phone Manufacturers and Network Operators

Analysed by: BEUC and Nokia

Summary: This option is related to the options 7 and 8 in this section. Raising consumer awareness on proper usage and disposal patterns requires that the information reaches all consumers. The consumers may have knowledge on the importance of being environmentally rational, but might not do anything about it until they are informed about what to do. This is an important option as the overall environmental impacts of mobile phones are dominated by the energy consumption in the use phase which depends heavily on the usage patterns and therefore consumers need to be fully aware of the difference they can make. Similarly significant environmental benefits can be achieved from recycling of phones if the consumers dispose their unwanted phones at the right collection centres.

Providing information in a user guide or in a separate brochure with the phone or in software can ensure that all consumers have access to the information. The information provided should be easy to understand and visible to the consumers. This option has an advantage in comparison to the option of carrying issue-specific awareness campaigns, as in this case information shall reach everyone rather than few consumers who get aware of the campaign, and who live in the right geographical area.

Global environmental benefits may be realised if consumer behaviour is influenced. The option may be implemented in a time period less than 1 year.

10. Research what incentives to consumers like money-back system, loyalty card reward points, ring tones, games, screen savers etc. could attract significant quantities of used/unwanted mobile phones; also assess the potential of deposit-refund scheme for mobile phones

For: Network Operators, Phone Manufacturers, Research Institutions and Consumer Organisations

Analysed by: France Telecom / Orange, TeliaSonera, Vodafone, SYKE and Nokia

Summary: The option aims to increase the collection rates of the unwanted mobile phones as the amount of such phones “at homes” is increasing. Presently only a fraction of the replaced phones enters the waste treatment facilities. This situation is mainly attributed to the consumer perception that a mobile phone is too valuable to give up for recycling (MPPI, 2004). Many consumers keep the old phone as backup and because of the ease of storing it. Significant environmental benefits may be realised if the number of unwanted phones collected and recycled can be increased considerably.

The research should be a co-operative project in which different stakeholders are involved so that their experiences can be utilised. There are also numerous programs in place on giving incentives to consumers to return their phones but no conclusive consolidation exists on what incentive system works the best, and which systems are best suited to be applied in different countries. At present, under the Mobile Phone Partnership Initiative the participants are setting up a number of pilots to test the developed best practice codes (MPPI, 2004).

This research could build upon the experiences and views of different stakeholders and the existing work. It can be expected that the results will increase the knowledge on consumer behaviour and on the drivers to increase collection rates of mobile phones leading to significant environmental benefits. A time frame of 6 months – 1 year may be required for this research results from which can be used to implement the next option.

11. Provide incentives, based on research findings, to consumers to return their unwanted mobile phones for recycling

For: Network Operators and Phone Manufacturers

Analysed by: France Telecom / Orange, TeliaSonera, Vodafone and Nokia

Summary: The option aims to increase the collection rates of the unwanted mobile phones and is based on the results of the research discussed in the previous option 10. In European countries, taking phones back is an ongoing activity for many operators and was started prior to the implementation of the WEEE directive through member-state legislation. In the EU, the consumers will also have possibilities to dispose of any waste electrical/electronic equipment after full implementation of the WEEE directive.

Some incentives are used by the independent take-back schemes currently in operation across Europe. These incentives vary depending on anticipated consumer preferences in a country/region and the type of service offered to customers (business to business or business to consumer). However, as the return rate is still low, emphasis is needed for developing more alluring incentives to encourage consumers to return their old phones.

The research results from the previous option on the best incentives and their suitability to different regions/countries will feed into this option. In addition, new and not yet existing options for the take back system will be explored if found more efficient. On the basis of this, better systems to offer incentives in different regions may be implemented. The option can be implemented in a period of 1-3 years and may yield significant environmental benefits due to the increased number of collected and recycled phones.

12. Further develop and standardise the KEPIs Approach for environmental assessment

For: Research Institutions, Phone Manufacturers, Component Manufacturers, Public Authorities and Standardisation Bodies

Analysed by: Nokia, Motorola and Panasonic

Summary: The stage I report discussed in detail the benefits of using KEPIs kind of approach for eco-design purposes in industry. KEPIs are a small number of product environmental performance indicators validated as representative of the most important environmental impacts of an electronic product's life cycle. KEPIs for mobile phones were derived on the basis of several LCA studies conducted by Nokia, Motorola, Panasonic and Philips and some new analyses (Singhal et al., 2004).

KEPIs type of approaches which account the physical and chemical characteristics of the components of product provide a good and simple assessment tool for use in the electronics industry as they are easy to use, require little time and only readily available simple technical data. This approach significantly reduces the reliance on the supply chain for data on material flows and allows the manufacturers to easily assess the relative environmental performance of their products. A full blown LCA can be done after regular periods in order to adjust the KEPI type indicators and to update the underlying data basis.

The further development and standardisation of KEPIs type eco-design approaches shall enable its widespread use within the industry and yield significant environmental benefits.

13. Develop tools for assessing the environmental and social impacts of different materials and substances

For: Research Institutions, Phone Manufacturers, Component Manufacturers, Recyclers, Environmental NGOs and Public Authorities

Analysed by: SYKE and Nokia

Summary: The manufacturing companies need a practical and useful tool to assess the environmental and social impacts of different materials and substances that they use or plan to use in their products. Presently there is a lack of reliable tool for this purpose.

Development of such a tool is necessary for the implementation of good design for environment (DfE) practices, identification and elimination of materials of concern, and use of materials that pose no significant environmental or social threats. Significant benefits may be realised if such a tool is developed and used for product development.

According to SYKE, the development of such a tool may require full Risk Assessment (RA)/Life Cycle Assessment (LCA) studies of different materials and substances with reliable impact assessment tools as background materials. There are several ongoing activities to improve the Life Cycle Inventory (LCI)/RA data of materials/substances and impact assessment methods. The aim of this research will be to find the best practices and to arrange/integrate different databases and tools in a practically usable way. The update practices, including data reliability, should also be developed. The research may require the input of 2-10 person working years depending on the scope.

The results of the research should lead to improved selection and use of environmentally preferable materials in the products and is critical in the development of products with better environmental and social performance over the entire life-cycle.

14. Provide life-cycle inventory data to phone manufacturers in line with the requirements of agreed environmental assessment methods/tools

For: Component Manufacturers and Recyclers

Analysed by: Intel, AMD and Epson

Summary: Life-cycle inventory data is required for assessing the environmental impacts of products and processes, and for identifying priority areas for environmental improvements. Before the actual environmental benefits of new improvement options, discussed in this report, can be verified, reliable data of the impacts of both the existing and suggested practices over the entire life-cycle of the products is needed.

Component manufacturers use select data to set environmental goals and targets, drive improvements in their operations and measure success against achieving environmental goals. However, such data collection can be extremely laborious and resource intensive. In addition, as with all life-cycle data and analysis, few standards exist to guide the collection or reporting of life-cycle inventory data, leaving the possibility for differing reporting and interpretation among companies. Finally, if boundaries are not set, life-cycle inventory data can be extremely broad, encompassing dozen of environmental variables and multiple layers in the supply chain, the value of which may be limited to both the component supplier and the final product manufacturer.

If undertaken as a regularly carried out practice in the supply chain, life-cycle inventory data collection should be focused to address specific environmental issues (e.g. energy consumption of components used, in manufacturing and use phase, in a final product). Open ended data collection will likely result in a high cost/low benefit to the supply chain and in turn, the final product manufacturer and consumer. However, when major changes are made in the products or processes, more comprehensive data collection and analysis will be needed.

Component manufacturers should participate in the development of the new assessment methods/tools discussed in this report. This would help them to prepare for the task and they could also share their expertise about the products and processes in question so that the chosen indicators will reflect the most relevant environmental aspects. If a standardised method is used for life-cycle inventory data collection, the task will be smaller and thus achieved sooner for the component manufacturers and also information will be more reliable and comparable.

Life-cycle inventory data collection warrants further study but its scope and purpose must first be clearly defined and should be in line with the requirements of agreed methods for environmental assessments. Such life-cycle inventory data should then form the basis for easy to use KEPI-type eco-design indicators, which can be used efficiently and effectively in the

eco-design work in the mobile phone industry. The “European Platform on Life Cycle Assessment” project started by the Commission shall address some of these problems²¹.

15. Develop transparent criterion for identifying the environmentally superior products and front-runners

For: Research Institutions, Phone Manufacturers, Component Manufacturers, Network Operators, Environmental NGOs, Consumer Organisations and Public Authorities

Analysed by: SYKE and Nokia

Summary: This option would be an important starting point for developing systems to identify the products with best environmental performance and to reward/acknowledge the front-runners as discussed in the next option 16. The criterion can also be used as a format for declaration of environmental facts on products by the manufacturers.

The criterion should be based on measurable facts and developed in co-operation between the industry and research institutions and approved by authorities, environmental NGOs and consumer organisations for the results to bring significant benefits. It should include relevant life-cycle environmental issues like energy efficiency and presence of materials of concern. A time period of six months - one year may be required for the development of this criterion.

16. Drive the work of environmental front-runners in industry by acknowledging them publicly, and encourage the laggards to improve

For: Environmental NGOs, Consumer Organisations and Public Authorities

Analysed by: Nokia, BEUC and WWF

Summary: As a background to this option there is a need to develop transparent criterion for identifying the environmentally superior products, front-runners and laggards as discussed in previous option 15.

This option is viewed as very effective from the manufacturers’ point of view as it can give a very strong incentive to the industry for improving its environmental performance. The NGOs and consumer organisations are generally trusted by the public and any recognition/acknowledgement of environmental front-runners by public authorities in collaboration with them would drive the environmental improvements in products. The European Commission has a few initiatives that are relevant in this context for example the work on performance targets²², the Sustainable Energy Partnership initiative²³, European

²¹ The Commission started the project “European Platform on Life Cycle Assessment”, which is running in its first stage until mid 2008. According to the Commission, this will be done with help of the methods to be developed, industry-based and stakeholder approved LCI data to be published and recommended impact factors to be developed, as well as a reliable review scheme to be designed and installed. This project will provide sound core data as the basis for such components and then stipulate the development and provision of component LCI data sets that are based on these core data and on the LCA methods, review process etc., which will be developed in that project, too. The project is hence expected to also provide consistent data for the electronic industry in the mid-term perspective until 2008/2009.

²² See <http://europa.eu.int/comm/environment/etap/index.htm>

²³ The European Commission has a similar initiative acknowledging frontrunners in the field of sustainable energy by developing an exclusive Partnership scheme for public and private actors. This is developed in the framework of the

Business Awards for the environment²⁴. However, an overall mechanism to reward frontrunners could be developed.

BEUC: This may not be one of the most effective options to reduce environmental impacts, though it is very important to give the front-runners positive attention so that they see their work is noticed and for stimulating further improvements. The industry needs continuous follow-up to keep the effect on publicity and encouragement.

Implementation of this option might not cost anything but the working force. For driving specific environmental issues with low performers funding for meetings/campaigns will be needed depending on the scope of the work.

The environmental and social benefits of this option are difficult to measure and will depend on the success of the scheme. If the laggards improve, there may be, for example, fewer materials of concern including hazardous chemicals in use. This will yield environmental benefits in both production as well as end-of-life phase.

The option requires dependence on the industry to provide environmental facts on products. BEUC does not have the competence to identify front-runners and laggards so external help will be required to assess the performance of the industry against the agreed upon criterion and this could be done through testing/market surveillance. BEUC prefers that an independent body identifies the front-runners.

Resources to gather environmental facts from the trade and to get into dialogue with the laggards will also be required. Global/Regional benefits can be achieved by implementing this option and a time span of 1-3 years may be required to implement it.

WWF: This is a feasible option for reducing the environmental impacts of mobile phones, but widespread effect would depend entirely on the mobile phone industry rising to the challenge. This activity is very relevant to WWF's work and is already ongoing. WWF has a number of initiatives²⁵ rating the performance of products within a sector.

Environmental NGOs are more concerned with criticising laggards than commending leaders. The 'stick' is usually found to be a more effective influencing tool than the 'carrot'. The stick is usually favoured since potential 'front-runner' companies are seldom good enough in all areas to justify public endorsement. Whilst it is feasible that front-runners could be publicly recognised, it is more likely that NGOs would publicly promote individual products or ranges

Sustainable Energy Europe 2005-2008 initiative. A campaign aiming to raise public awareness and promote sustainable energy production and use among individuals and organisations, private companies and public authorities, professional and energy agencies, industry associations and NGOs across Europe. The **Sustainable Energy Partnership** is one of the instruments of the campaign which offers a common European programme of visibility, giving greater strength and cohesion to European sustainable energy stakeholders and their initiatives. Private companies can also apply as Partner. They should demonstrate in their application their frontrunner actions and voluntary commitments to produce and promote more energy efficient products, use renewable energies, etc. Accepted partners receive many exclusive benefits such as: usage of the **Campaign logo**, invitation to actively take part in campaign events such as the forthcoming **European Energy Week**, invitation to take part in the **Campaign Award scheme**, **Media promotion** through fact sheets, video news releases, press releases etc, usage of the **Campaign network** to spread their achievements, receipt of an official Certificate from the EC, receipt of **promotional toolbox** (For more information see: www.sustenergy.org).

²⁴ See http://europa.eu.int/comm/environment/awards/index_en.htm

²⁵ For example see a league table of the top 10 domestic appliances at: www.topten.ch. A league table ranking the environmental performance of paper tissue manufacturers can be seen at: http://www.panda.org/about_wwf/what_we_do/forests/what_you_can_do/consumers/tissue_issues/tissue_results/index.cfm

of products – e.g. chargers or specific phone models, than a whole company. This is more appropriate as companies sell a wide range of phone models within a country and around the world, not all of which would warrant public recognition.

Another problem with relying on this approach to secure environmental improvements in phones is that NGO activity would have limited coverage, probably limited nationally, and the majority of consumers (needed to exert influence on manufacturers) in the world are in countries without recognised NGO influence. Also, since some manufacturers would not engage in the front-runner approach, a significant portion of phones would not benefit from environmental improvements. This improvement option should be considered in association with other options.

3.2 Medium Environmental Priority Options

1. Standardise the battery chargers (interfaces) for mobile phones

For: Phone Manufacturers and Network Operators

Analysed by: Nokia, Motorola and Panasonic

Summary: The objective of this option is to reduce environmental impacts arising mainly from the production of the chargers. The amount of chargers manufactured and sold could be decreased, if people do not buy a new charger every time they buy a new phone and, use the old charger instead.

The stage I report identifies that the environmental impacts from the production of charger account from 0.5% – 8% of the life-cycle impacts of the phone. The % varies with the environmental impact categories. In the case of energy, the manufacturing of charger accounts for approximately 7% of the life-time energy consumption of a phone. In addition to this, as chargers do not contain many environmentally significant components and materials, the environmental priority of this option is ranked medium. Unnecessary resource consumption should, however, be avoided by limiting the quantity of chargers.

Two different kinds of phone packages should be available in the market to limit the quantity of chargers sold a) Package containing only phone (chargers or any possible adapters/connector cables would be sold separately) and b) Conventional package in which the phone is bundled with the charger. The consumers will have a choice and they need not buy a new charger if they are replacing their existing phone.

Standardising chargers will ensure that they, irrespective of their manufacturers, can be used for charging any phones. Standardising chargers means that the connector interfaces and the output current/voltages of all chargers are same. Different chargers will still be needed for countries with different voltages and different sockets.

Table 3-1: Aspects of standardising the chargers (to decrease their consumption/production levels)

| Economic/Business Aspects | Environmental Aspects | Social Aspects |
|--|--|--|
| <ul style="list-style-type: none"> – Presently the performance of the chargers is aligned to the phone it comes with. The reliability of the phone may be affected if a charger from manufacturer A is used for | <ul style="list-style-type: none"> – The upstream environmental impacts from the production of chargers will decrease. – The consumers may buy cheaper pirated chargers if original chargers are not | <ul style="list-style-type: none"> – If the charger and the phone do not match then it may damage the phone. – There may be safety |

| | | |
|--|---|---|
| <p>charging phone from manufacturer B.</p> <ul style="list-style-type: none"> - In many cases it may be difficult to judge the reason for the faults in the phone when they arise. It may be difficult to know if the charger from the different manufacturer or the phone itself caused the fault. This may lead to liability issues for the phone manufacturers. - The standardisation may entail major costs for the manufacturers. - Standardisation of chargers may limit innovations. | <p>bundled with the new phones. This situation may lead to a significant increase in the environmental impacts as pirated chargers tend to have higher impacts in manufacturing and use phase as their production is not strictly monitored as it is for the official equipment.</p> <ul style="list-style-type: none"> - The existing trends show that the chargers are getting more and more energy efficient with time. Thus the use of older chargers which are relatively less energy efficient may not always be environmentally beneficial. | <p>concerns if the phone battery is charged with improper chargers.</p> |
|--|---|---|

This option can bring improvements that have a global reach. The development needs to be driven by front-runner companies to make sure that the standard charger has all the advanced features. Work is being initiated on this option through other forums with the use of micro-USB as standardised interface. Owing to this, in a few years many chargers may have common interfaces.

2. Reduce the use of beryllium and its compounds in the components

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: “Beryllium is not an absolute barrier to environmentally sound material recovery, but it is a consideration in selection of appropriate recovery processes and facilities” (MPPI, 2004). Technological solutions (may) exist for elimination of beryllium and its compounds in most of the current applications. However, there are definite issues with the availability of alternative materials.

A detailed study on the technological alternatives, their reliability, availability, and pricing needs to be carried out together with the material suppliers before this option can be implemented. If alternatives are suitable, positive environmental and social benefits may be achieved in the components manufacture and end-of-life phase. The period required to implement this option and the significance of the environmental benefits can only be judged after the detailed study has been carried out. If it is found beneficial, a voluntary agreement on this option between the phone and component manufacturers may drive it.

3. Explore the potential benefits of using Product Service System (PSS) model for mobile phones

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: This option also aims to increase the collection rates of the unwanted mobile phones. Implementing PSS may mean changing the existing model of phone ownership to phone rental. The customer will have to hand in the old phone when renting a new one.

Detailed investigation is needed to understand the implications of PSS on the present business models. Aspects like time required for implementing PSS, and significance of environmental benefits from it can only be identified after the investigation. This could be a research of a few years and if the outcome of this research is positive and significant environmental benefits can be realised, then the network operators could use PSS for mobile phones.

3.3 Low Environmental Priority Options

1. Reduce/Eliminate the use of halogen containing polymers in the plastics used for product packaging

For: Phone Manufacturers and Network Operators

Analysed by: Nokia, Motorola, Panasonic, France Telecom / Orange, TeliaSonera and Vodafone

Summary: This option aims to decrease the environmental impacts from packaging and encourage the use of environmentally preferable materials. In some regions, the packaging material may contain halogens in plastics due to the demands from the major business customers to have attractive see-through packaging. Even though the phone manufacturers have recommended the use of alternative materials, there are cases when the customers (generally non-European operators) still insist on using packaging with certain materials.

This option with global outreach shall yield environmental benefits related to elimination of materials of concern in the packaging and increased use of recycled materials but these benefits are little in comparison to the life-cycle impacts of the phone. The environmental benefit of other alternative packaging materials replacing PVCs should be evaluated in a life-cycle perspective.

The environmental impacts from packaging material are far less than 1% of the life-cycle environmental impacts of a phone. However, as phone manufacturers and operators have no control over what happens to the packaging after they have been sold the phone, it is important to make sure that packaging is made of materials that have no undue environmental impacts regardless of their use and disposal.

This option may involve the participation of big retailers and wholesalers in addition to network operators and phone manufacturers. The option could be implemented if the network operators, as major customers, around the world get in a voluntary agreement with the phone manufacturers to develop packaging solutions that use less and environmentally preferable materials. The elimination of halogens from packaging can be done within a time-frame of 6 months - 1 year after the approval from the customers.

2. Develop an assessment system for IPP purposes where the key business related factors are taken into account

For: Research Institutions

Analysed by: SYKE

Summary: The option aims to develop a system for policy makers by which they may assess the economic, environmental and social impacts of their decisions. The most important issues are to determine proper criteria, threshold values, and tradeoffs between different impacts. In general, it can be expected that the results will help to identify, which policies/strategies can get the best environmental benefits with the least economic/social costs. The assessment guidelines²⁶ used for the analysis of improvement options in this IPP third stage could be considered for this purpose.

²⁶ See assessment guideline used to analyse the improvement options in appendix B.

4. Improvement Options Underway - Ongoing

This chapter discusses the options, which are classified as ‘Ongoing’. For these options similar/related activities are already ongoing. These options are ongoing either as a part of normal business activities at least for some companies/organisations or there are, for e.g., voluntary project groups working on them.

The ongoing options are also given the environmental priorities of high, medium and low. For strengthening the ongoing work and making further significant improvements, impetus should be given to at least all the high priority ongoing options.

4.1 High Environmental Priority Options

1. Reduce the no-load power consumption of the charger

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The stage I report identified the no-load power consumption of the charger as a very significant life-cycle environmental issue for mobile phones. The no-load power consumption of the charger accounts for over 30% of the life-time energy consumption of a mobile phone (if the use period is assumed as 2 years and charger is plugged to the energy supply all the time).

Reducing the no-load power consumption has been a focus area for the mobile phone manufacturers for many years. There already exists a code of conduct ‘European Commission’s voluntary Code of Conduct on Efficiency of External Power Supplies’ (European Commission, 2004), signed by some interested companies, which provides targets for reducing the no-load power consumption. The phone manufacturers - Nokia, Motorola and Panasonic – participating in this pilot are, amongst others, signatories to this Code of Conduct²⁷.

Owing to this agreement, the no-load power consumption of chargers has significantly reduced over the past years. The chargers had a no-load power consumption of approximately 1.3 watts in 1999 in comparison to lower than 0.3 watts of the present generation of chargers. Further reductions are ongoing and chargers are being developed with no-load power consumption as low as 0.15 watts.

An alternative to completely eliminate the no-load power consumption, by adding an intelligent circuit in the charger which automatically switches the charger off when a phone is fully charged, was also evaluated. A charge with such a circuit will eliminate the no-load power consumption of the charger in use phase, but, at the same time it also will cause some increase in the environmental impacts in the manufacturing and use phase.

²⁷ See:

http://energyefficiency.jrc.ec.eu.int/pdf/Workshop_Nov.2004/PS%20meeting/Code%20of%20Conduct%20for%20PS%20Version%202024%20November%202004.pdf

NOKIA

Such a charger would require addition of a control/monitoring unit which consists of a few high impact components like PWB, IC²⁸. This will lead to an increase in impacts both in the production and in the use phase as the monitoring unit will itself consume some energy. The costs for manufacturing chargers with automatic off are also significantly high.

2. Reduce the amounts of precious metals in the components

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The stage I report identified Printed Wiring Boards (PWBs), Integrated Circuits (ICs) and Liquid Crystal Display (LCD) as the components with highest environmental impacts. The main reasons for the high impact of these components are a) the presence of minute amounts of precious metals like gold and palladium and b) the energy consumption of their manufacturing processes.

The phone and component manufacturers have a continuous focus on reducing the amount of precious metals in the components as a part of normal business activities because the costs of components are proportional to the amount of embedded precious metals. Moreover, miniaturisation and integration have resulted in continuous decrease in the amount of materials including precious metals in the phones over the years. At the same time the number of functions a mobile phone serves has also increased continuously.

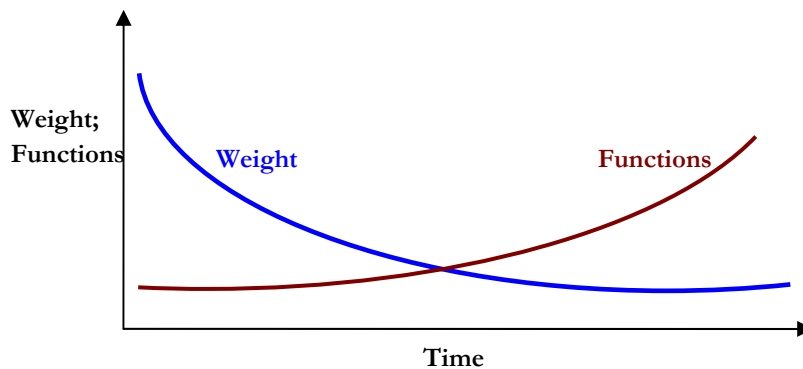


Figure 4-1: Effects of miniaturisation and integration on mobile phones over the years

The participating component manufacturers have also analysed this option to assess further reduction in the amount of precious metals by replacing them with materials that have lower environmental impacts from a life-cycle perspective.

Analysed by: Intel and AMD

Summary: Intel and AMD have analysed the options from the view point of ICs manufacturers. For any material reduction or replacement options, the analysis must include an evaluation of the replacements to these materials. At first glance, these improvement options may appear to be positive. However, without evaluating the alternative materials and

²⁸ The stage I report identifies PWBs and ICs as components with highest environmental loads.

their respective life-cycle impacts, it is impossible to state the net environmental benefit or to judge the priority of implementing these options.

For example, in ICs, gold wire is sometimes used to bond the silicon to the substrate material creating the necessary electrical connections to make the chip function. There are technologies that do not use gold bonding wires. An example of an alternative technology is flip-chip technology where the silicon is directly soldered to the substrate material using tiny solder balls. At first glance, this may appear to be a positive step from an environmental standpoint, due to reduction in the environmental impacts from mining and processing gold. However, flip-chip joints contain lead, which may not be preferable to using gold when judging the environmental impacts. Furthermore, gold is also being used as bonding wires in MCP (Multi-Chip Packaging) technology, where at least two silicon dies are combined into one package, thus decreasing the material demands of packaging.

Analysed by: Epson

Epson has analysed the possibility of replacing precious metals from the LCD module.

| Objective | Issues |
|---|---|
| Reduce the amount of Gold in LCDs | Alternative materials do not have comparable <ul style="list-style-type: none"> - Electrical conductivity - Resistance to corrosion - Stability and reliability of contact electrical connection, and - Reliability of long-term electrical connection. |
| Reduce the amount of Silver (for reflector plate) in LCDs | Alternative materials do not have comparable <ul style="list-style-type: none"> - Optical reflection - Reliability |
| Reduce the amount of Silver (for Solder) in LCDs | Silver based solder is the alternative to lead, which is banned. Another alternative has not been found yet. |

The component manufacturers suggest that an industry wide effort should be launched to find suitable alternatives to precious metals if this option is to be pursued further.

3. Optimise the number and characteristics of the high impact components like Printed Wiring Board (PWB), Integrated Circuits (ICs) and Liquid Crystal Display (LCD) with respect to their environmental impacts

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The stage I report identifies PWB, ICs and LCD as components in the phone with highest environmental impacts. This option suggests that the physical characteristics like size should be optimised so that the environmental impacts of these components are minimal. Some physical characteristics of these components are directly linked to their environmental impacts as suggested by the KEPIs approach (Singhal et al., 2004) discussed in stage I report section 3.4.

NOKIA

The trends of miniaturisation and integration over the years have already led to the optimisation of these high impact components. This is evident from the decrease in the size of the phones over the years. Moreover, these components are also very expensive and complex, so for e.g. reducing their numbers creates cost savings, increases reliability and quality, and supports many other crucial business targets. The optimising of number and characteristics of these components is a continuous product development challenge as a part of normal business activities.

4. Analyse the aspects of refurbishment of old phones

For: Research Institutions, Recyclers, Phone Manufacturers, Network Operators, Consumer Organisations and Environmental NGOs

Analysed by: Nokia, Motorola, Panasonic and Umicore

Summary: The refurbishment of phones increases the in-use life of a phone but there are several concerns related to it owing to which the net environmental benefits from life-cycle extension from refurbishment may not always be positive.

Most importantly the refurbished phones (may) contain materials no longer acceptable in products sold for example in the EU. These phones are, thus, sent for sale in the developing countries which mostly lack proper/any recycling infrastructure. At the end of their extended life the refurbished phones may be mismanaged in these countries leading to no recovery of metals and/or disbursement of materials of concern in the environment.

Some other critical issues related to refurbished phones include – these phones may not always function properly, they do not always meet the type approval criteria, they may have safety concerns, they can be unreliable, and can cause disturbances within the network. They may also have higher power consumption when compared to new phones, and may include components with restricted materials.

This option is partially covered in the Mobile Phone Partnership Initiative (MPPI)²⁹ under the Basel Convention, UNEP. MPPI is running a project on “Reuse of Used Mobile Phones” and is developing guidelines on refurbishing and recycling old phones safely and in an environmentally sound way. However, further research on analysing the various aspects of refurbishing may be useful.

5. Declare the material composition of components to the phone manufacturers

For: Component Manufacturers and Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: A detailed knowledge of the material composition of components is essential for design for environment (DfE) activities of phone manufacturers. It is also required for handling the manufacturing waste and used products at the end-of-life. Only if the phone manufacturers know what materials are present in the components they can evaluate and identify and eliminate the materials of concern. This information is also required for declaring

²⁹ For more information on Mobile Phone Partnership Initiative see <http://www.basel.int/industry/index.html>

any product related environmental facts to the consumers. As the knowledge of the material content is the basis for many improvement options with possible significant environmental benefits, this option is assigned a high priority.

Nokia and other manufacturers are making continuous efforts to identify all the materials in the components of their phone. The information on material contents helps to act proactively and systematically phase out materials that are identified to have adverse effects. Nokia is actively working to standardise the process of materials declaration and is the main sponsor for the industry's joint initiative 'RosettaNet'³⁰ to develop e-business tools for exchange of product information between producers and suppliers. RosettaNet will result in the integration of information about the material contents of the products with the business-related information. A business agreement between the phone and component manufacturers on using a standardised approach for material content declaration will be useful.

Analysed by: Intel, AMD and Epson

Summary: Today, many component manufacturers make material content information of their products available to customers on their websites³¹. However, a standardised procedure is needed for full/necessary material content declaration and information exchange.

There are several standards, which have been developed or are under development for material content reporting. Four efforts of significance include:

- EIA, JEDEC, JGPSSI Joint Industry Guide - A list of materials and substances to be disclosed as a minimum by suppliers;
- IPC Draft standards 1751 & 1752;
- IEC TC111 WG1 – newly formed committee to develop an international standard for material declaration;
- RosettaNet Material Composition PIPs (2A13 & 2A15) and upcoming version for small enterprises.

6. Use Environment Management System (EMS) ISO 14001 based to reduce the environmental impacts in the manufacturing phases

For: Component Manufacturers and Phone Manufacturers

Analysed by: Intel, AMD, and Nokia

Summary: The components manufacture phase was identified as one of the main contributors to the life-cycle environmental impacts of mobile phones. The energy consumption of the manufacturing processes accounts for the majority of the impacts from

³⁰ For more information on RosettaNet initiative see section 4.4.3 in stage I report at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf, and <http://www.rosettanet.org>

³¹ An example of such can be found on the Intel website at: <http://developer.intel.com/design/PACKTECH/packbook.htm> (Chapter 17), as well as at http://www.amd.com/us-en/assets/content_type/DownloadableAssets/04packagematerials3.pdf at AMD website.

this phase. By using EMS, the environmental impacts from the manufacturing phase can be decreased significantly. The Chapter 3 in the stage II report discusses some of the results achieved by the participating component manufacturers by using EMS.

All the phone and component manufacturers participating in this pilot are using EMS for their operations. The phone manufacturers through their supplier requirements also mandate the use of EMS by suppliers, for example the Nokia supplier requirements state that the suppliers, including component manufacturers, shall have a documented Environmental Management System to ensure effective planning, operation and control of environmental aspects. This Environmental Management System shall satisfy the requirements of ISO 14001 or other internationally recognised standard. Continuous improvement efforts shall be addressed within the Environmental Management System.

The use of environmental management systems or environmental, health and safety (EHS) management systems offers significant opportunities for EHS improvements. This is true for the following reasons:

- A broad range of activities can be undertaken via EMS or EHS systems;
- These systems encourage continuous improvements to products and processes.

The programs allow component manufacturers the flexibility to address EHS issues unique to their operations. For example, for an IC manufacturing plant in a heavy populated city with air quality issues, the most important focus area may be to reduce volatile organic compound (VOC) emissions. In an arid region with limited water supply, the focus may be on to water use reduction, conservation and recycling. The use of EMS and EHS systems with quantitative improvement options allows such flexibility and does not assume a “one size fits all” approach. To both maximise their benefits and to be a credible improvement option, EMS and EHS systems should include quantitative goals or measures that are transparent to the regulator and general public³².

7. Collect data on the health and environmental effects of process chemicals used in manufacturing and the substances embedded in the components

For: Phone Manufacturers and Component Manufacturers

Analysed by: Intel, AMD, Epson, Nokia, Motorola and Panasonic

Summary: For process chemicals this option has been business as usual for a long time. For materials and substances embedded in components, work is underway on a continuous basis. The option requires continual cooperation with raw material suppliers and sufficient hazards identification and risk evaluations. REACH may have a significantly influence the availability of data on the chemicals and substances.

8. Increase the energy efficiency of the network infrastructure

³² Examples of EMS systems used to drive environmental improvements by setting transparent goals and targets can be found at: <http://www.intel.com/intel/other/ehs/goals.htm> & http://www.amd.com/us-en/Corporate/AboutAMD/0,,51_52_531,00.html

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Increasing energy efficiency of the network infrastructure is an ongoing activity for the network operators for both environmental and economic (cost) reasons. When analysing the overall energy consumption for the network infrastructure (i.e. its distribution between network elements) the energy consumption of the Base Transceiver Station (BTS) comes out to be the most significant.

Overall, network operators are working with suppliers to try and make energy efficiency gains associated with areas such as cooling, free cooling and on the technology side (such as remote radio head and energy consumption). Minimising energy consumption is a continuous activity for network equipment vendors as it has a direct impact to heat management, reliability and physical design of the network infrastructure products.

Reducing energy consumption on a BTS site level can be done in many ways, e.g.:

- Increasing efficiency of the power amplifiers
- Cooling solutions
- Studying and identifying overall Radio Frequency (RF) chain efficiency improvements including antenna solutions, feeders, BTS equipments, radio heads

Advanced solutions for improving energy efficiency by any one network operator will be generic and can benefit other network operators. This includes system level standardisation in order to enable interoperable solutions across different equipment vendors. This is where standardisation forums have proved essential for improving energy efficiency through sharing knowledge and good practice.

Other strategic considerations for reducing/optimising energy use, is to influence the RF characteristics of a network which in turn influence the overall network design and therefore the number of BTSs needed. This is a longer term solution and challenging direction to take for energy efficiency because of the range of other technical, operational, social and environmental factors that have to be considered in network design.

9. Exchange information on materials and substances in the phone that may cause environmental or OH&S concerns during recycling operations with recyclers

For: Phone Manufacturers and Recyclers

Analysed by: Nokia, Motorola, Panasonic and Umicore

Summary: The general requirement for any holder of waste to be informed about and provide information on the content and nature of the waste to any contracted third party is an integral element of operating according to the present waste and product liability regulations in the EU. This is further emphasised as a requirement in the WEEE (2002/96/EC).

In this regard, EICTA (European Information & Communications Technology Industry Association), CECED (European Committee of Domestic Equipment Manufacturers), AeA

Europe (American Electronics Association Europe), and EERA (European Electronics Recyclers Association), have established the conditions for a sustained dialogue between producers and recyclers based on agreed items of interest for a better handling of WEEE³³:

- “Each producer creates an access point for recyclers to post questions in relation to their products, for example an alias to be used on the producer's internet site, or via the organisation in charge of managing the producer responsibility, of which they are a member.
- Producers track information on agreed, specified components and materials used in their equipment on the basis of “positive presence” at product level or product family level.
- Producers and recyclers contribute via above-mentioned associations to a constructive and sustained dialogue to discuss past and future technology trends in products as well as the technical evolutions of treatment operations so as to update guidance as appropriate.”

Nokia, like many other phone manufacturers, has dialogue with recyclers in order to be able to decide which processes are most suitable for its products and to determine whether changes are needed in product design in order to facilitate better recycling. Some material bans have already been established based on the information sharing with recyclers, one example of such a material is Beryllium Oxide, which is now banned from use in Nokia phones.

10. Ensure that the collected unwanted phones are sent to appropriate recycling plants and are properly treated

For: Phone Manufacturers, Network Operators and Public Authorities

Analysed by: Nokia, Motorola, Panasonic, France Telecom/Orange, TeliaSonera, Vodafone and Umicore

Summary: This option discusses the activities that take place after the take-back/collection of the phones. Effective recycling closes the life-cycle loop and returns energy and materials back to the circulation. Making sure that unwanted phones do not end up in landfills or other inappropriate waste streams is one of the current environmental focus areas for the mobile phone industry and there are several initiatives ongoing that aim at ensuring proper take-back and recycling practices.

According to Umicore, downstream monitoring requires a good understanding of recycling technologies in order to be able to identify the right operations. Auditing of recyclers and downstream monitoring should follow the material streams until the final recovery step. In this context, especially the recovery of precious and non-ferrous metals should be checked critically, both in terms of environmental compliance of the operation as well as on eco-efficiency and recovery yields that are achieved.

Downstream supplier management is an established practice for many manufacturers and network operators. For example, Nokia has evaluated and selected suitable take-back channels in different regions. Nokia has also chosen approved recyclers to be used based on assessments made on their performance. These assessments include recycler requirements and audits. The purpose of the assessments is to ensure that Nokia selects, assesses and

³³ See <http://www.eicta.org/press.asp?level0=1&level1=6&level2=42&year=2005&docid=575>

makes contracts with recycling companies, which are certified, comply with relevant legislation and fulfil Nokia requirements.

11. Provide scientific inputs to the public authorities on key environmental areas and key industrial sectors where major environmental improvements can be made

For: Research Institutions

Analysed by: Finnish Environment Institute (SYKE)

Summary: The aim of this research is to integrate the existing initiatives, data and methodologies in order to create an overview. One of the key issues is to determine the possibility of major environmental improvements in industrial sectors with highest environmental impacts and to focus on these in order to achieve the maximum benefits. The background work for this option includes development of economic input-output (IO) tables in different countries, life-cycle inventory databases, hybrid LCA-IO methodology etc.

The EC has started work on identifying the products with the greatest potential for environmental improvements within the IPP framework. The EIPRO project³⁴ carried by DG JRC is presently in its first stage, and identifies products with the greatest environmental impact from a life-cycle perspective. The DG JRC has also carried out a study on environmentally extended input-output tables and models for Europe. Based on findings of this study, further research might be carried out in this area. It should be ensured that the results of such studies when suitable are utilised when determining focus areas for example for environmental regulations.

In addition, a project proposal for assessing the environmental impacts of Finnish economic sectors has been made by the initiative of sustainable consumption and production committee in Finland. In this project, both impacts in Finland and abroad will be assessed.

4.2 Medium Environmental Priority Options

1. Provide possibilities for upgrading the phone software and downloading applications from remote locations

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: Mobile infrastructure and operating systems are continually developing. With operating system upgrades new network features can be added by consumers to an old mobile phone. One emerging technology that allows users to download the latest firmware for their mobile device and update the firmware from anywhere is the Firmware Over-the-Air (FOTA) update technology. FOTA is sometimes referred to as Over-The-Air (OTA). FOTA could also be looked as content downloading into mobiles.

³⁴ See EIPRO details at: <http://europa.eu.int/comm/environment/ipp/identifying.htm>

The upgrading of the software in phones provides more functions and better service options. Consumers no longer need to take their mobile phone to a repair centre when they experience problems due to its operating system. This could also extend the phone's in-use life by enabling new features and lead to environmental benefits. Content could be downloaded on the mobiles through OTA or Over-The-Internet (OTI). OTA allows users to download firmware/applications over the air, whereas OTI allows users to download firmware/applications through an Internet connection.

Network Operators and Mobile phone manufacturers are beginning to introduce FOTA technologies, which enables users to do software upgrades. From 2007, this technology should be a standard functionality for mobile phones of at least the middle and higher price ranges.

2. Integrate more functions in the phones so that they can substitute other products

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The convergence of the telecommunication, consumer electronics, internet and wireless technologies has led to an increase in the functionalities of a mobile phone. During the last few years, the mobile phones have been (and continue to be) in a transition phase from 'communication terminals' to 'multiple-use mobile terminals'. Figure 5.1 identifies these trends.

The development of multiple-use mobile terminals creates a substitution effect and has the potential for consumers to satisfy their needs by buying one, instead of many electronic devices thereby reducing the environmental impacts by reduced use of resources. The actual environmental benefits depend on a) the ability of these features to perform well enough to replace other products without causing new environmental burdens and b) on how consumers substitute the need of buying/using several products by buying/using a single integrated product.

Some trends in line with this transition include integration of functions like text messaging, alarm clock, games, Internet browser, music player, radio, digital TV receiver, still and video camera, personal digital assistant (PDA), global positioning device, business application packages for creating and reading documents, video conferencing, and possibility to make payments at shops and bank transactions by phone.



Figure 4-2: Trends in digital convergence

3. Include environmental criteria in the technical specifications to select providers of mobile phones

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: To help contextualise this option further and consider the possible options open to the operators, the following has been identified as possible criteria that could be included in technical specifications:

- asking for description of the general approach to environmental management as part of request for proposal;
- ask questions about mobile phone design, energy efficiency of charger and end-of-life;
- requesting standardisation of accessories (at the least by the same manufacturer);
- requesting provision of relevant environmental information in the user guides

This work is ongoing by operators individually and at an industry level through the supply chain initiative of GeSI³⁵ (Global e-Sustainability Initiative backed by UNEP).

4. Make provisions for availability of spare parts and accessories of old mobile phones

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

³⁵ See <http://www.gesi.org/activ/representing.htm> for more information

Summary: The objective of this option is to provide solutions to the consumer so that the damaged/dysfunctional mobile phone can be repaired and in-use life of a phone prolonged. This is an ongoing activity for the phone manufacturers under their customer care initiatives. There are also existing regulations which oblige the product manufacturers to ensure the availability of spare parts for a specific time period.

5. Implement a system for assisting suppliers to lower their environmental impacts

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The components manufacture phase was identified as one of the biggest contributors to life cycle environmental impacts of phones.

Effective supply base management processes are important to encourage suppliers to minimise the environmental impacts of their components. Providing clear guidance on the restriction of hazardous substances to component suppliers is one example, as component suppliers must be able to meet the substance restriction requirements in order to supply. In addition, setting Design for Environment supplier requirements encourages the supplier to consider how to best include environmental criteria within their own product development work. Supplier requirements on Environmental Management Systems are crucial to ensure that the companies are addressing the impacts associated with their manufacturing processes.

Other responsible companies are following similar voluntary guidelines, as an example of this is the Electronics Industry Code of Conduct which aims at ensuring that working conditions in the electronics industry supply chain are safe, that workers are treated with respect and dignity, and that manufacturing processes are environmentally responsible³⁶.

6. Provide a preferential supplier status to suppliers with low environmental impacts

For: Phone Manufacturers and Component Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: As part of supply base management processes, suppliers can be awarded with different levels of status according to their performance and ability to meet or exceed customer requirements. This status can then be used as help for informed purchasing decisions and to encourage continuous improvements. For companies managing a large supplier base this can present certain challenges that depend on the way in which the suppliers are assessed.

At present, there is no system in use to evaluate the environmental impacts of the suppliers due to non-availability of a viable & reliable method, apart from checklists, to do it. In Nokia, the environmental performance of the suppliers is assessed against its environmental

³⁶ For example see <http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/supcode.pdf>

requirements for suppliers³⁷. These requirements include environmental requirements and ethical considerations for labour conditions.

7. Share base stations with other service providers to reduce the energy consumption and ensure that they are used up to their peak capacities

For: Network Operators

Analysed by: France Telecom/Orange, TeliaSonera and Vodafone

Summary: In general, network operators do currently share base stations with each other in countries where local planning regulations allow. The network operators regard energy optimisation as an ongoing business activity for environmental and economic (cost) reasons. However, there are some constraints to sharing base stations for the purpose of reducing energy consumption.

Further investigation is needed whether sharing of base stations leads to anticipated energy efficiencies and whether there are broader operational or technical solutions for optimising energy use.

Reducing energy consumption through site sharing is an option in countries that support site sharing activities. Country policy with respect to site sharing can vary for different European countries. For instance, the UK planning authorities support site sharing to reduce the number of stand alone base stations. However, in France, planning authorities can advise network operators against site sharing because of a detrimental visual impact on the local environment. Since, site sharing often involves wider and taller sites to manage the equipment from different operators without interference from each other.

Work on improving the energy efficiency of network equipment does lead to shared benefits. One operator expects to increase the efficiency of network equipment on shared sites and hope to gain up to a 25% improvement over the coming years.

There are one or two unusual examples where operators have shared the construction of a common network. One network operator recently undertook a unique joint venture in Australia where they have shared the construction and operation of a network with a competitor. This was only feasible due to a market and geography size which made the cost for network build and operation extremely high. This is regarded as a unique experience, leading to reduced costs for network operators and where network coverage becomes less of a differentiator.

8. Use renewable energy sources for powering network infrastructure

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: The use of renewable energy can lower the environmental impacts from the energy consumption of the network infrastructure. In most countries, renewable energy

³⁷ See Nokia Supplier Requirements at http://www.nokia.com/link?cid=EDITORIAL_788

makes up a very small proportion of overall electricity supply. It is possible to purchase electricity from renewable sources, such as wind, solar power and energy from waste, although availability is limited in some countries.

Generally, it is not cost-effective to install solar panels at base stations, except in sunny locations and where there is a limited electricity grid. Wind power is also not currently cost effective to install. The network operators are putting efforts to use renewable energy in countries where it is possible to do so³⁸. However, further investigation could be done on countries where the use of renewable energy is feasible.

9. Carry research on what end-of-life management techniques may yield most environmental benefits

For: Research Institutions, Phone Manufacturers and Recyclers

Analysed by: Nokia, Motorola, Panasonic and Umicore

Summary: Producers as well as recyclers have made numerous studies in this area. The research has assisted in knowing the processes that yield most environmental benefits in the end-of-life phase. Research covers the whole chain from optimising collection methods for next step of treatment to best pre-treatment methods for present and future scenarios of recycling technologies. Some of the research results include:

- Arnaiz, S., Bodenhofer, K., Harrison, D., Herrmann, C., Hussein, H., Irasarri, L., et al. (2004, September 6 -8). *Active Disassembly using Smart materials End-of-life Technology for WEEE - Results from the Framework V project*. Paper presented at the Electronics Goes Green 2004+, Berlin.
- Arnaiz, S., Bodenhofer, K., Constantin, H., Hussein, H., Irasarri, L., Schnecke, D., Tanskanen, P. (2002), *Active Disassembly Using Smart Materials (ADSM), a status report of the ongoing EU project*, Care Innovation, Vienna
- Falcon, V. (2001). *Recycling of plastics from mobile phones*. Helsinki University of Technology, Helsinki.
- Leskinen, K., Tanskanen, P., Takala, R., & Ahonen, H. (2003). *Disassembly of Mobile Phones with Induction Heating*. Paper presented at the International Electronics Recycling Congress ICM, Basel.
- Takala, R., & Tanskanen, P. (2002). *Outlining Opportunities of Engineering Processes and Technology on Environmental Impacts of the End-of-life Treatment of Mobile Terminals*. Paper presented at the IMAPS Nordic Annual Conference, Stockholm.
- Takala, R., & Tanskanen, P. (Submitted). A decomposition of the End-of-life process. *Journal of Cleaner Production*.

³⁸ For e.g. in 2004-2005, 11% of Vodafone's energy came from renewable sources. This figure includes company-owned renewable power units and specifically purchased wind and renewable energy.

- Huisman, J. (2004). *QWERTY and Eco-Efficiency analysis on cellular phone treatment in Sweden*. Delft: Delft University of Technology.
- Hageluken, C., Kerckhoven, T. (2006). *Coping with the challenges in WEEE recycling by using state-of-the-art smelting & refining processes*. Paper presented at the 5th International Recycling Congress, Hamburg

In addition, the Mobile Phone Partnership Initiative (MPPI)³⁹ under Basel Convention, UNEP is running a project on “Recovery and Recycling of End-Of-Life Mobile Phones” which looks at similar aspects.

10. Develop guidelines on best available technology (BAT) & best environmental practices (BEP) for mobile phones

For: Research Institutions and Recyclers

Analysed by: Umicore

Summary: The Mobile Phone Partnership Initiative (MPPI) under Basel Convention, UNEP is running a project on “Recovery and Recycling of End-Of-Life Mobile Phones”, which looks at similar aspects and identifies the best practices. Mobile phone operators will soon be piloting recycling guidelines developed by mobile phone manufacturers under the MPPI.

The main conclusions for recycling of mobile phones include:

- Consideration of eco-efficiency aspects;
- Avoid deep manual/mechanical dismantling unless it can lead to real environmental, health and safety benefits;
- Evaluate and monitor output streams and health impacts from recycling operations (off-gas, effluents, wastes);
- Largest environmental benefits come from recycling of precious metals so focus on the overall yields that can be achieved in their recycling.

11. Assist governments / authorities in identifying areas where voluntary measures can be promoted & where legislation may be needed

For: Research Institutions

Analysed by: Finnish Environment Institute (SYKE)

Summary: Many R&D institutions in Europe (e.g. SYKE) have continuous activities in this area, but further activity is needed in order to ensure that the findings are taken into use.

³⁹ For more information on Mobile Phone Partnership Initiative see <http://www.basel.int/industry/index.html>

4.3 Low Environmental Priority Options

1. Use bio-based materials in the phones

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: Bio-based materials can be used for the covers of the mobile phones and in the product packaging. This improvement option has a low environmental priority as the plastic covers in mobile phones account for 0.2 - 0.6% of life-cycle impacts of the phones as identified in the stage I report. Bio-materials may help in reducing these impacts, but further research is still needed in order to clarify the actual life-cycle environmental benefits. The plastic covers currently used in mobile phones⁴⁰ do not contain any flame retardants or materials of concern, so there is no urgent need to replace the material without solid knowledge of the benefits.

Biomaterials are defined as biodegradable and bio-based plastics or composite materials that meet the following criteria:

- Material is non-toxic and harmless to human beings and to the environment;
- Origin of the material must be renewable;
- Organic portion of the material degrades in compost conditions under the influence of water and/or microbes into natural, harmless degradation products.

The mobile phone manufacturers are presently researching the use of bio-based plastics for mobile phones and packaging. Nokia's research results on use of bio-plastics for mobile phones were recently discussed in Bioplastics 2005 conference (Helminen, 2005).

Presently manufacturing issues related to reliability, endurance, as well as the availability and suitability of these materials for mass production are under evaluation. The environmental benefits of using bio-based materials are also not clear yet. Several studies have been made to assess the impacts of bio-based materials but no general statement can be made. "For the time being, it is not possible to make a concluding general judgment whether bio-based plastics should be preferred to petrochemical polymers from an environmental point of view" (Patel & Narayan, 2005). Scientific studies are still needed to show the difference over the entire life-cycle between plastics from renewable resources and oil based plastics.

2. Reduce the size and mass of the product packaging

For: Phone Manufacturers and Network Operators

Analysed by: Nokia, Motorola and Panasonic

Summary: The environmental impacts from packaging material are far less than 1% of the life-cycle environmental impacts of a phone due to which this option has a low priority. The size and mass of the product packaging has been reduced by all the manufacturers over the years.

⁴⁰ The plastic covers of Nokia mobile phones do not contain any flame retardants.

Nokia, for example, has reduced the package size for its products wherever possible, and in regions where it is acceptable by the market social behaviour (customer perception of product through the packaging).

Until year 2004, Nokia had a package measuring 190 x 140 x 74 mm as its smallest standard size sales package. This package size was and is still much used for products where the sales package carries the necessary accessories (mobile phone, charger, battery and user guidance manual). The packaging materials in this package consist of a corrugated carton box and as a standard in Europe, Africa, Gulf, Asia Pacific and China a moulded pulp part holding tray. This package has the volume of 1969 cm³ and its packaging materials weigh 95 grams.

In 2004, a new smaller package standard size was launched for use in Nokia. This package type has since then been used in Europe, Africa & Gulf for many products. The new small package consists of a corrugated cardboard box and a thermoformed plastic insert. This package measures 140 x 140 x 76 mm, has the volume of 1490 cm³ and the packaging materials weigh 77 grams.

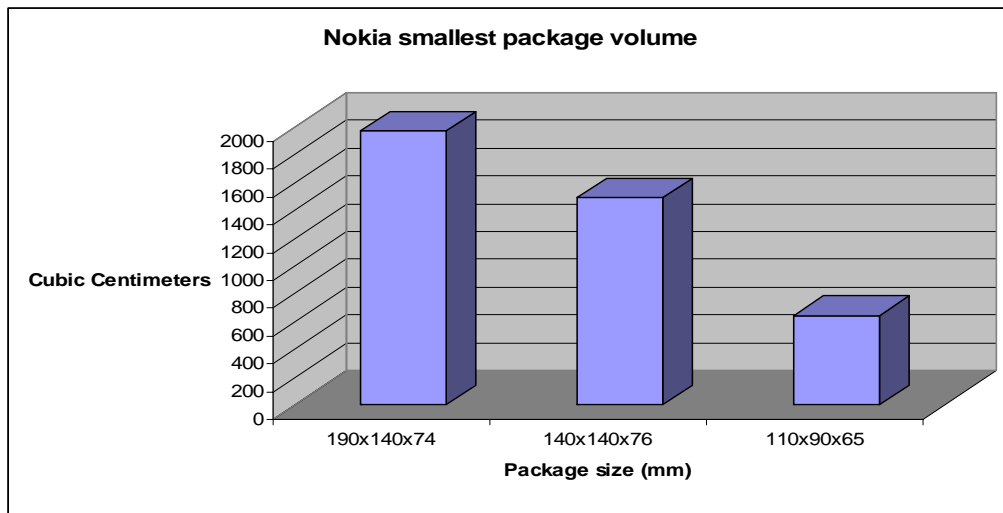


Figure 4-3: Development of smallest Nokia standard package size and volume (cc)

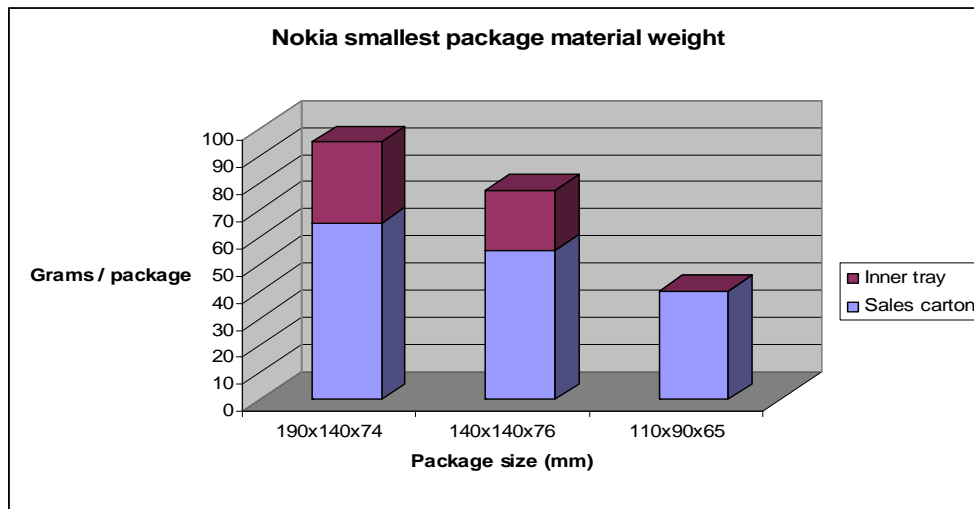


Figure 4-4: Development of smallest Nokia standard package weight (grams)

Nokia has ongoing development to reduce package size further and additionally to eliminate need for a product holding tray in a new package design targeted for the low tier products globally, as can be seen in the figures above. These activities reduce the environmental impacts from raw material acquisition phase and from transportation phase.

3. Develop cooperation with industry to develop environmental technologies

For: Research Institutions and Public Authorities

Analysed by: Finnish Environment Institute (SYKE) and Nokia

Summary: Environmental technologies are those technologies which do the same thing but in comparison to other similar technologies they have less environmental impacts.

The desirability of this kind of cooperation depends on the openness of the cooperation process. Although all industrial actors cannot take part in such cooperation, they should have the possibility to follow it. The content and costs of research varies from case to case. In general, it can be expected that the results of implementation can lead to suitable/positive economic and environmental impacts.

Work is already ongoing on this option, e.g. the European Commission is stimulating the development and uptake of environmental technologies through Environmental Technology Action Plan (ETAP)⁴¹. ETAP is composed of actions around three main themes:

- Getting from Research to Markets;
- Improving Market Conditions;
- Acting globally.

⁴¹ See details of ETAP at: <http://europa.eu.int/comm/environment/etap/>

5. Improvement Options Currently Discounted - Disqualified

This chapter discusses the options that cannot be implemented as of now according to the participating stakeholders. These options are either not feasible yet or they have insignificant/unknown environmental benefits or they have adverse social or economic impacts. The options may become feasible to implement in the future and should be reviewed again at a later date when more solutions are available.

5.1 Medium Environmental Priority Options

1. Develop chargers that use different energy sources like kinetic, solar and make them main stream products

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The impacts from energy consumption in the use phase of phones can be reduced by using solar or kinetic chargers but there are usability problems with such chargers and they are not yet practical for normal day-to-day use. Solar chargers need good amount of sunlight to be used and kinetic chargers require winding for a very long time to charge the batteries. The manufacturing costs of such chargers are also very high in comparison to the normal chargers.

Due to the practical limitations of kinetic or solar chargers most consumers use them only when they are doing outdoor activities and are away from a source of electrical energy. These consumers generally possess two chargers a) a conventional charger, and b) a solar or kinetic energy powered charger. The increased consumption of an additional charger causes increase in environmental impacts in the manufacturing phase.

Many companies have carried research in this area and there already are some solar/kinetic energy powered chargers in the market.

2. Develop modular structure for mobile phones to enable upgrading of hardware as long as technically possible

For: Phone Manufacturers

Analysed by: Nokia, Motorola and Panasonic

Summary: The in-use life of a phone could be prolonged if the consumers have the possibility to replace/update the hardware according to their needs and preferences. Presently the consumers have possibilities to replace the covers and the batteries of the phones.

The fast technological evolution and increase in the number of functionalities in mobile phones make the design of modular hardware interfaces over different product generations practically impossible.

In addition, new generation products are generally more environmentally friendly than older generation products, for example several materials of concern have been phased out and newer products are also designed to be more energy efficient.

3. Untie the mobile phones from the network

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: The option aims to increase the in-use life of a phone. In many cases when users have to change their service providers they also need to replace their existing phones as they cannot be used on other networks. Only after a certain period of time the consumers can get their phones untied from the existing network.

The feasibility of this option varies country by country. This option is currently governed/influenced by telecommunication licensing and competition rulings in European countries. Phones that are linked to a network represent promises of high quality and service related to a particular network at a competitive price. If phones had to be tested on all networks prior to selling to customers this could lead to an increase in costs for customers. Such increases would affect different population groups differently but could make access to telecommunications less accessible for some population groups.

In addition, the possible environmental benefits from untying phones i.e. fewer phones in circulation and therefore fewer phones that need to be manufactured, assumes that consumers wouldn't necessarily be interested in purchasing the latest model. Given the market research carried out by the operators in European countries into market/customer segments this is not necessarily a valid assumption.

4. Stimulate demand for environmentally superior phones by providing cheaper tariffs for them

For: Network Operators

Analysed by: France Telecom / Orange, TeliaSonera and Vodafone

Summary: For implementing this improvement option first a transparent, measurable and verifiable criteria for identifying mobile phones with superior environmental performance (as discussed in section 3.1 - option 15) should be developed in cooperation with stakeholders. The option requires a basic change in the tariffs structure. Currently the tariffs are based on the usage profile of the phones rather than the phone itself i.e. the amount of calls made and data sent across the network.

5.2 Low Environmental Priority Options

1. Develop in-house competence to identify the key areas where efforts should be directed

For: Environmental NGOs, Consumer Organisations

Analysed by: WWF & BEUC

Summary: The environmental benefits may be achieved from this option if the NGOs and consumer organisations can direct their efforts for the promotion of right solutions. In order for the criticism to be valid and efforts pointed in right direction NGOs and Consumer Organisations should make sure that they have enough competence for assessing the environmental and social impacts of the products. However, the capacity of NGOs for such specialised tasks is very limited. It is thus better to hire external consultants for these tasks whenever required.

6. Policy Tools

This chapter discusses the policy options that can be used to stimulate sustainable production and consumption patterns for the mobile phones product group. The policy tools are discussed considering IPP principles and the life-cycle environmental issues of mobile phones.

“TPP approach is built on five key principles:

- *Life-Cycle Thinking*
- *Working with the market*
- *Stakeholder Involvement*
- *Continuous Improvement*
- *A Variety of Policy Instruments”* (Commission of the European Communities, 2003)

For mobile phones the most important life-cycle environmental issues as identified in the IPP Stage I report include - energy consumption in the components manufacturing phase, no-load power consumption of the charger in the use phase, presence of some materials of concern⁴² in phones, collection of unwanted phones and their recycling. From the perspective of a mobile system⁴³, the energy consumption of radio base stations during the use phase is most significant. There are impacts in other areas too but their contribution to life-cycle impacts is relatively less.

The size, weight and energy consumption of mobile phones are already optimised as there are driven by business/customer requirements. Therefore, this chapter explores policy solutions in the high life-cycle impact areas for mobile phones looked in relation to the environmental improvement options of high importance discussed previously in the report. Due to time constraints only significant environmental impacts are covered in the scope of this report.

Several different kinds of policy tools ranging from information-based strategies to regulatory instruments may be used to stimulate the environmental improvements in products. Many of these tools can be seen in the figure below.

⁴² These materials may be released in the environment from landfills, incinerators and recycling facilities if the EoL treatment is not carried out properly.

⁴³ A mobile system consists of mobile phones, a radio network with radio base stations and radio network control equipment, and a core network with switches, routers, servers and workstations.

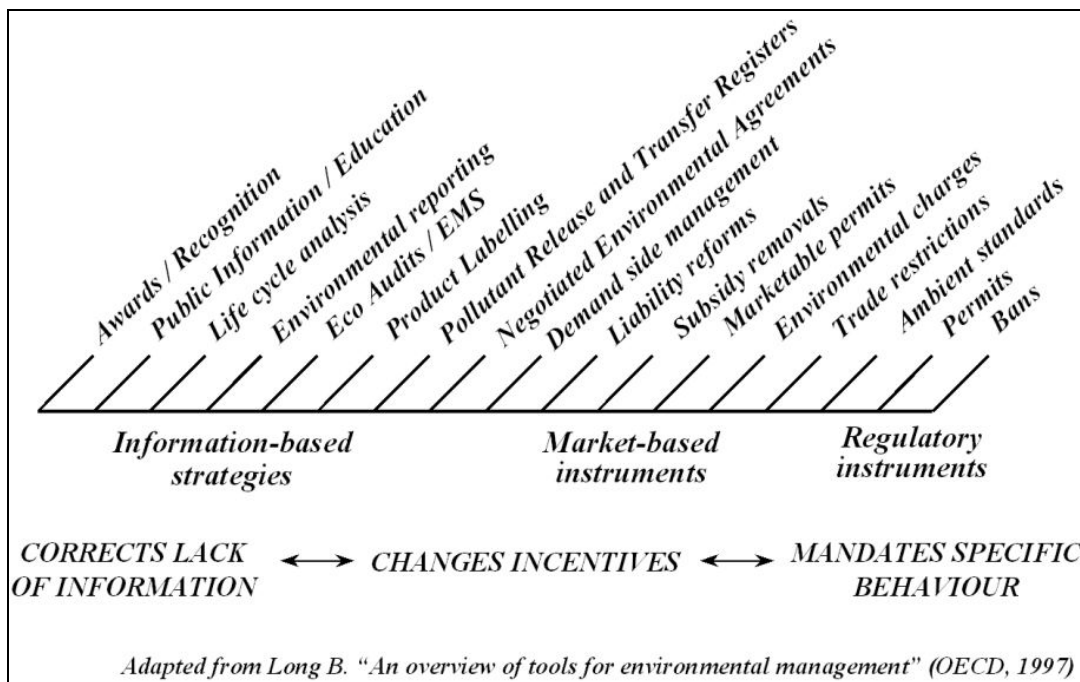


Figure 6-1: Tools and Instruments for Environmental Policy

The Commission’s IPP Communication also highlights the use of several types of policy tools for improving the environmental performance of products and emphasises the use of market-based instruments such as voluntary agreements as part of the IPP toolbox.

“...To green products effectively, non-legislative solutions, such as environmental agreements and the standardisation process, need to be considered in addition to legislation.

...the IPP approach requires a number of different instruments because there are such a variety of products available and different stakeholders involved. These instruments range from voluntary initiatives to regulations and from the local to the international scale. Within IPP, the tendency is clearly to work with voluntary approaches, although mandatory measures might also be required” (Commission of the European Communities, 2003).

This chapter explores a wide-range of policy tools from information-based to market-based approaches in regard to the most important life-cycle environmental issues of mobile phones. The policy tools relevant for the network infrastructure have not been covered in this chapter due to the time limitations. In cases where regulation is discussed, the report draws legislative principles from lessons learned by Nokia and other mobile phone manufacturers.⁴⁴

6.1 Policy Tools for Energy

This section mainly represents the views of the phone and the component manufacturers. Not all participating stakeholders contributed or were able to contribute due to lack of direct experience in this area.

⁴⁴ The European Information & Communications Technology Industry Association (EICTA) has also developed a comprehensive document “EICTA Principles for Product Related Environmental Legislation for the Future” that discusses related issues. This document can be found at <http://www.eicta.org/files/WasteStrategyII-152856A.pdf>

The stage I report identified energy consumption as the most important environmental aspect for mobile phones. The energy consumption of the manufacturing processes in the components manufacture and the no-load power consumption of the charger accounts for most of the life-cycle energy consumption of mobile phones.

6.1.1 Voluntary Environmental Agreements

The ‘Voluntary Code of Conduct on Efficiency of External Power Supplies’ (European Commission, 2004) has led to significant reduction of 1.3 watts in 1999 to less than 0.3 watts today in the no-load power consumption of the chargers in mobile phones. This Code of Conduct (CoC) provides specific targets to manufacturers for reducing the no-load power consumption. Alcatel, Motorola, Nokia, Panasonic, and Sony are signatories to this CoC amongst manufacturers of other electronic products.

In the absence of legislation in this area, the signatory manufacturers have successfully demonstrated that Voluntary Agreements (VAs) can be used as a lead policy instrument to accelerate environmental improvements. However, the status of this VA could be raised to make it more visible as this may increase the number of the participating companies.

6.1.2 Other Voluntary Measures

The components and phone manufacturers participating in this pilot are using certified Environment Management Systems (EMS) based on ISO 14001 to reduce the environmental impacts including energy consumption from the manufacturing processes. The EMS creates a virtuous cycle of improvement due to its periodic review. The manufacturing facilities can use EMS for setting and reaching targets on energy efficiency. This voluntary initiative supports the IPP principle of continuous improvement.

For its suppliers, for example, Nokia requires that they should have a documented environmental management system to ensure effective planning, operation, and control of environmental aspects. This EMS should satisfy the requirements of ISO 14001 or other internationally recognised standards and continuous improvement efforts should be addressed within the EMS.

Manufacturing of mobile devices is a global business, and it is therefore extremely important that globally recognised Environmental Management System (EMS) standards like ISO 14001 are used.

6.1.3 Recommendations

As there are ongoing activities on reducing the energy consumption, no further policy measures are suggested for this area. However, it is recommended that the status of Voluntary Code of Conduct on Efficiency of External Power Supplies could be raised to make it more visible. A raise in its status and visibility may encourage further uptake by companies who are not yet signatories.

Furthermore, ISO 14001 and EMAS within the EU and outside if it becomes globally available, should continue to remain as the lead instrument for continuous environmental improvements.

6.2 Policy Tools for Materials and Substances

This section mainly represents the views of the phone and the component manufacturers. Not all participating stakeholders contributed or were able to contribute due to lack of direct experience in this area.

For materials and substances there are two main areas for environmental improvements a) a continuous increase in the material use efficiency for manufacturing products, and b) the reduction/elimination of materials of concern from the products.

For mobile phones, dematerialisation is an inherent characteristic and an important business driver. The first portable phones, for instance, weighed upwards of 10 kilos and only offered basic voice services. In contrast, today's mobile phones - many weighing in at under 100 grams - can provide a variety of digital services, including voice, imaging, email, fax, and access to the Internet.

Mobile phones contain small amounts of some materials, which may be of concern during the manufacture and end-of-life phase. These materials have been discussed in the stage I report in section 3.5. These substances do not present any environmental or human health hazard when the phone is in ordinary use but they might be released into the environment from landfills, incinerators and recycling facilities if the end-of-life processes are not properly managed. To stimulate the reduction/elimination of materials of concerns, several policy options could be and in some cases are used like material bans, fiscal tools to increase the costs of using such materials, voluntary environmental agreements, mandatory warnings on products that contain such materials, information tools to create consumer demand for products free of these materials.

Traditionally the management of materials and substance content has been highly regulated in the EU. However, as a complementary approach to the regulations in managing the materials of concern, voluntary agreements could be used prior to embarking on new legislation.

The analysis of regulatory approaches in this section draws from a wide range of regulations affecting mobile phones in the EU.

6.2.1 Voluntary Environmental Agreements

The voluntary agreements could be used when the industry front-runners are willing to take the lead and drive changes which lead to significant life-cycle environmental benefits. For mobile phones a new voluntary agreement could be discussed and agreed to reduce/eliminate the use of agreed materials of concern.

6.2.2 Regulatory Instruments

Regulations in the domain of material and substance management have led to significant reduction in potential human health and environment impacts related to the use of materials of concern. They have considerably raised the awareness too and have stimulated the environmental thinking in industry on the use of materials and substances in products.

However, there have been challenges with some regulations relevant for mobile phones according to the phone manufacturers. To avert these challenges in the future, efforts should be made to develop policy instruments in line with the IPP principles with special emphasis

on advanced stakeholder dialogue such as the workshop on the RoHS Directive⁴⁵ so that they are effective, enforceable and yield life-cycle environmental benefits. On the other hand companies should also further improve their knowledge of the existing EU legislation and the European legislative process. Examples of regulatory challenges, which according to the phone manufacturers, could have been mitigated with more dialogue and use of IPP principles include:

- Setting appropriate regulatory mechanisms: According to Nokia, for example, it should be avoided that the notion of Maximum Concentration Values (MCV's) in Homogeneous Materials in the RoHS Directive will create practical difficulties for the mobile phone manufacturers in terms of compliance. From phone manufacturers' point of view, for mobile phones the approach adapted requires the industry, and market surveillance authorities, to manage and enforce by proper procedures the contents of every entity of "homogenous material". Nokia also stresses that in the case of very small entities a physical separation and chemical analysis may be impossible to carry out, should that be required.

Member States are currently discussing enforcement and compliance procedures including testing methods and sampling with regard to this. The participating mobile phone manufacturers recommend that the member states take a practical approach to ensure that the mobile phones in the market comply with the requirements.

"...To be successful, the policy also has to take into account several characteristics of products..."

...Any product policy has therefore to be flexible in order to address many different product variations simultaneously...

...This means that product expertise is increasingly concentrated in the hands of those who are responsible for their design. It is very difficult for regulators, let alone the general public, to have any realistic idea of what technical changes are achievable. For this reason any product policy needs to ensure that producers and designers become more responsible for ensuring that their products fulfil agreed criteria on health, safety and the environment" (Commission of the European Communities, 2003).

Standard stakeholder consultation together with the IPP process of stakeholder engagement brings with it the possibility to bring substantial amounts of scientific knowledge on products and their components. Stakeholder engagement processes could provide more information for the setting of compliance targets in the future.

- Balanced approach: For complying with RoHS Directive, the electronics industry has generally moved towards using silver based solders (e.g. SnAgCu solder with Sn-95.5%; Cu-0.7%; Ag-3.8% is the most common lead-free solder). Silver is a precious metal and has high resource depletion impacts. The impacts in the category of toxicity have significantly decreased due to the elimination of lead but at the same time they have also increased in the categories of resource depletion as well as energy consumption (Aspelin, 2001; Huisman, 2004). Such tradeoffs could have been assessed when using life-cycle thinking as promoted by the IPP approach in policy making.

"... it (IPP) considers a product's life-cycle and aims for a reduction of its cumulative environmental impacts" (Commission of the European Communities, 2003).

⁴⁵ E.g. DTI workshop on the implementation of the RoHS Directive on 19 May 2005 in London which included relevant stakeholders like front-runners, experts, market surveillance authorities, member state governments.

Legislation requires balance to ensure the cumulative environmental impacts are reduced and not transferred from one impact category to another.

- On proportionality: The RoHS Directive addresses a small percentage⁴⁶ of the overall lead used in the EU⁴⁷. The majority of lead in the products can however be found in car batteries⁴⁸, ammunition and other applications not covered by RoHS. The IPP approach can help in focussing on products with the greatest impacts.

“...focus on products with the greatest potential for environmental improvement” (Commission of the European Communities, 2003)

The principle of proportionality must be considered as much as possible prior to legislating in a particular sector or product domain.

- Product related flexibility: The stage I report highlights that there are significant differences between the life-cycle environmental impacts of batteries with different chemistries for e.g. a NiCd battery has significantly higher impacts than a Li-polymer battery. The critical environment issues of batteries are related to their material contents. Depending on their materials content, the batteries may require separate treatment at the end of their use life e.g. NiCd batteries need separate treatment.

The Directive on Batteries and Accumulators and Spent Batteries and Accumulators makes some differentiation between different battery chemistries by prohibiting the placing batteries on market having certain level of mercury and cadmium. In addition to this there are different recycling targets set in the directive (recycling targets for cadmium, lead and others) and different marking requirements depending on the battery chemistry. In Nokia's view, a better approach might be to consider batteries with benign chemistries just as components of EEE and regulate them in the same way as other components. Particularly, requirements to remove batteries need to be balanced against their intended environmental benefits. For example, the impact of process requirements of battery removal should not negate intended environmental benefits in cases where batteries contain benign chemicals.

“...Any product policy has therefore to be flexible in order to address many different product variations simultaneously” (Commission of the European Communities, 2003).

These examples are used only to describe some of the practical challenges with existing product related regulatory requirements in the highly complex ICT industry.

⁴⁶ “The lead used in electronics accounts for less than 2% of total world consumption, with batteries accounting for 90%. Only 40% of the amount of lead in landfill is from WEEE, but of that, only 4% is from lead in PCBs while 36% is due to the use of leaded glass in monitors and televisions. For example, the CRT in a TV can contain 2 kg of lead. The elimination of lead used within power electronics is an insignificant factor compared total global lead usage (EPSMA, 2003)”. See the EPSMA report at: http://www.epsma.org/pdf/Report%20on%20Lead%20free%20Electronics_June%2030%202003_summary%20article.pdf

⁴⁷ Lead is one of the six restricted substances in the EEE.

⁴⁸ Note that the use of lead in car batteries is prohibited by Article 4(2) (a) of the ELV Directive. However, since no substitutes are available at this moment, the use of lead in car batteries is exempted in Annex II to the ELV Directive.

6.2.3 New developments in the EU product related environmental legislation

The Commission has adopted initiatives that aimed at guiding policy making and legislation towards stronger consideration of the overall life-cycle impacts of products. Examples include the IPP Communication, the closely related EuP Framework Directive, the Thematic Strategy on the sustainable use of natural resources, the Thematic Strategy on prevention and recycling of waste and the draft for a revision of the Waste Framework Directive. Impact assessments are now carried out on each major legislative proposal, looking into the environmental, economic and social impacts of the legislation prepared by the Commission based on scientific and other evidence.

There has been wide stakeholder consultations held for example when granting exemptions within the RoHS Directive and for the revision of the Batteries Directive. The Batteries Directive was complemented by an impact assessment. Such impact assessment will accompany any forthcoming revision of the WEEE and RoHS directives thereby taking into account concerns of the type described above. In addition the Commission has launched a wide stakeholder consultation on the revision, is in the process of launching several studies to inform the revision and has completed a study looking into implementation problems related to the WEEE Directive.

6.2.4 Recommendations

The IPP process has been very useful in identifying the challenges of regulation in the material and substance domain. While acknowledging that legislation has improved environmental performance, momentum in this area could be continued through the introduction of voluntary agreements as policy instruments to further reduce/eliminate the use of agreed materials of concern.

According to participating phone manufacturers, experience with materials and substance legislation has confirmed the IPP principle that there is a need for regulators to take into account the complexity of the products. In their view legislators will need to further deepen and advance their engagement with stakeholders as products are increasingly getting complex. Leveraging the use of scientific knowledge will help to create compliance targets which are achievable and appropriate. It is important that legislation is proportional to ensure that it targets the sector and product areas, which have the greatest environmental impacts.

In keeping with the life-cycle principle, it is important to ensure that regulations are balanced, in other words, that they aim for cumulative environmental improvements avoiding to simply shift the impacts from one category to the other, as well as to avoid potential overlaps or contradictions.

It is also very important to leave room and create incentives for innovation in environmental performance which can drive eco-efficiency. This means that regulations should prescribe an overall goal rather than proposing detailed requirements on how to reach goals.

6.3 Policy Tools for End-of-Life

This chapter mainly represents the views of the participating phone manufacturers and the recycler. Not all participating stakeholders contributed or were able to contribute due to lack of direct experience in this area.

As mentioned in the stage I report “The collection and proper management of the mobile phones (and accessories) at the end of their life is crucial to have positive environmental impacts from end-of-life (EoL) phase and to prevent any material and substance dispersions to the environment. The positive environmental impacts in the EoL phase mainly arise from the recovery of metals, especially precious ones”.

This section proposes some policy improvements which could help increase collection rate and recycling of phones at the end of their use life. At present the collection rate of mobile phones is low. To ensure proper treatment of used phones in the end-of-life phase, measures are needed to increase the collection rates and to ensure that the collected phones are recycled appropriately.

According to Umicore, a recycling firm, some key issues in this area include:

- Often exporters of old electronic equipment including mobile phones try to circumvent the regulations of the Basel Convention on waste shipments by falsely declaring material as “reuse”, which in reality is largely a waste. Hence, much stricter controls, severe penalties and clear definitions of reuse and waste are needed to stop these practices.
- For the phones that are really reused in the country of destination (generally developing countries which lack proper recycling infrastructure) there should be a mechanism to provide them with proper recycling treatment at the end of their life. This could involve moving them back to countries which have appropriate recycling infrastructure. If reuse does not lead to final recycling of the product, then the usual waste hierarchy - reuse is “better” than recycling - is not valid.
- Efficient and environmentally sound metals recovery from mobile phones is a very complex and capital intensive process (economies of scale, high investments). Few integrated metals smelters & refineries globally are equipped accordingly, however they can provide sufficient treatment capacity. It is not economically feasible for the recyclers to build such sites in each and every country.
- After local collection, the EoL phones in many cases have to be shipped back to countries for appropriate processing in state-of-the-art recycling operations. This falls under the purview of the Basel convention, which - in its present set-up - can create significant administrative and economic hurdles for senders from smaller local enterprises, who do not have the trained staff to handle this.

In summary, the present situation leads to an increasingly outflow of unwanted/old mobile phones out of Europe, while import of the final EoL phones into Europe is practically obstructed. This can lead the environmentally counter productive effect of depriving EoL phones from efficient material recycling. Therefore, the wide-range of policy instruments proposed below focus on the improvement of collection and recycling schemes.

6.3.1 Regulatory Instruments

An example of regulation on EoL issues relevant for mobile phones is the EC Directive on Waste Electrical and Electronic Equipment (WEEE), which addresses the collection and recycling issues.

The WEEE directive has significantly raised the awareness on the end-of-life management of (Electrical and Electronic Equipment) EEE, and has provided solutions to consumers for disposing their electrical and electronic waste without any additional costs. WEEE directive also aims for management of downstream operations for EEE and recovery of materials from their waste.

However, according to Nokia and other participating phone manufacturers, there are some challenges with a few regulations affecting the EoL issues when they are evaluated against the IPP principles.

- On specific requirements: An Interim Report on Annex II of the WEEE Directive (TAC 050706⁴⁹) demonstrated that the treatment of WEEE in a limited way creates additional costs and burdens with no significant benefits demonstrated for life-cycle environment, health and safety gains. Furthermore, the approach hinders the development of new End-of-Life (EoL) technologies.

Producers should be encouraged to offer/use any technological solutions that achieve environmentally sound treatment of equipment, without mandating any specific practices or techniques.

- Eco-efficiency: WEEE directive sets recycling targets based on weight rather than the environmental impacts of the materials being recycled which may not be the most eco-efficient approach (Stevels, 2003; Huisman, 2004).

“The LCAs (using Eco-indicator 99) of a few 2002-2003 mobile phone models bring to light that the recovery of gold alone in the disposal phase has the potential to offset over 83% of the impacts from the raw material acquisition phase. The incineration or the recycling of the plastics which constitute majority of the weight of phone has negligible contribution in offsetting the impacts” (Singhal et al., 2004).

- Administrative procedures: The proposed battery directive and the WEEE directive set related requirements as the collection of batteries can be run in conjunction of the WEEE directive. There is coherence of these two policy instruments in the area of collection and financing schemes. Coherence could be improved with regard to having two different administrative and reporting entities and so decrease compliance burden in this area. In Nokia’s view, the collection and treatment of batteries could be regulated simply by (amending) WEEE directive as it requires environmentally sound collection and treatment of all electronic equipment including batteries. However, it should be considered that the battery directive covers industrial and automotive batteries as well.

Setting standards and requirements for the reuse/recovery/recycling operations also need to be considered to ensure proper end-of-life treatment at all stages. The EoL operations are not under the direct control of either manufacturers or operators or retailers. It is important that material streams are monitored down to the final destination.

⁴⁹ See: Interim report Min VROM on Annex II, TAC 050706 – Agenda point 4, on Improving Annex II of the WEEE directive: selective treatment.

6.3.2 Voluntary Environmental Agreements

WEEE directive should influence the collection rates as the take-back systems are being set up in the EU countries. However, if the collection rates for mobile phones remain low even after the implementation of WEEE then an appropriate voluntary agreement/measure between the network operators, phone manufacturers, retailers and distributors could be discussed to reach targeted collection rates of old/unwanted mobile phones. A voluntary measure in this regard is being discussed in the stage IV of the pilot.

6.3.3 Recommendations

Phone manufacturers and recyclers agree that the use of regulation for environmental management in the end-of-life phase has proven to be challenging for mobile phones. When proposing or revising regulations in this area close attention needs to be paid to ensure eco-efficient solution is reached, regulations are coherent, do not overlap and do not create administrative burdens without added environmental benefits.

Most importantly the regulations need to allow for any technological solutions that achieve environmentally sound treatment of equipment, without mandating any specific practices or techniques.

Given that EoL operations are not under the direct control of either manufacturers or operators or retailers, continued stakeholder engagement in this area will be tantamount to success. To improve upon collection volumes, if they are found to be low after the implementation of WEEE directive, a voluntary initiative on targeted collection rates of old/unwanted mobile phones could be considered.

6.4 Information Flows

Several kinds of information flows are needed between different actors during the life-cycle phases for improving the environmental performance of products. Information flows are needed between the suppliers and the manufacturers, from the manufacturers to consumers, and between the manufacturers and the recyclers. This section draws on the views of participating stakeholders, although there were different views about the strength of the advantages and disadvantages of the various types of communication that can be used (section 6.4.2.1.).

The strengthening of information-based instruments is specially supported to create consumer demand for environmentally sound products and steer their behaviour to be more sustainable.

6.4.1 Supply Chain Information

The manufacturers mainly need information from the suppliers on the material composition of the components, and their life-cycle environmental impacts. There is already ongoing work in this area and is discussed in the improvement option 5 (under high priority options) in chapter 4.

6.4.1.1 Voluntary Business Agreement

In context of this pilot, a business agreement can be discussed for information exchange between the manufacturers and the suppliers. An agreement between the suppliers and the

manufacturers can help to ensure that there is sufficient information about the materials available for the design for environment activities.

- Agreement on declaring full/necessary material contents of the components: As discussed earlier, this information is vital for the phone manufacturers to identify and eliminate the materials of concern from their products. This information is also needed by the manufacturers to declare the environmental facts about their products to the consumers.

6.4.2 Information for Consumers

“...Giving Consumers the Information to Decide - ...Consumers, whether private, public or individual, decide whether or not they purchase greener products and once bought, how they are used” (Commission of the European Communities, 2003).

This group fully supports the Commission’s policy on the consumers’ right to decide and therefore suggests policy measures which support the efforts to provide information on sustainable consumption to consumers for informed decisions about purchasing, using and disposing products. These goals support both continued improvement in environmental performance of products and the nurturing of a growing market for environmentally sound products.

Important elements in changing consumption patterns include awareness raising on environment and providing relevant environmental information on products to the consumers for better purchasing decisions in a way that respects their preferences, and for proper usage and disposal.

A good policy measure for consumer information for example is the EU Energy Label for house-hold appliances. This measure has effectively shifted the consumer buying behaviour towards the purchase of more energy and water efficient large household appliances (European Environment Agency, 2005). Lesson learnt from this approach suggests that progress can be made if relevant and timely information is provided to the consumers.

6.4.2.1 Information on the environmental aspects of products to assist in purchasing decisions

The customers need information on the relevant environmental, health and safety aspects of the product if they are to give their contribution by choosing the products with best environmental performance. This information must be easy to understand, readily available and comparable. Thus, a common and agreed way for providing environmental information is required.

In environmental discussions, very often ISO 14020 series Type I, II, III are referred to describe different types of information schemes for consumers. These schemes are aimed at influencing the consumer decision in favour of environmentally superior products.

- Type I is a multi-attribute label developed by a third party;
- Type II is (typically) a single-attribute self-declaration developed by the producer;
- Type III is a multi-attribute and third-party verified report card with quantitative environmental information based on a life cycle assessment.

The suitability of all these types of information schemes for the product group of mobile phones is analysed in the appendix D. Based on the analysis a proposal is made which builds on the positive aspects of these schemes but avoids their limitations.

6.4.2.1.1 Attributes of a good information scheme

The analysis of the information schemes (Type I, Type II and Type III) in appendix D shows that each of them has certain benefits, but also limitations. There are features of the market for mobile phones - especially the complexity of the product and the fast-moving nature of the technology and the market - which do not work easily with the Type I labelling ‘award’ approach. There are credibility issues with companies’ own Type II declarations and labels. Type III scheme is being used in the sector at present, but there are aspects of this approach which could be more suited to the mobile phone market. Based on the analysis of the schemes the attributes of a good information scheme are identified in the following table.

Table 6-1: Attributes of a good scheme for informing consumers on the environmental aspects of products

| Consumers’ Perspective | Manufacturer’s Perspective |
|---|--|
| Information should be: <ul style="list-style-type: none"> – Relevant – Easily understandable – Easily accessible – Comparable for products in same category – Provided in a suitable format – Credible – Widely accepted – Verifiable Information scheme should: <ul style="list-style-type: none"> – Cover significant life-cycle environmental aspects | Information should be: <ul style="list-style-type: none"> – Easy and fast to produce – Format can be updated regularly in line with technological developments – Cost-efficient to produce Information scheme should: <ul style="list-style-type: none"> – Support continuous improvements and innovations – Not increase the time to market products |

6.4.2.1.2 Recommendation: Product Environmental Facts

A suitable information scheme, which includes the attributes discussed in the table above, can be developed in context of this IPP pilot. For mobile phones, the following hybrid information scheme is proposed:

1. Further stakeholder engagement: A multi-stakeholder workgroup be established to develop and agree on a suitable format for declaring environmental facts on significant life-cycle environment aspects of phones. The format should include important issues such as no-load power consumption of chargers, presence of materials of concern in the phone and other information agreed in the stakeholder group.
2. Voluntary agreement: The phone manufacturers and operators could launch a voluntary agreement to use this agreed format for declaring the environmental facts to the consumers. The product environmental fact sheet should be readily available to the consumers when they are buying the products. To raise the status and build awareness about this scheme, the European Commission could verify it and also acknowledge the Voluntary Agreement between the phone manufacturers and the network operators. This initiative would comply with the rules of competition.

3. **Credibility through surveillance:** Market surveillance could be carried to ensure the credibility of the environmental facts being declared by the manufacturers and operators. New approach based market surveillance⁵⁰ is already used in many other important areas like electrical safety.
4. **Consumer and public procurement decision-making:** The declared environmental facts can then be used by consumers for making environmentally rational choices. The facts can also be used by public authorities for Green Public Procurement (GPP) and identification of environmentally superior products and the industry front-runners.

6.4.2.2 Information on sustainable behaviour on usage and disposal

The consumers can play a big role in reducing the environmental impacts of mobile phones for example by unplugging the chargers from the electricity supply after the phones are charged and by depositing the unwanted phones at the collection centre.

The phone manufacturers and network operators should provide information on sustainable usage and disposal patterns to reduce the environmental impacts from the use and end-of-life phases. Many phone manufacturers and network operators already have activities in this area and they could be further strengthened by implementation of the related qualified improvement options discussed in chapter 3.

6.4.3 Educational & awareness activities

The public authorities could strengthen educational and awareness activities on environment for the consumers. There are already some initiatives, for example UK is working on a new information service for consumers ('Environment Direct'), which could give consumers advice about the impacts of everyday products - e.g., what features to consider when purchasing, how to reduce impacts during use, and how to dispose of the product responsibly.

6.4.4 Information for Recyclers

The recyclers need information on some of the material contents of the products to design appropriate recycling operations. Also, the manufacturers need feedback from the recyclers on materials, which are of concern during recycling operations so that they can be eliminated from the products.

EICTA (European Information & Communications Technology Industry Association), CECED (European Committee of Domestic Equipment Manufacturers), AeA Europe (American Electronics Association Europe), and EERA (European Electronics Recyclers Association) have established the conditions for a sustained dialogue between producers and recyclers based on agreed items of interest for a better handling of WEEE and have developed a voluntary guidance document "Guideline to implement WEEE Directive 2002/96/EC- Article 11"⁵¹.

Also in the case of new technological developments which require products to contain new materials, recyclers could be consulted at an early stage to check whether the use of these

⁵⁰ See <http://europa.eu.int/comm/enterprise/newapproach/legislation/guide/legislation.htm>

⁵¹ See <http://www.eicta.org/press.asp?level0=1&level1=6&level2=42&year=2005&docid=575>

materials implies any negative effects on recyclability for considering the environmental impact of products through their life-cycle.

6.4.5 Recommendations

Some progress has been made in raising environmental awareness with consumers but clearly more efforts need to be put in this area. Information flows on in the various life-cycle stages can help all stakeholders - suppliers, manufacturers, consumers and recyclers - to understand the environmental impacts of products and ways to reduce them.

There are many opportunities to improve the environmental information flow. This report suggests the use of voluntary agreements in the case of manufacturer to consumer flows and business agreement in case of supplier to manufacturer information flows.

There are several schemes each with strengths and weaknesses to inform consumers on the environmental aspects of the product to assist them in environmentally rational purchasing decisions. This report emphasises the need to create a new approach - Product Environmental Facts - which would draw upon lessons learned from Type I, II & III information schemes.

The report also calls upon public institutions to emphasise education and awareness activities on sustainable behaviour.

6.5 Environmental Assessment Methods/Tools

The stage I report identifies and discusses the advantages and several limitations of the present assessment methods/tools for analysing the life-cycle environmental performance of products. It also highlights the need for further developing the existing methods/tools in addition to the new ones.

The report gives special emphasis to practical tools like Key Environmental Performance Indicators (KEPIs), which can be used by the industry for day-to-day eco-design purposes. If the public authorities and industry have the right set of tools then effective policies and products with better environmental performance can be developed.

Some tools are being progressed at a general framework level e.g. ISO work on guidelines for LCA, Commission's work on the European Platform on LCA that creates a useful basis for the assessment of products in general. These works help in creating a base, but further efforts needs to be put to develop tools specific and relevant to different sectors on this base.

6.5.1 Working Arrangements and Standards

There is a need to develop an agreed simplified assessment methods in co-operation between industry, research institutions and possibly consumers or other non-governmental organisations. Two different sorts of tools are urgently needed in this sector a) Methods/tools for assessing life cycle environmental impacts of products and b) Tools for assessing environmental and social impacts of materials and substances used in the products. These tools are necessary for the eco-design work to progress.

The Key Environmental Performance Indicators (KEPIs) (Singhal et al., 2004) suggested in the first report⁵², the EPIC-ICT approach developed by a research consortium in an EU funded project⁵³, and other similar methodologies developed for energy using products are examples for the first sort of tool.

Working arrangements could also be discussed between the research institutions, material and substances manufacturers, component manufacturers, phone manufacturers, recyclers, consumer organisations and NGOs for:

- Further developing KEPIs or a similar approach. The developed approach could then be standardised so that it can be used widely within the industry.
- Developing an agreed materials and substances evaluation tool for use by the industry.

6.6 Other Significant Policy Measures

6.6.1 Green Public Procurement (GPP)

Green public procurement could have crucial benefits for the environment by stimulating the demand for environmentally superior products. Significant spending is made on public procurement (16 % of EU wide GDP or a sum equivalent to half the GDP of Germany). Green purchasing can set an example and influence the market place.

By establishing a green procurement policy, and communicating the actions taken and their results, the authorities can demonstrate that an action in this area is possible, and it leads to concrete results. Further, by promoting green procurement, public authorities indirectly give incentives to industry to develop products with superior environmental performance.

In general, some priorities for GPP include:

- It must be strongly coherent with the spirit and rules of the regulation concerning public procurement.
- The purchasing organisation must have the right to select and also weight environmental aspects according to its needs.

The proposal on product environmental facts discussed in a previous section is relevant for GPP. To select their suppliers and products, the public authorities can use the facts declared by the manufacturers. These facts will be in line with the format developed by the stakeholders to declare the most significant life-cycle environmental aspects of products.

6.6.1.1 Existing Initiatives on GPP

In view of selecting appropriate environmental criteria, the public procurement directives in EU explicitly recognise the possibility for contracting authorities to make use of underlying criteria of eco-labels to describe the subject matter in their tender documents. Use of such criteria should be encouraged where possible, on the condition that they are linked to the

⁵² See, stage I report - section 3.4 - for KEPIs information at:

http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

⁵³ See www.epic-ict.org

subject matter of the contract, and that they have been established on the basis of scientific information, with the participation of all stakeholders and are accessible to all interested parties.

A public authority may also have recourse to standardised criteria and format for declaring environmental facts of products as a source of (environmental) information for decision making, on the condition that the specifications or criteria referred to by the contracting authority are sufficiently clear and verifiable in order to allow bidders to prepare balanced bids and to allow the contracting authority to compare those bids on the basis of the same set of specifications and criteria. The product environmental facts scheme proposed earlier for complex ICT products shall meet these requirements.

6.6.2 Incentives for Front-Runners

According to Nokia, a front-runner approach⁵⁴ should be discussed to give incentives to manufacturers for developing products with superior environmental performance. This should have the aim to move the market to the sustainable direction. Through this approach, products with the best environmental performance on the market should be identified and their manufacturers recognised. Standards could be established on the basis of the products in market that have the best environment performance.

“...Working with the market – setting incentives so that the market moves in a more sustainable direction by encouraging the supply and demand of greener products. This will reward those companies that are innovative, forward-thinking and committed to sustainable development.

...Continual environmental improvement requires incentives for producers to make new product generations greener than their predecessors on the basis of life-cycle thinking and taking into account the parameters set by the market. It also requires incentives for consumers to buy these” (Commission of the European Communities, 2003).

The front-runners could be treated as trusted partners by public authorities and could be invited to participate in the process of setting future policies so that their expertise is utilised. This approach should be issue focussed and targeted on an industry sector or a product group. To initiate the front-runner approach the following actions may be needed:

- Development of transparent criteria for identifying the products with best environmental performance in the focus industry sector or product group.

For mobile phones, the format for declaring product environmental facts products discussed earlier could be used. That format would be set by a multi-stakeholder workgroup and would include important environmental aspects like energy consumption and presence of materials of concern in the phone.

- Identification/development of public benchmarks, targets and standards based on the products with best environmental performance in cooperation with the front-runners.
- Identification of award schemes/incentives for the front-runners.

⁵⁴ Please note that the proposed approach has been called as Front-Runner approach so as to differentiate it with the Top-Runner approach of Japan.

- Identification of incentives for other manufacturers whose products reach the benchmarks/targets/standards established on the basis of products with best environmental performance within a certain time-period.

The European Commission has few initiatives that are relevant in this context for example the work on performance targets⁵⁵, the Sustainable Energy Partnership initiative⁵⁶, European Business Awards for the environment⁵⁷. However, an overall mechanism to reward frontrunners could be developed. The Commission also, in general, conducts consultation of stakeholders and cooperation with stakeholders when carrying out its work. Examples for this are the numerous stakeholder consultations being carried out, the IPP pilot projects, different working groups, in the case of the Energy Using Product directive establishment of a group of experts called “Consultation Forum” which will allow stakeholders to be informed and provide their contribution on the implementation of the Directive.

6.6.3 Harmonisation of Legislation

As the EU regulation is transposed to member state regulation and executed locally, different approaches exist between and inside different EU Member States. However, a better harmonisation of implementation would make the internal market function more effectively. Nokia’s view is that besides of other coordinative actions, the Commission could more invoke Article 95 of the Treaty as the legal basis more regularly, especially for product related regulation.

6.6.4 Improvements for Voluntary Environmental Agreements

The stakeholder group suggests that the voluntary environmental agreements should be used by the public authorities as a complementary approach to regulations. Several voluntary agreements have been suggested in this chapter to improve the life-cycle environmental performance of the phones. To enhance the uptake of the VAs in the industry and to increase their success rate there are some possibilities for improving the existing approach for VAs.

- Industry should actively initiate more voluntary environmental agreements.
- The European Commission could stimulate and support the development of VAs that can have a remarkable/significant contribution to the life-cycle environmental improvements in products.

According to Nokia and other stakeholders, to stimulate the set up of VAs, the Commission could continue and put more efforts, before initiating new regulatory requirements, to encourage companies to develop VAs in areas which they see important.

⁵⁵ The Commission has started working on performance targets. These are quantified long-term objectives for measurable parameters representative of the environmental performance of a product, a group of products, a service or a production process. These would be set by dialogue with stakeholders. This approach is expected to increase the competition on the basis of the environmental performance of products and services, thus rewarding the front runners and leading to a general improvement of the products and services on the market. See <http://europa.eu.int/comm/environment/etap/index.htm>

⁵⁶ See: www.sustenergy.org

⁵⁷ This award given by the European Commission recognises companies that pioneered environmentally friendly policies and products. The award recognises and promotes organisations which make an outstanding contribution to sustainable development. This includes a product award for sustainable development. See http://europa.eu.int/comm/environment/awards/index_en.htm

The Commission should initiate the regulatory approach if no acceptable VAs emerge in the stipulated time frame or the VAs do not yield significant results.

- The VAs that yield significant environmental benefits and comply with the requirements set out should be recognised and acknowledged at an EU level⁵⁸. The status and the visibility of the acknowledged VAs should be raised for example by information and communications means to encourage the non-signatories to join them. A good example of such a working VA is the Energy Star, which has an official status in EU.
- According to Nokia and other stakeholders, using acknowledged VA as a basis the Commission could give a mandate to create a harmonised standard⁵⁹ if required. However, if the coverage of the acknowledged VA is unsatisfactory, a regulatory action could be drafted based on the standard. The new EuP directive provides a good framework for this purpose. In this case, the volunteers to the VAs would get some advantage from an early start.

6.7 Summary

This report suggests a wide-range of policy solutions for continuously improving overall product life-cycle environmental performance. The IPP process has demonstrated that close cooperation between all stakeholders can lead to innovative policy proposals ranging from improvements in information flow strategies, market-based instruments and regulatory tools. For all stages of the life-cycle, the report emphasises the need to create incentives for all stakeholders to create supply and demand for products with lower environmental impacts.

To steer the consumer behaviour towards being sustainable the report stresses the need to improve environmental information flow. It suggests the use of voluntary agreements in the case of information flow from manufacturer to consumers and business agreements for information flow from suppliers to manufacturers. It also calls upon public institutions to emphasise education and awareness initiatives on sustainable behaviour.

In the report Nokia and other stakeholders explore the benefits and challenges of Type I, II and III information schemes and propose an innovative hybrid scheme for mobile phones - Product environmental facts - by taking the best from each approach to ensure high impact environmental information flow to influence the consumers' buying patterns and public procurement practices.

As concerns energy consumption, the report has shown successful reduction in no-load power of the chargers through the use of a voluntary code of conduct on external power supplies. This bodes well for the use of market-based approaches and encourages the EU to recognise and promote the usage of voluntary agreements as a viable policy instrument prior to legislation where possible.

⁵⁸ It seems that the main reasons for the VAs to not succeed include the lack of their visibility and the limited advantages for the signatories.

⁵⁹ Standardisation can be - inter alia - described as a process to agree on common specifications. This process is necessary to ensure that requirements can normally be met, with a minimum of variety, in a reproducible and economic manner. Standardisation can take place at different levels: across an organisation; throughout an industry; across a nation and around the world. It is important to establish a formal link from regulation to the standardisation process. Standardisation can be utilised as a tool to establish detailed technical requirements based on the goals set in regulations. Well-established standardisation processes guarantee practical implementation of upper level regulatory framework objectives.

The use of voluntary instruments to carry out high priority improvement options in this pilot project was also looked for – reduction/elimination of materials of concern, provision of reminders in chargers (to remind consumers to unplug them from the wall after the phone is charged), providing information to consumers through Product Environmental Facts scheme, increase the collection rates of the used/unwanted mobile phones, and further development of environmental assessment methods/tools.

When regulations are necessary, they should to focus on priority sectors and priority areas based on life-cycle thinking. Results from research like EIPRO can provide useful inputs for this purpose. The report looks at recent experiences with legislation to turn lessons learned into proposals for improved policy instruments based on Nokia’s and other manufacturers’ experiences and views. The report cautions regulators to take a proportional, product flexible, balanced and an eco-efficient approach to regulation.

Considering the complex nature of mobile phones and the rapid technology development, the phone manufacturers suggest that regulation needs to be goal-based and not focused on specific requirements on how to reach them. Furthermore, goals need to be attainable with consistent procedures such that they are as administratively as light as possible.

Public authorities, businesses and consumers must work collectively to shift both the production and consumption trends. Policy-makers can stimulate this work by creating appropriate incentives. The report identifies many incentive opportunities such as Green Public Procurement, recognition for industry front-runners and the promotion and recognition of voluntary agreements.

The IPP process in this pilot has demonstrated that through enhanced stakeholder dialogue policy tools can be developed in such a way so that all players play their role in areas of their influence. The IPP process is a welcomed improvement in approach to policy development.

7. Conclusions and Outlook

Reaching sustainable production and consumption patterns is a challenge which requires work from all actors including public authorities, businesses, consumers and NGOs.

This pilot comprehensively covers the life-cycle environmental issues and improvements for the mobile phones but does not cover all the life-cycle phases of the network infrastructure. For the network infrastructure, only improvement options for reducing the impacts from energy consumption in use phase are identified and analysed. Improvements options during the production and end-of-life (EoL) phase of the network infrastructure are not in the scope of this pilot.

For mobile phones, the most important life-cycle environmental issues as identified in stage I⁶⁰ report include energy consumption in the components manufacturing phase, no-load power consumption of the charger in the use phase, presence of some materials of concern in phones, collection of unwanted phones and their recycling. As the IPP pilot project was planned to be completed in a year's time, the scope of the project was narrowed down to address selected most significant aspects of the mobile phones after the stage I. Three focus areas were selected for further work: Energy consumption during the life-cycle of mobile phones; Material related environmental issues in the life-cycle, and Methods/Tools for assessing life-cycle environmental performance/impacts.

To improve the life-cycle environmental performance of the mobile phones numerous improvement options relevant for all life-cycle actors were identified in the second stage of this pilot. In the third stage, these options were briefly analysed and classified/screened as Qualified, Ongoing or Disqualified. The policy measures that can be used to drive environmental improvements in all the life-cycle stages were also discussed and evaluated.

The analysis of the options suggests that there are many technological, behavioural and policy solutions which can be used to improve performance in these areas and requires various stakeholders to act on and implement solutions which are under their control and influence. The summary of the high priority options as identified and agreed by the participating stakeholders can be seen in the figure.

⁶⁰ See Nokia's stage I final report at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

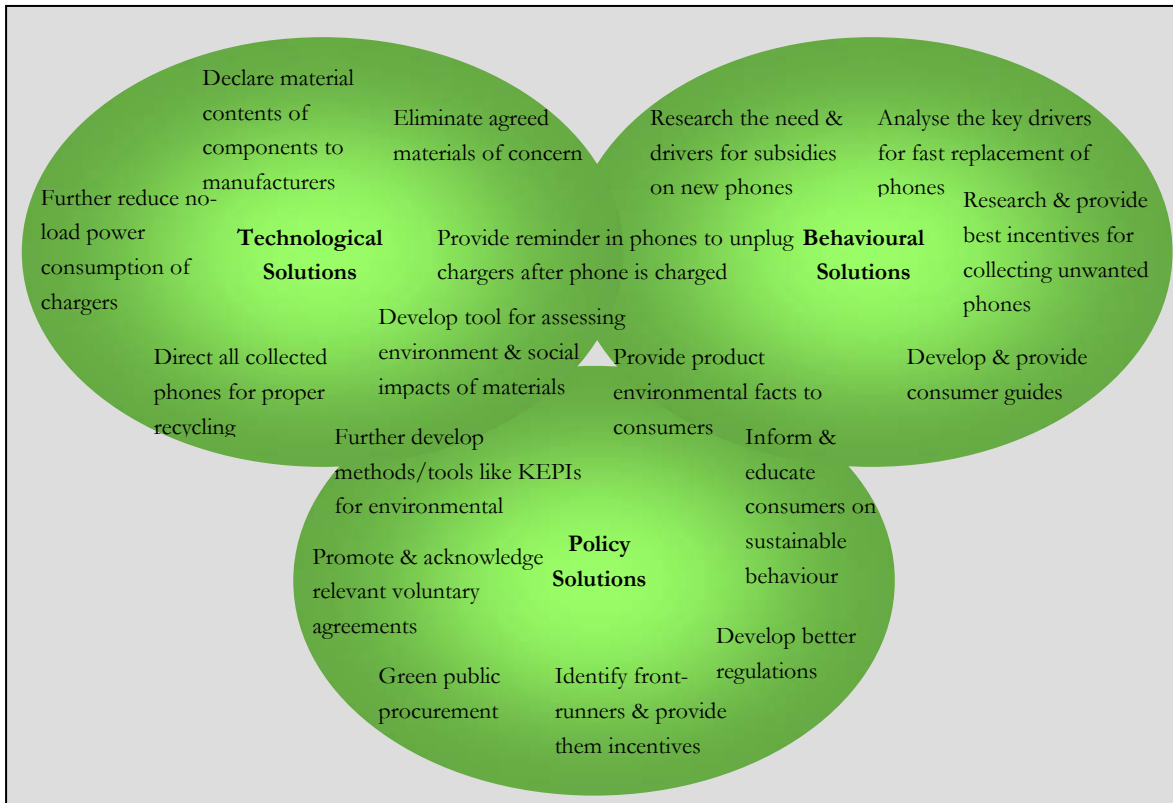


Figure 7-1: Prioritised solutions to improve environmental performance

The most important technological solutions include elimination of the agreed materials of concern and provision of reminders to unplug chargers when phone is charged. The behavioural solutions aim at influencing the consumption patterns mainly by ensuring the flow of information to the consumers. This report identifies the necessity of information flow from suppliers to manufacturers and also from manufacturers to consumers. It also calls upon public institutions to initiate education and awareness activities on sustainable consumption behaviour. The ability of stakeholders like NGOs and consumer organisations to communicate relevant environmental information in a trustworthy way is also identified to have a great impact on the behaviour of the consumers.

For information flow on products to consumers, the report explores the benefits and challenges of Type I, II and III information schemes and proposes a hybrid scheme - Product environmental facts - for complex products like mobile phones by taking the best from each approach to ensure relevant, timely and high impact environmental information to influence the consumers' buying patterns.

To ensure speed and effective implementation of the technological and behavioural solutions, the report recommends the use of market-driven approaches - such as voluntary agreements (VAs) - to complement regulations. For minimising the no-load energy consumption of chargers, the signatory manufacturers have successfully demonstrated that VAs can be used as a lead policy measure to accelerate and incentivise environmental improvements in the absence of regulations. However, some recommendations, to increase the visibility of this VA have been made to enhance its adoption and effectiveness.

For mobile phones voluntary agreements could be discussed for elimination/reduction of agreed materials of concern in the phone, and for providing product environmental facts to

the consumers in an agreed way. Business agreements can be discussed for information exchange on the material contents of the components between the suppliers and the manufacturers. The strengthening of information-based instruments discussed above is also supported to create consumer demand for environmentally sound products and steer consumer behaviour to be more sustainable.

When and where regulations are required, they should focus on priority sectors and priority areas based on life-cycle thinking. Results from research like EIPRO can provide useful inputs for this purpose.

The environmental regulations have led to significant reduction in potential human health and environment impacts. They have also raised the awareness and have stimulated the environmental thinking in the industry. However, there have been challenges with some regulations. The report looks at recent experiences and recommends regulators to take a proportional, product flexible, balanced and an eco-efficient approach to regulation. Particularly the complex nature of mobile phones and the rapid technology development suggests that regulation needs to be goal-based and not focused on specific requirements on how to reach them. Furthermore, goals need to be attainable with consistent procedures such that they are as administratively as light as possible.

The report also suggests incentive opportunities for driving the environmental work of the industry such as Green Public Procurement, recognition for industry front-runners and the promotion and recognition of relevant voluntary agreements.

This report feeds into the present stage IV of the pilot wherein new initiatives are being set with the participation of the relevant stakeholders to further work on and implement many 'Qualified' options. These initiatives will be monitored in stage V to assess their implementation and effectiveness. In the stage IV there will be a final report summing up – the action plans for the new initiatives that are set by the stakeholders and experiences from and suggestions of this stakeholder group.

Bibliography

- Aspelin, T. (2001). *Life Cycle Assessment of Solder Pastes*. Lappeenranta University of Technology, Lappeenranta.
- Commission of the European Communities. (2002). *Communication from the Commission on Impact Assessment*. Retrieved 20 July, 2005, from http://europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0276en01.pdf
- Commission of the European Communities. (2003). Communication from the Commission to the Council and the European Parliament. *Integrated Product Policy – Building on Environmental Life-Cycle Thinking*. Retrieved 15 October, 2004, from http://europa.eu.int/eur-lex/en/com/cnc/2003/com2003_0302en01.pdf
- European Commission. (2004). *Code of Conduct on Energy Efficiency of External Power Supplies - Version 2*. Available at: http://energyefficiency.jrc.cec.eu.int/pdf/Workshop_Nov.2004/PS%20meeting/Cod e%20of%20Conduct%20for%20PS%20Version%202%2024%20November%202004.pdf
- European Commission. (2005). *Impact Assessment Guidelines*. Retrieved 20 July, 2005, from http://europa.eu.int/comm/secretariat_general/impact/docs/SEC2005_791_IA%20guidelines_annexes.pdf
- European Environment Agency. (2005). *Household consumption and the environment*. Retrieved 15 January, 2006, from http://reports.eea.eu.int/eea_report_2005_11/en/EEA_report_11_2005.pdf
- GeSI. (2004). *Supply Chain*. Retrieved 3 December, 2004, from <http://www.gesi.org/activ/representing.htm>
- Helminen, A O. (2005). *Bioplastics in mobile telephones*. Presentation made at the Bioplastics 2005, Frankfurt.
- Huisman, J. (2004). *QWERTY and Eco-Efficiency analysis on cellular phone treatment in Sweden*. Delft: Delft University of Technology.
- Mäkirintala, O-P. (2003). *The New Challenge for the Industry: Material composition - integrated approach using RosettaNet*. Paper presented at the Recycling Electrical and Electronic Equipment 6, Leatherhead.
- MPPI. (2004). *Mobile Phone Partnership Initiative, project 3.1: Recovery and recycling of end-of-life mobile phones*. Retrieved 20 December, 2004, from www.basel.int/industry/
- Patel, M. & Narayan, R., How Sustainable Are Biopolymers and Biobased Products? *The hope, the Doubts, and the Reality*. In Natural Fibers, Biopolymers, and Biocomposites, Mohanty, A.K., Misra, M., and Drzal, L.T. (Eds.), CRC Press, Taylor & Francis Group, 2005, pp. 833-853
- Singhal, P. (2005a). Integrated Product Policy Pilot Project. *Stage I Final Report: Life Cycle Environmental Issues of Mobile Phones*. Nokia: Espoo. 87 pp. Available at: http://europa.eu.int/comm/environment/ipp/pdf/nokia_mobile_05_04.pdf

Singhal, P. (2005b). Integrated Product Policy Pilot Project. *Stage II Final Report: Options for Improving Life-Cycle Environmental Performance of Mobile Phones*. Nokia: Espoo. 31 pp.
Available at:
http://europa.eu.int/comm/environment/ipp/pdf/nokia_st_II_final_report.pdf

Singhal, P., Ahonen, S., Rice, G., Stutz, M., Terho, M., & van der Wel, H. (2004). *Key Environmental Performance Indicators (KEPIs): A new approach to environmental assessment*. Paper presented at the Electronics Goes Green 2004+, Berlin. Also available at:
<http://www.lcainfo.ch/df/DF27/Stutz2KEPIPaper2004.pdf>

Stevens, A. (2003). *Is the WEEE Directive EcoEfficient?* Paper presented at the IEEE Symposium on Electronics and the Environment, Boston.

Abbreviations

| | |
|-------|---|
| BEP | Best Environmental Practice |
| BAT | Best Available Technology |
| BEUC | The European Consumers' Organisation |
| CoC | Code of Conduct |
| DfE | Design for Environment |
| EC | European Commission |
| EEE | Electrical and Electronic Equipment |
| EIA | Electronics Industry Alliance |
| EICTA | European Information & Communications Technology Industry Association |
| EMAS | Eco-Management & Audit Scheme |
| EMS | Environmental Management System |
| EHS | Environment, Health and Safety |
| ETSI | European Telecommunications Standards Institute |
| EuP | Energy using Products |
| EoL | End-of-Life |
| EU | European Union |
| GeSI | Global e-Sustainability Initiative |
| GPP | Green Public Procurement |
| GSMA | GSM Association |
| HAP | Hazardous Air Pollutants |
| ICs | Integrated Circuits |
| ICT | Information Communication Technology |
| IEC | International Electrotechnical Commission. |
| IPP | Integrated Product Policy |
| ISO | International Organisation for Standardisation |
| JGI | Joint Industry Guide |

| | |
|--------|---|
| JGPSSI | Japan Green Procurement Survey Standardisation Initiative |
| KEPIs | Key Environmental Performance Indicators |
| LCA | Life -Cycle Assessment |
| LCI | Life -Cycle Inventory |
| LCD | Liquid Crystal Display |
| MCVs | Maximum Concentration Values |
| MMF | Mobile Manufacturers Forum |
| MPPI | Mobile Phone Partnership Initiative |
| MPWG | Mobile Phone Working Group |
| NGOs | Non Governmental Organisations |
| PR | Public Relations |
| PSS | Product Service System |
| PVC | Poly Vinyl Chloride |
| PWB | Printed Wiring Board |
| UNEP | United Nations Environment Programme |
| VAs | Voluntary Agreements |
| VAT | Value Added Tax |
| VOC | Volatile Organic Compounds |
| WEEE | Waste Electrical and Electronic Equipment |

Appendix A: List of Stakeholders Participating in Nokia’s IPP Pilot Project on Mobile Phones

Phone Manufacturers

- Motorola
- Panasonic

Components Manufacturers

- AMD
- Epson
- Intel

Network Operators

- France Telecom/Orange
- TeliaSonera
- Vodafone

Recyclers

- Umicore

Government Agencies

- Department of Environment, Food and Rural Affairs (DEFRA), UK
- Finnish Environmental Institute (SYKE), Finland

NGO

- WWF

Consumer Organisation

- The European Consumers’ Organisation (BEUC)

Appendix B: Guidelines Followed for Analysing the Improvement Options

| | |
|--|----------------------|
| Improvement Option: | |
| Main Actor (for implementing) : | Other Actors: |
| Influence of Main Actor on Other Actors: | |
| Additional Details on Improvement Option: | |

Provide reasons for your answers
 ** Manufacturing Parameters

| Economic/Business Impacts | Environmental Impacts | | | | Social Impacts | | Time required for implementation | | Driving Factors | |
|---|---|--------|------------|----------|------------------------------------|--|---|----------------------|--|----------------------|
| | | Impact | Importance | Comments | | | | | | |
| Costs | Upstream Impacts | | | | Health Impacts on Consumers | | Short Term | 6 months - 1 year | Existing Legislation | Yes (Which?)/No |
| Alternative Material Properties** | Use Phase Impacts | | | | Health Impacts on Workers | | Medium Term | 1 Year - 3 Years | Upcoming Legislation | Yes (Which?)/No |
| Suitability for Mass Production** | End-of-Life Impacts | | | | Safety of Product | | Long Term | 3 Years - 5 Years | Existing Voluntary Agreements | Yes (Which?)/No |
| Availability for Mass Production** | Energy consumption | | | | Safety of Production | | Geographical reach of improvements | | Proposed Voluntary Agreements | Yes (What?)/No |
| Origin of Materials** | Use of environmentally relevant substances | | | | Jobs | | Global | Yes | Existing Standards | Yes (Which?)/No |
| Yields** | Hazardous Waste | | | | Wages | | Regional | Yes (Which?)/No | Proposed Standards | Yes (What?)/No |
| Product Reliability** | | | | | | | National | Yes (Which?)/No | Existing Fiscal Incentives | Yes (Which?)/No |
| End User Expectations** | | | | | | | Local | Yes/No | Proposed Fiscal Incentives | Yes (What?)/No |
| Product Acceptance** | | | | | | | Feasibility | | Stakeholder Requirements | Yes (What/Where?)/No |
| Customer Specifications** | | | | | | | Summary | Yes (How?)/No (Why?) | Existing Other Policy Instruments | Yes (What/Where?)/No |
| Consumer Perceptions | | | | | | | | | Proposed Other Policy Instruments | Yes (What/Where?)/No |
| Functionality** | | | | | | | | | | |
| Competitiveness | | | | | | | | | | |

| |
|------------------------------------|
| Related Ongoing Activities: |
|------------------------------------|

Appendix C: Voluntary Agreements in the Electronics Industry

| Voluntary Agreements | Status |
|---|---|
| <p><i>Code of Conduct on Efficiency of External Power Supplies and Chargers. Version 2. (2004)</i> http://energyefficiency.jrc.cec.eu.int/pdf/Workshop_Nov.2004/PS%20meeting/Code%20of%20Conduct%20for%20PS%20Version%202%2024%20November%202004.pdf</p> <p><u>Concern:</u> external power supplies and chargers (hereinafter defined “external power supplies”) have in common that they mostly do not have an on-off switch and consume electricity in a no-load situation.</p> <p><u>Aim:</u> to minimise no-load losses of external power supplies.</p> | <p>ON GOING/</p> <p><u>Participants</u>⁶¹: Alcatel, Motorola, Panasonic, Sony, Nokia, IBM, NEC, HP, Epson, Canon, Apple.</p> <p><u>Results:</u></p> <p>-(from 2005-2006) No-load maximum power consumption ranging from 0.3 to 1 W</p> <p>-(from 2007) No-load maximum power consumption ranging from 0.3 to 0.5 W</p> |
| <p><i>Agreement by the Consumer Electronics Industry on Reducing the Energy Consumption of Televisions and Video Recorders in Stand-by Mode (1997)</i></p> <p>http://energyefficiency.jrc.cec.eu.int/pdf/TV_VCR_VA_agreement.pdf</p> <p><u>Concern:</u> consumption of energy in stand-by mode</p> <p><u>Aim:</u> to reduce energy consumption by televisions ("TVs") and video recorders ("VCRs") in standby mode.</p> | <p>REPLACED BY THE SELF-COMMITMENT ON TV & DIGITAL TV SERVICES/</p> <p><u>Participants:</u> Bang & Olufsen, Hitachi, JVC, Loewe Opta, Mitsubishi, Panasonic, Philips, Pioneer, Samsung, Sanyo, Sharp, Sony, Thomson Multimedia, Toshiba</p> <p><u>Results:</u></p> <p>From 1.1.2000 all TVs and VCRs placed on the market have a standby power use less than or equal to 10W. The average standby power consumption of all the units sold by a given manufacturer does not exceed 6W.</p> |
| <p><i>Code of conduct for Digital TV Services (2001)</i></p> <p>http://energyefficiency.jrc.cec.eu.int/pdf/COP_IRDv10_march2001.pdf</p> <p><u>Concern:</u> the absence of a standby passive mode or a normal on/off</p> | <p>ON GOING/</p> <p><u>Participants:</u> Matsushita, Nokia, Philips, Pioneer, Sony</p> <p><u>Results:</u></p> |

⁶¹ Only EICTA members are listed.

| | |
|---|--|
| <p>switch</p> <p><u>Aim:</u> to introduce power management for this equipment together with targets for the consumption in standby.</p> | <p>-(from 2003-2005) Stand-alone STBs in the basic configuration: 6 W (standby passive) and 9 W (standby active)</p> <p>-(from 2005-2006) Digital TVs with IRD: 3 W (standby passive), and standby active ranging from 7 W (Terr.) till 9 W (Sat)</p> <p>-(from 2005-2006) Basic Digital TV converters boxes: 2 W (standby passive) and standby active ranging from 11W (Terr) till 14 W (Sat.)</p> |
| <p><i>Commitment by the Consumer Electronics Industry on Reducing the Energy Consumption of Audio Products in Stand-by Mode (2000)</i></p> <p>http://energyefficiency.jrc.cec.eu.int/pdf/TR-036-r01_Audio_VA.pdf</p> <p><u>Concern:</u> consumption of energy in stand-by mode</p> <p><u>Aim:</u> to save energy by reducing the stand-by power consumption for audio products</p> | <p>ON GOING/</p> <p><u>Participants:</u> Pioneer, JVC, Thomson, B&O, Matsushita, Sharp, Sanyo, Sony</p> <p><u>Results:</u></p> <p>To reduce standby power consumption of audio product to < 1W by 1.1.2007</p> |
| <p><i>Industry Self-Commitment to improve the energy performance of CRT and flat LCD televisions and stand by mode for DVD players sold in the EU</i></p> <p><u>Concern:</u> to increase demand on energy efficient appliances (need for consumer information regarding consumption of energy and other resources by household appliances)</p> <p><u>Aim:</u> To reduce the energy burden of consumer electronics by continuously seeking to improve the energy performance per appliance (Initially it will cover on mode and stand by mode for CRT televisions and stand by mode for DVD players and flat TV LCD screens; in the future, it is expected to bring other appliances within its scope).</p> | <p>ON GOING/ The European Commission announced in the last EU Labelling Committee meeting its official acceptance of the “EICTA Self Commitment for TV”</p> <p><u>Participants:</u></p> <p>-CRT TV: Thomson, Toshiba, Sharp, Philips, Loewe Opta, Sony, Bang & Olufsen, Panasonic, LG, Sanyo, Hitachi.</p> <p>-Non CRT: Sharp, Pioneer, B&O, Sanyo, Samsung</p> <p>-DVD: Sharp, Philips, Pioneer, Sony, Bang & Olufsen, Hitachi, Samsung.</p> <p><u>Results:</u></p> <p>CRT TV: company average 3.0 W by 2005; Maximum value 1.0 W by 2007</p> <p>Non CTR TV: company average 3.0 W by 2005; Maximum value 1.0 W by 2007</p> <p>DVD: Maximum standby value 1.0 W by 2005</p> |

| | |
|---|---|
| <p>European Community Energy Star Board on Office Equipment (PCs, Monitors, etc)- ECESB (2003) http://www.eu-energystar.org/en/index.html</p> <p><u>Concern:</u> Office information and communication technology equipment is responsible for a large share of electricity consumption in the tertiary sector within the EU</p> <p><u>Aim:</u> electricity savings by stimulating the supply of, and the demand for, energy efficient office equipment. In this sense, in order to remain on the list of participating product manufacturers the participants shall provide clear labelling and annual updates of ENERGY STAR qualifying office equipment models.</p> | <p>ON GOING/</p> <p><u>Participants:</u> Apple, Canon, Dell, Epson, Fujitsu, Fujitsu-Siemens, Hitachi, HP, HP-Compaq, IBM, Lexmark, LG, Matsushita, NEC, OCE, Philips, Ricoh, Samsung, Sharp, Sony, Sun, Toshiba</p> <p><u>Results:</u></p> <p>The database shows energy consumption and main performance data as supplied by the manufacturers for close to 10 000 models. All products listed (see at http://www.eu-energystar.org/en/en_database.htm) are above the voluntary minimum standards.</p> |
|---|---|

Appendix D: Analysis of Type I, Type II and Type III Eco-information Schemes in Context of Mobile Phones

This analysis was primarily conducted by the phone manufacturers in discussion with the participating stakeholders. A few participating stakeholders do not necessarily agree with all the points in the analysis.

Type I Eco-labels

Type I is a multi-attribute eco-label based on certain pre-defined criteria set by an independent eco-labelling body. Typically, this type of label is granted by an independent organisation after third party verification.

The positive aspects of eco-labels are:

- They can form a reliable information source for consumers and other buyers.
- Consumers can readily recognise products with these labels if they are well-established.
- They may give a competitive advantage to companies if they are well recognised, respected and preferred by the consumers.

However, according to the participating mobile phone manufacturers and operators labels have had less success for complex ICT products like for mobile phones than for other products. The main challenges are:

- It can be difficult for eco-labelling bodies to keep up with rapid technological improvements taking place in the ICT industry. Setting and amending criteria using a proper stakeholder consultation is a time consuming process. The criteria set by these bodies may already be obsolete when published for the first time.
- Unless these labels are updated regularly in line with technological developments they do not support continuous improvements. If the body defining criteria cannot keep up with technological developments then such a label may even hinder environmental improvements. Ensuring continuous improvement may practically mean that the eco-labelling bodies should know new technologies before they are on the market.
- It could be very difficult to develop criteria to take complex product and technology environment into account – for example how to assess the impact of digital convergence. In the case of mobile phones an example could be a multimedia device vs. a separate phone, PDA, camera etc.
- From the mobile phone manufacturers' point of view, additional costs and possible delays in product launches are significant issues especially as third party verification for each product type is required. One manufacturer alone can release more than 40 new products per year.

Type II Self-Declarations

Type II self-declarations are based on producers' claims on certain environmental aspects of their products. Producers can add a symbol or statement e.g. 'lead-free', 'made of recycled materials' on their products. The positive characteristics of these declarations include:

- They are fast and cheap to produce.
- Producers can rapidly and cost-efficiently communicate environmental aspects of their products including new environmental improvements by using them.
- New technological innovations, which have led to reduction in environmental impacts, can be taken into account immediately after the products are put on the market. This supports continuous improvements and in the best case can become a sales argument, thus, speeding up the improvements.

The challenges with this scheme are:

- Relevance, adequacy, and credibility of the information declared by the manufacturers as it not verified by a third party.
- Simplicity of the information declared so that the consumers clearly understand it.

Type III Certified Product Declarations

Type III scheme requires quantified environmental information to be declared as a certified/verified report card. The quantified environmental information on product in type III declarations must be based on results from a life cycle assessment (LCA) in conformity with ISO 14040 standards.

As discussed in the stage I report in section 3.1, the practical usage of LCAs for mobile phones (and similar complex products) has proven to be very difficult. The stage I report also discusses that the LCAs are not precise enough to reliably differentiate complex ICT products of same category or type. The main value of detailed and effort intensive LCA studies lies in providing input to the strategic decisions during technology development.

These labels are more suited for business customers rather than the general consumers. The business customers can make an informed decision about their choices in line with their environmental priorities. The main challenge with using type III labels for mobile phones is that the LCAs cannot be relied upon to differentiate between different models of mobile phones due to the limitations discussed in the stage I report in section 3.1 and in appendix E.

Appendix E: Issues with using LCA for Complex Products like Mobile Phones

| Limitations of LCA for mobile phones |
|--|
| <p>LCA provides a useful framework for assessing the environmental impacts of products and providing scientific input to the strategic decisions. However, their use, as of now, has certain practical limitations, as described below, for the mobile phones⁶².</p> <ul style="list-style-type: none"> – Full LCA studies require a considerable effort if done for complex products such as mobile phones. In order to increase the cost and time-efficiency of such studies to meet the short innovation and development cycles in this industry, two options are viable: a) generic, mobile-phone specific LCI models have to be developed (such as those developed by some car manufacturers for their products). According to the Commission, the experience made by the in-house LCA experts of these car producers shows that the effort for reaching the same reliability in results goes down by a factor of 10 to 30 for further studies, once such a model is established. Such models have to be filled with data and interpreted by LCA experts; b) KEPI-type Eco-design tools could be developed. They would be based on underlying full LCI data sets but can be used without understanding of LCA methodology, and hence also by product developers and designers. These tools are based on technical product parameters and have an interface in the design language of the specific product group, for which the tools are made, but have the life cycle logic of that product group already built-in. – Due to the complex nature of many electronics products including mobile phones, the potential scope of the data that has to be collected to conduct a life-cycle inventory is very large if aiming at all data of all materials and processes involved along the supply chain. To solve this problem, first a very limited number of representative but detailed LCA studies should derive insight on the environmentally dominating contributors to mobile phones and their most relevant functions and related components. This insight is then used to both develop KEPI-type eco-design tools and underlying LCI data sets and to strongly limit the effort for data collection and data updating to the relevant materials, parts and processes. – LCA tools need to be further developed to be able to assess the differences between two mobile phones from the same generation. Presently the differences in the results are so small that they easily get buried in the assumptions that need to be made for conducting LCA. – A major issue restricting at present the use of LCA (and hence any simplified tools based on LCA) is the current lack of available process and environmental data for many substances and components in mobile phones. For example, data is only just becoming available for many of the materials used e.g. precious metals such as gold and silver. Information on any substances that are not in widespread use, including rare earth metals and rare substances, are not usually available at all. In particular there is a lack of data on the toxicity issues related to the end-of-life phase. Therefore, inventorying and especially assessing toxic releases and their potential effects is one of the issues that require further scientific development, in order to increase the reliability of this part of the results of LCA studies. – The results of LCA studies are not directly interpretable/useful for non-LCA experts. The “translation” into decision support recommendations is required. This has to be done by LCA experts. Once simplified tools are established on the basis of LCA (e.g. KEPIs - type eco-design tools) the output of such tools can directly be used. – The impact assessment phase is in LCA inevitably contentious because of the complexity of environmental problems and also because it involves value judgements in weighting the significance of different environmental impacts. LCIA helps to better structure and compare all relevant impacts, while the weighting itself is beyond scientific objectivity, as it involves subjective choices and priority setting. This setting of weights should be done in a transparent way and involving different stakeholder groups to come to generally/widely accepted weighting methods. – LCA does not cover local environmental problems and priorities, but gives an overview of the possible global problems. It requires additional tools such as e.g. EIA to be used together with LCA, if local issues are expected or known to play a relevant role in the specific case investigated. – While LCA needs further development in some aspects and methodological harmonisation (such as the one on- |

⁶² For discussions on LCA see the section 3.1.4 in the stage I report available at: http://ec.europa.eu/environment/ipp/pdf/nokia_mobile_05_04.pdf

going in the Commission's project "European Platform on Life Cycle Assessment"), if its weaknesses are acknowledged it is already today suitable as a basis for example, for:

- Strategic environmental assessment of a new technology or a new business model, i.e. new type of component, material, technology, product or service provision.
- Developing easy-to-use KEPI-type Ecodesign tools to implement life-cycle thinking in daily design and development decision-making in industries which produce complex products.
- Research purposes in identifying the most significant environmental impacts of a product life-cycle.

Appendix F: EU Regulations Most Relevant to Environmental Aspects of Mobile Phones

Almost all the environmental regulations including waste and majority of chemical regulations as well as some others have direct, indirect or possible influence on the life-cycle environmental issues of the mobile phone industry (including upstream and downstream suppliers). Regulations from areas other than environment also affect the environmental issues of products. There are hundreds of regulations, relevant directives, and decisions at the European Union (EU) level that should be considered if a complete picture is to be drawn. If the considerations are limited to the product related aspects, the following regulations have major influence on environmental issues of mobile phones.

| EU Regulations Relevant to Product Related Aspects | |
|--|---|
| 2002/95/EC | RoHS Directive |
| 2002/96/EC | WEEE Directive |
| 2005/32/EC | EuP Directive |
| 91/157/EEC + amendments | Battery Directive |
| COM(2003)723 | Proposed Battery Directive |
| 94/62/EC + amendments | Packaging Directive |
| 67/548/EEC + amendments | Directive on classification, packaging and labelling of dangerous substances |
| 76/769/EEC + amendments | Directive on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations |
| COM(2003)644 | Proposed REACH Directive |
| EC/2037/2000 + amendments | Regulation of the European Parliament and of the Council on substances that deplete the ozone layer |
| COD/2003/0189 | Proposal for a Regulation of the European Parliament and of the Council on certain fluorinated greenhouse gases |
| 1999/13/EC | Council Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installation |
| 75/442/EEC + amendments | Council Directive on waste |
| 91/689/EEC + amendments | Council Directive on hazardous waste |
| 2000/532/EC + amendments | European Waste Catalogue |
| EEC no 259/93 | Council Regulation on the supervision and control of shipments of waste within, into and out of the European Community |
| 2001/95/EC | Directive of the European Parliament and of the Council on general product safety |
| 73/23/EEC | Low Voltage Directive |
| 2000/729/EC | Commission Decision on a standard contract covering the terms of use of the Community Eco-label |
| (EC) No 1606/2002 | Regulation (EC) No 1606/2002 of the European Parliament and of the Council on the application of international accounting standards |

| Acknowledged (by EU Commission) Voluntary Measures | |
|---|---|
| EC No 761/2001 + amend | EMAS |
| EC/1980/2000 | Euro Flower |
| 2003/269/EC | EU Energy Star |
| 2001/453/EC | Commission Recommendation on the recognition, measurement and disclosure of environmental issues in the annual accounts and annual reports of companies |
| Ref. European Commission Directorate General JRC Joint Research Centre Institute for Environment and Sustainability Renewable Energies Unit | Code of Conduct on Efficiency of External Power Supplies |