

Smart tracker chips — Feasibility study on the inclusion of RFID in Electrical and Electronic Equipment for WEEE management

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National foreword

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**Smart tracker chips -
Feasibility study on the inclusion of RFID
in Electrical and Electronic Equipment
for WEEE management**

This Technical Report was approved by CENELEC on 2006-06-17.

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CENELEC

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Foreword

This Technical Report was prepared by CENELEC BTTF 116-3, Waste from electrical and electronic equipment (WEEE).

The text of the draft was submitted to the formal vote and was approved by CENELEC as CLC/TR 50489 on 2006-06-17.

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Introduction

An RFID (Radio Frequency Identification) system consists of a transmitter, a receiver (mostly combined and called a transceiver, interrogator or reader), an antenna and a tag or transponder. The transmitter sends out a radio signal on a certain frequency by means of an antenna. This signal is recognised by the tag if within the transmitter's reading range. The tag then responds with a signal that is recognised by the receiver. Data within a tag may provide identification for an item in manufacture, goods in transit, a location, the identity of a vehicle, an animal, an individual, etc. By including additional data, it is possible to support applications by item specific information or instructions immediately available on reading the tag. A certain protocol takes care of the communication between reader and the host computer.

Three frequency ranges has generally been distinguished for RFID systems: low, medium and high. Table 1 summarises these three frequency ranges, along with the typical system characteristics and examples of major areas of application.

Table 1 – Frequency bands and typical characteristics

Frequency range	Typical characteristics
Low 1 Hz - 300 kHz	Short to medium read range Low reading speed
Medium 300 – 3 000 kHz	Short to medium read range Potentially, medium reading speed
High 3 MHz – 30 GHz	Long read range High reading speed Line of sight required

The choice of operating frequency is of primary importance in determining data transfer rates. Generally speaking the higher the frequency the higher the data transfer or throughput rates that can be achieved.

The CECED report “ELECTRONIC PRODUCT IDENTIFICATION, A Study into the feasibility of technologies that enable the identification of producer and product characteristics”, (see Annex A) was considered the most relevant report available and used as main reference for this Technical Report.

1 Scope

This Technical Report investigates in the light of the implementation of the WEEE Directive (2002/96/EC) the feasibility of deploying machine readable product identification technologies (e.g. smart tracker chips) to fulfil the marking requirement for the purpose of implementing producer responsibility. The product recognition shall provide information for waste stream management (sorting, reporting and cost allocation).

Machine readable product identification technologies can be utilized during every phase of the product life cycle of an EEE. The WEEE management is the last phase. This Technical Report focuses on this phase only.

2 Abbreviations

In the body of this Technical Report the following abbreviations have been used:

CECED: Comité Européen des Constructeurs d'Equipements Domestiques

EEE: Electrical and Electronic Equipment

RFID: Radio Frequency IDentification

SWOT: Strength Weakness Opportunity Threat

WEEE: Waste Electrical and Electronic Equipment

3 SWOT Analysis of RFID use in waste management

Strength	Weakness
• No line of sight • Bulk tag reading • Not affected by dirt or scratches • Information link • Non-contact identification	• Shielding of metals • Initially only pallets & boxes are tagged • Range/Readability. • Reliability/Durability • Changing technology in lifetime of product • Recycling Industry may not use RFID unless whole WEEE category uses them • Creating more WEEE. • Missing infrastructure
Opportunity	Threat
• Read-rate • Cost / tag • Process innovation • Key to Product Life-cycle Management • Additional data • Data format standardization • Integrity of supply chain management systems	• Data security • Limitation of RFID use until Point of Sales • Privacy • Cost of Tag • Could be used for other purposes • Could store commercially sensitive data • Identity Theft • Miss-Identification • Future incompatibility technology changes • RFID not implemented in logistics at item level

4 Technical requirements

In addition to the requirements in the CECED report the main requirements of the RFID's are:

- Accurate multiple/bulk tag reading
- Live span of tag and information stored longer than product life
- Tag environmental compatible with the product life cycle
- Interoperability between tags and readers used for the same purpose
- Tags to fit into all product types
- The data format stored shall be widely international recognized

5 Economic requirements

According to current knowledge and the return on investments, the use of RFID for only waste management purposes is not economically feasible.

RFID use for WEEE management needs to be an integrated part of automatic products identification during the whole product life-cycle and by its included actors.

To be able to justify RFID for waste management we would have to build on existing RFID applications such as supply chain management. However until technology and standards in these other applications can become stable then RFID for waste management can not be considered.

6 Social considerations

When introducing RFID for WEEE management the following aspects have to be addressed (alphabetic):

- data security
- ethics
- health and safety
- market acceptance
- privacy legislation

7 Legal considerations

When introducing RFID for WEEE management as part of a legislative requirement it has to be at least harmonized within European Union (Article 95 in the European Treaty).

8 Environmental considerations

If RFID is introduced solely for WEEE management without taking benefit from the use of RFID in other management aspects one would just introduce an additional electronic component with a negative impact on the environment. As RFID gives an opportunity for better waste management an assessment of introducing a new component against this must be carried out.

9 Conclusion

Utilization of machine readable product ID identification for WEEE management is dependant on it being applied during production.

The introduction of machine readable product identification technologies can not solely be introduce for WEEE management purposes but needs wider consideration of all needs and limitations along the product life cycle.

The task force has not been able to determine any progress in RFID technology which significantly changes the conclusions of the CECED report.

The key conclusion from the Executive Summary of the CECED report is still considered valid:

- No tagging system currently available or available in the foreseeable future will meet the current operational requirements for disposal and logistics of WEEE.
- There is no clear financial case for adopting a tagging system in the short term (10 years). Having made substantial up-front investment then tagging may offer financial benefit over a 20 year plus period for large goods.
- The major hurdle to adoption of tagging is the acceptance of the investment and operational changes required by other stakeholders such as disposal companies and local authorities.

The resulting conclusions from the task force are as follows:

- There are no technical and economical ground for implementing RFID for waste management.
- The RFID technology are evolving and due to this fact the issue should be reviewed within the next 3-5 years or as soon as RFID at item level is used widely.

Bibliography

ISO/IEC 19762-3:2005, Information technology - Automatic identification and data capture (AIDC) techniques - Harmonized vocabulary - Part 3: Radio frequency identification (RFID)

Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) - Joint declaration of the European Parliament, the Council and the Commission relating to Article 9, Official Journal L 037, 13/02/2003 P. 0024 - 0039

Annex A
(informative)

CECED report
ELECTRONIC PRODUCT IDENTIFICATION
A Study into the feasibility of technologies that enable
the identification of producer and product characteristics

ELECTRONIC PRODUCT IDENTIFICATION
A Study into the feasibility of technologies that enable the
identification of producer and product characteristics

CECED

FINAL VERSION

4th July 2003

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EXECUTIVE SUMMARY

This report has been produced for CECED by Scientific Generics Ltd., Cambridge, England. The report is a study into the feasibility of using technologies that enable the identification of producer and product characteristics in order to address the EU directives regarding waste electrical and electronic equipment (WEEE) and the restriction of the use of hazardous substances.

The study comprised four main sections of work:

- Tagging System Requirements
- A technology review
- An examination of other benefits
- A cost/benefit model

Data was compiled from CECED members and other stakeholders such as disposal companies and local authorities. Market data was supplied by CECED and combined with other sources of public information. Information regarding equipment and costs was obtained from system suppliers.

The results of the studies are included in the appendices and an overview presented in the main summary document.

The key conclusions are:

- No tagging system currently available or available in the foreseeable future will meet the current operational requirements for disposal and logistics of WEEE.
- There is no clear financial case for adopting a tagging system in the short term (10-15 years). Having made substantial up-front investment then tagging may offer financial benefit over a 20 year plus period for large goods.
- The major hurdle to adoption of tagging is the acceptance of the investment and operational changes required by other stakeholders such as disposal companies and local authorities.

The key recommendations are:

- Do not adopt a tagging solution to address WEEE and RoHS for the present
- Investigate other means of management of disposal costs associated with the WEEE directive, for example sampling.

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D	Technology Review
E	RFID Technical Summary
F	Supplier Questionnaire
G	Report on Suppliers of RFID systems
H	CECED Member Questionnaire
I	Report from Recycling and Disposal Companies

1 INTRODUCTION

This document is the output from Scientific Generics' study into the feasibility of using tagging technologies to enable the identification of producer and product characteristics of electronic and electrical items. Details of the programme of work for the study are contained in Scientific Generics proposal dated 17th March 2003 and agreed on behalf of CECED by Mr Luigi Meli on the 30th April 2003. A copy of the proposal has been attached in Appendix B. The proposal was written in response to the CECED Electronic Product Identification (EPI) request for proposal dated 6th March 2003 (Appendix A).

The primary purpose of the study was to investigate whether tagging would be an appropriate technical and cost effective method to address the European Union (EU) directives 2002/96/EC on waste electronic and electrical equipment (WEEE) and 2002/95/EC on the restriction of the use of certain hazardous substances (RoHS). The primary objective of the study was to recommend to CECED a way forward with respect to tagging to address the EU requirements.

A secondary objective for the study was to identify whether tagging could add further functions of benefit to the producer throughout a product's lifecycle and to consider whether these benefits could offset any additional cost due to installing tagging and its infrastructure.

For convenience the report has been divided into the following sections though none of the topics are independent and within the study have been considered "in the round" for the purposes of the conclusions. This document contains a summary of our findings for each section described below plus our conclusions and recommendations. The detailed results have been included as appendices and referred to as appropriate throughout the text.

- **Technology requirements** – the tagging requirements as stated by the CECED members have been collected into a Requirements Specification. Other stakeholders such as disposal and recycling companies, local authorities and retailers have also been consulted to obtain their input as to the minimum technical requirements needed to generate a viable system. As technologies have been reviewed they have been compared with these requirements to assess whether their technical performance satisfies or come close to satisfying the industry requirements.
- **Technology review** – Scientific Generics has reviewed identification technologies either currently available or close to being available and described each group of technologies in the technology report. Each technology has initially been assessed to see whether three basic requirements agreed with CECED members are met. Technologies that do meet the basic requirements have then been discussed in more detail and various options for adoption reviewed. SG has contacted system suppliers using a questionnaire followed by telephone interviews and also researched case studies via the web.

- **SWOT Analysis** – The technologies that have been identified as potentially being of use in addressing the WEEE directives (as opposed to satisfying all the requirements requested by the CECED membership) have been subjected to an analysis of their strengths, weaknesses, opportunities and threats as requested by CECED.
- **Other Applications** – Other uses for tagging were investigated using a questionnaire sent out to CECED members and followed by a workshop held in Brussels to discuss the various options.
- **Other Stakeholders** – The decision to implement any system that can identify the original producer and also the material content of the article will require agreement of all interested parties and not just the producers. To this end we have contacted several other stakeholders to understand the current status of their industry and canvas opinions on tagging. The stakeholders spoken to included the Department of Trade and Industry in London, the local authorities in the UK, disposal companies and recycling and reprocessing companies in Europe. A summary of our findings is given for each group of stakeholders. (Other National Government sources have been contacted but at time of writing no replies have been received as yet).
- **System Infrastructure and Integration** – In order for a tagging solution to operate, a management information system will need to be constructed and common standards of data structure agreed. Several groups are starting to devise systems and agree data structure standards to address this issue. SG has contacted two such groups and comments on a way forward for CECED members.
- **Cost Benefit Analysis** – Using data from a number of sources including system suppliers, market statistics, disposal companies and local authorities, a model has been constructed to assess the costs versus the benefits of adding tagging technology to products.
- **Conclusions** - Taking into consideration all the inputs from the areas studied conclusions have been drawn as to the applicability of tagging to address the EU directives and recommendations made as to how the CECED membership should proceed.
- **Recommendations** – Scientific Generics' recommendations as to how to progress are listed.

2 TECHNOLOGY REQUIREMENTS

The completed Requirements Specification document is included in Appendix C.

The specification was constructed initially by taking into account those requirements listed in the CECED request for proposal dated 6th March 2003. Further requirements were added and some of the existing data refined in discussions with the CECED members present at the meeting held in Brussels on 16th April 2003.

Three overriding requirements were agreed, these were:

- 1 The technology had to be commercially available now or at least by the entry into force of the financing requirement of the WEEE directive. This will be effective from the 13th August 2005.
- 2 The technology must allow for “remote read”. A read range of 5cm was chosen as the absolute minimum acceptable (a much larger read range of 2m was requested by some CECED members, however, to adopt that criteria would exclude the vast majority of technologies available)
- 3 The data capacity must be sufficient for 5 billion codes (33 bits). This number was based on 50 million large items and 200 million small items being manufactured per annum over a twenty year period

These three requirements were used as a first pass assessment in the technology review.

The main functions of any system were stipulated as follows:

- to identify the producer or importer
- to identify the type of equipment, allowing appropriate disposal
- to identify the individual item to allow payment of disposal tax and recording of that disposal
- identification of data detailing the hazardous materials content of the equipment to enable correct disposal and recycling to be carried out.

In order to achieve these functions it was concluded that any system must meet the following general requirements summarised below:

- universal across the region within EU jurisdiction
- meet regulatory requirements in all member countries
- be robust
- immune from duplicated readings
- the system must be secure against fraud, though this could be at the system level rather than the technology level
- A system must be “future proof”, i.e. able to be adapted as new developments in technology and regulations become available
- Each product should be assigned its own unique code valid for twenty years

Each of these requirements is explained in more detail in the specification in Appendix C.

3 TECHNOLOGY REVIEW

Scientific Generics has a great deal of experience in assessing and developing tagging systems and indeed owns IPR in two technologies “Programmable

Magnetic Resonance” and “Flying Null”. SG has also carried out reviews of tagging solutions for clients in many different scenarios from medical devices to gas cylinders. In order to carry out the technology review for CECED SG has drawn on this past experience to generate an overview of tagging technologies for the CECED EPI application. This is presented as a “stand alone” document in Appendix D.

The following classes of technology have been briefly described and also illustrated.

- Retail security tags
- Contact technologies
- Optical bar codes
- Chipless tags
- RFID tags
- Other technologies

Each technology has then been assessed against the three primary criteria defined in the Requirements Study (see Section 2 above), i.e.:

- 1 Commercially available
- 2 Remote read (>5cm)
- 3 Data capacity (>33 bits)

Two technologies passed all three criteria: optical barcoding and RFID tagging, and these were investigated in greater depth.

System suppliers were contacted using a basic questionnaire relating to the CECED EPI application. The supplier questionnaire is included in Appendix F. In most cases, the suppliers were also interviewed by telephone in order to discuss in detail their technology performance and further assess its applicability to the EPI application. A report of the detailed technology findings from the suppliers is given in Appendix G.

Several variants of the two technologies were evaluated against the key requirements, as shown in Table 1 below. From these, variants representing the range of product cost estimates were considered in carrying out the cost benefit analysis.

Technologies	Barcodes		RFID						
			125-134kHz	13.56MHz	13.56MHz	13.56MHz	433MHz	868MHz	915MHz
Requirements	1D barcodes	2D barcodes	LF R/O	HF R/O	HF ISO15693	HF ISO14443	UHF	UHF (Eur)	UHF (US)
General									
Data Capacity	<50 bit	>50bit	>50bit	>50bit	>50bit	>50bit	>50bit	>50bit	>50bit
Tag lifetime (data retention)	>20 years	>20 years	> 20 years	> 20 years	10 years guar.	10 years guar.	10 years guar.	10 years guar.	10 years guar.
Passive tag (no battery required)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Secure/Fraud proof	Easy to copy	Easy to copy	Hard to copy	Hard to copy	Hard to copy	Crypto	Hard to copy	Hard to copy	Hard to copy
Tag removal destroys tag	Can design	Can design	Can design	Can design	Can design	Can design	Can design	Can design	Can design
Fault tolerance	Can misread	Can fail to read	Can fail to read	Can fail to read	Can fail to read	Can fail to read	Can fail to read	Can fail to read	Can fail to read
Read on metal	Yes	Yes	Range 70%	Range<<70%	Range<<70%	Range<<70%	Range<<70%	Range<<70%	Range<<70%
Read-only available	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Line of sight read required	Yes	Yes	No	No	No	No	No	No	No
Remote read possible	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Robustness to environment	Badly affected	Badly affected	Unaffected	Range 70%	Range 70%	Range 70%	Badly affected	Badly affected	Badly affected
Robustness to handling	Easily destroyed	Easily destroyed	Robust	Robust	Robust	Robust	Robust	Robust	Robust
Standards available	Established	Established	Some exist	Emerging	Established	Established	Emerging	Emerging	Emerging
Comply with EC freq regulations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Comply with US freq regulations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Comply with hazardous materials regulations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commercially available	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-type specific									
Large white goods (Class 1 & 2)									
Tag cost (installed, 100s millions volumes)	20-50c	20-50c	30-60c	30-50c	40-60c	50-70c	20-50c	20-50c	20-50c
Handheld reader cost (linked to a PC)	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400
Tag size	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today
Read range (assumes on metal)	> 1.5m	> 1.5m	Up to 1m	< 70cm	< 70cm	< 70cm	Up to 1m	Up to 1m	Up to 1m
Compatible with recycling	Not compacted	Not compacted	Orientated	Orientated	Orientated	Orientated	Orientated	Orientated	Orientated
Compatible with logistics	No	No	No	No	No	No	No	No	No
Vacuums and microwaves									
Tag cost (installed, 100s millions volumes)	20-50c	20-50c	30-60c	30-50c	40-60c	50-70c	20-50c	20-50c	20-50c
Handheld reader cost (linked to a PC)	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400
Tag size	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today
Read range (assumes on metal)	> 1.5m	> 1.5m	Up to 1m	< 70cm	< 70cm	< 70cm	Up to 1m	Up to 1m	Up to 1m
Compatible with recycling	At drop off	At drop off	If robust tag	At drop off	At drop off	At drop off	At drop off	At drop off	At drop off
Compatible with logistics	No	No	No	No	No	No	No	No	No
Class 4 & 5									
Tag cost (installed, 100s millions volumes)	15-40c	15-40c	25-50c	30-50c	40-60c	50-70c	20-50c	20-50c	20-50c
Handheld reader cost (linked to a PC)	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400	300-400
Tag size (for smallest products)	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today	Fits today
Read range (for smallest products)	10cm	10cm	20cm	10cm	10cm	10cm	Up to 1m	Up to 1m	Up to 1m
Compatible with recycling	At drop off	At drop off	At drop off	At drop off	At drop off	At drop off	At drop off	At drop off	At drop off
Compatible with logistics	No	No	No	No	No	No	No	No	No

Table 1: Comparison of Tag Technologies verses System Requirements

Legend

Data Capacity		<50 bit	>50bit
Tag lifetime (data retention)	<10 years	10 years guaranteed	>20 years
Passive tag (no battery required)	No		Yes
Secure/Fraud proof	Easy to read and copy	Easy to read Hard to copy	Encrypted Hard to read and copy
Tag removal destroys tag	No	Can be designed	Yes
Fault tolerance (inherent technology property - environmental impact covered later)	Potential for misreads	Low % fail to read, but not misread	Never fails to read
Read on metal	Read range greatly reduced	Read range reduced 30%	Yes
Read-only available	No - R/W		Yes
Light of sight read required		Yes	No
Remote read possible	No		Yes
Robustness to environment	Read range greatly reduced	Read range reduced 30%	Unaffected by dirt and water
Robustness to handling	Easily destroyed		Hard to destroy if packaged well
Standards available	No	Emerging	Established
Comply with EC regulations	No		Yes
Comply with US regulations		No	Yes
Comply with hazardous materials regulations	No		Yes
Commerically available		In < 1 year	Yes
Large white goods (1&2)			
Tag size	Too big for product	Fit with redesign	Fits today
Read range	<0.5m	0.5-1.5m	>1.5m
Compatible with recycling	No	Yes, if individualised, orientated and not compacted	Yes, if orientated and partially compacted
Compatible with logistics	No added benefit over existing barcode systems		Yes, if can read stacked pallets, e.g. 18 washing machines (3x3x2)
Vacuums and microwaves			
Tag size	Too big for product	Fit with redesign	Fits today
Read range	<0.5m	0.5-1.5m	>1.5m
Compatible with recycling	No	Yes, at drop-off point when individualised	Yes, if individualised during processing after compacting
Compatible with logistics	No added benefit over existing barcode systems		Yes, if can read pallet of many products
Class 4 & 5			
Tag size	Too big for product	Fit with redesign	Fits today
Read range	<0.5m	0.5-1.5m	>1.5m
Compatible with recycling	No	Yes, at drop-off point when individualised	Yes, if individualised during processing after compacting
Compatible with logistics	No added benefit over existing barcode systems		Yes, if can read pallet of many products

Table 2: Legend for Comparison of Tag Technologies verses System Requirements

4 SWOT ANALYSIS

The SWOT analysis has been performed on:

- 1D bar-codes
- 2D bar-codes
- low frequency read only RFID technology
- high frequency read only technology
- high frequency read/write technology, ultra high frequency and microwave technologies.

4.1 1D Bar codes

Strengths

- Can be very low cost (depending on tag substrate)
- Widely available
- Familiarity
- Could use existing infrastructure

Weaknesses

- Easily obscured
- Limited data capacity
- Not secure
- Easily copied
- Easily damaged physically (e.g. Compacting)
- Requires line of sight
- Label relatively large for small goods, poor visual impact

Opportunities

- Integrate with current systems

Threats

- Damaged codes lead to too many labels unable to be read resulting in loss of system credibility
- Not extensible
- Greater potential for misreads than other systems

4.2 2D Bar codes

Strengths

- Can be very low cost (depending on tag substrate)
- Adequate data capacity (variable according to area)

Weaknesses

- Easily obscured
- Not secure
- Easily copied
- Easily damaged physically (e.g. Compacting)
- Requires line of sight
- Label relatively large for small goods, poor visual impact

Opportunities

- Integrate by upgrading current systems

Threats

- Damaged codes lead to too many labels unable to be read resulting in loss of system credibility

4.3 Low Frequency – Read Only

Strengths

- Adequate data capacity
- Resistant to contamination
- Not line of sight
- Discreet for small product
- Can be made physically robust

Weaknesses

- Needs to be orientated
- Range diminished by metal
- Minimum cost for complete label higher than bar codes
- Immature standards

Opportunities

- Could replace current bar code systems with a more robust solution

Threats

- Public perceive threat to their data protection rights
- Poor read rate would destroy credibility

4.4 High Frequency Read /only

Strengths

- Adequate data capacity
- Resistant to contamination
- Not line of sight
- Discreet for small product
- Can be made physically robust
- Most established frequency in RFID

Weaknesses

- Shorter read range than LF
- Greater sensitivity to contamination
- Needs to be orientated
- Range diminished by metal
- Minimum cost for complete label higher than bar codes
- Not compatible with other equipment such as conveyors

Opportunities

- Could replace current bar code systems with a more robust solution

Threats

- Public perceive threat to their data protection rights
- Poor read rate would destroy credibility

4.5 High Frequency Read/write ISO 15693

As for HF R/O

Additional threat that the data may not be retained for 20 years.

4.6 High Frequency Read/write ISO 14443

As above except:

Strengths

- Cryptographic format

Weakness

- Higher cost

4.7 Ultra High Frequency (UHF)

Strengths

- Adequate data capacity
- Not line of sight
- Discreet for small product
- Can be made physically robust
- Potential compatibility with emerging technologies
- High data rate
- Increased read range

Weaknesses

- Much greater sensitivity to contamination
- Needs to be orientated
- Range diminished by metal

Opportunities

- Very low costs claimed once technology is available.

Threats

- Public perceive threat to their data protection rights

- Poor read rate would destroy credibility

4.8 Microwave

Strengths

- Adequate data capacity
- Not line of sight
- Discreet for small product
- Can be made physically robust
- Increased read range

Weaknesses

- Very sensitive to contamination
- Only available in the US

Opportunities

- Future changes in EU regulations may make technology available

Threats

- Public perceive threat to their data protection rights
- Poor read rate would destroy credibility

5 OTHER APPLICATIONS

A number of possible other applications for tagging were listed in the CECED request for proposal dated 6th March 2003. These were amplified in discussions with CECED members at the pre-start-up meeting held in Brussels on the 16th April. More information was sought firstly, by sending out a questionnaire to the CECED members (Appendix H) and secondly by use of a workshop held with those members of the CECED task force that could attend the CECED offices on the 11th June 2003. At that meeting the possible applications were reviewed and it was agreed with the members present which applications were potentially of real benefit and which were not. Those applications that were thought by the CECED members to be potentially beneficial have been considered for the cost/benefit model.

The additional potential applications identified in the CECED request for proposal were:

- Manufacturing assembly line

- Supply chain logistics
- Wholesale
- Retail
- After sales service
- Waste disposal
- Fee payment

To gain further information regarding additional benefits questions were included in the CECED member questionnaire to see if members had already implemented or trailed tagging within their businesses for other purposes. A workshop was organised for the 11th June at the CECED offices to review the questionnaire, the cost benefit model and any additional benefits identified with CECED task force members able to attend.

At this meeting the following were agreed regarding the additional benefits of tagging:

Manufacturing - Producers of electrical goods already have tagging of components and assemblies usually in the form of bar codes. It was agreed that the current installed systems serve the purposes of manufacturing well and little or no functional benefit could be identified for manufacturing if the systems were changed to integrate with any new tagging system adopted to address WEEE. Therefore it was concluded that no additional benefit would accrue as a result of tagging for WEEE only additional cost.

Logistics - Currently bar code systems are extensively used to track and log the movement of items for the purposes of logistics. Operation of the system is carried out using hand held scanners operated by low skill, low cost staff. Electronic tagging may offer the possibility of full automation of the logistics cycle replacing the reader operators. It was estimated in the meeting that the total saving across Europe would be 15,000 Euro per person per annum. It was estimated there were approximately 600 operators in Europe that could be replaced. It was agreed that this was a benefit and should be included in the cost /benefit model if all of the technical requirements such as multiple tags in a stack or on a pallet could be met. Wholesale was included in the logistics section.

Presales - this was defined as mail order/internet/order taking and is a new and growing area. However, sales in this segment are relatively small and although growing were not thought to be likely to become significant compared to conventional retail outlets for the majority of members' products. It was concluded that there was no significant benefit for CECED members here.

Retail - The retail industry has very different characteristics in different countries in Europe. In France and the UK there are a few large retail groups that dominate the retail sector with only relatively few independent traders. However, in other markets such as Germany independent small traders dominate the business. Due to the large number and diverse nature of retailers across Europe it was felt unlikely that a universal standard necessary to gain benefit from tagging could be agreed. The cost to the traders of installing the necessary readers and computing

equipment to handle the tagging system would be prohibitive particularly for small retailers handling relatively few products per annum. The benefit to the producer (which is the focus of this study) could not be seen. It was agreed to exclude retail from the cost/benefit model as no producer benefit could be identified.

After-sales service - In many cases a sophisticated after-sales tracking and registration system already exists using bar code systems. Increasingly after-sales service is being contracted out and is not operated by the producer. Again there was little benefit to the producer that could be identified by linking after-sales service with WEEE directive tagging. It was agreed it was not relevant to include a benefit in the cost/benefit model.

Guarantee enforcement - A recent article in the press in Germany raised the possibility of using RFID tagging to assist in guarantee verification. This article produced a great deal of adverse publicity with respect to concerns regarding data protection. Due to its potentially controversial nature it was agreed this was not a benefit to producers and should be excluded.

Waste disposal – Benefits of tagging to address the WEEE directive are the main purpose of the study.

Verification of fee payment - Confirmation of payment, ensuring payment is only made once and avoiding paying for other companies' waste is part of this study.

The cost benefit model described in section 8 reflects these decisions made by the CECED task force.

6 OTHER STAKEHOLDERS

In order to implement a tagging scheme to address the EU directives on waste disposal it is likely that a number of other stakeholders will need to be involved unless the producer companies set up their own collection and disposal arrangements. These stakeholders include European and National Governments, local authorities, waste management and disposal companies and retailers.

As part of the study SG has contacted a number of interested parties to obtain their opinions on whether they would be prepared to accept tagging as a method for identifying product and producer for the purposes of satisfying the EU directives on waste disposal. Public data has also been accessed using press resources and the Internet and a summary of these views has been given below. The SG investigation is a "snap shot" of interested parties and is not claimed to be an exhaustive study of all interested parties.

There is an enormous amount of work being undertaken by Governments and other groups such as the UK Department of Trade and Industry (DTI) to investigate how best to address the directives, these studies are as yet incomplete. Details of the DTI initiative can be found on their web site <http://www.dti.gov.uk/sustainability/weee/index.htm>.

6.1 European Government

The European Union has issued the WEEE and RoHS Directives. Within these directives the principle of “the producer pays” is paramount. The methodology for ensuring that payment is made is not discussed within the directive but left for the producers to determine.

Within these directives there is inevitably a political element; individual producers will be able to decide whether they wish to address their commitment individually or whether they wish to join a collective scheme. Clearly, however, producers will need to conform to those schemes available. It is unlikely that individual companies or even collectives such as CECED will be able to totally determine how the directive is implemented, all the other parties involved in the product life-cycle will have to agree to any system either voluntarily or by compulsion. SG has spoken with a number of other stakeholders to gather opinion as to how they are planning to comply with the directives and whether product tagging could be part of those plans.

6.2 National Government

In order to obtain a view as to the UK central Government approach to WEEE SG contacted the UK Department of Trade and Industry (DTI).

The DTI has just completed a survey of third party reactions to the WEEE directive via its web site. The survey consisted of an interpretation of the directives followed by a series of questions on each article. The survey results are currently being collated, however it is clear that a sampling or market share approach has been assumed to identify producer cost and this will be compared to a point of sale tax or fee.

The leader of the initiative at the DTI is Dr Mark Downs who was contacted by telephone. Dr Downs stated that although he was aware that in some quarters the tagging of goods to enable producer identification at disposal might be considered as a possibility, it was not an option being investigated as a way forward by the DTI. No explanation was given as to why this option was not considered a viable route.

A major risk to producers is that different countries will adopt different standards or practices that put different requirements on producers, for example one country may adopt tagging and put the necessary legislation in place to ensure its use whilst another meets its obligations by sampling. Having to apply different practices to products being introduced into different markets in the EU would be expensive for producers and offer a very unattractive option going against any trends for standardisation.

Enquiries have been sent to other European Governments regarding their plans as to how apportion costs to manufacturers as required by WEEE and also

whether they are considering electronic tagging as an option. At time of writing no replies have been received.

6.3 Local Government

In the UK collection of waste is the responsibility of the local District Council, disposal is the responsibility of the County Council. This situation potentially complicates the situation with respect to WEEE and tagging as both parties need to accept and adopt the same system.

SG has spoken to representatives from both councils and received a common view that both are willing to adopt a tagging system as long as they do not bear any costs. The councils would look to the producers to provide finance for equipment and databases to operate such a system. Exactly how that payment would be implemented was not specified and both councils felt that in truth such a system was not practical. Both councils favoured an up-front disposal tax paid at point of sale and passed on to the local authority to pay for disposal. Their argument was that such a system is fair to all and avoids the problem of “free-riders” or “orphan” goods.

6.4 Retailers

The main concern of retailers with respect to WEEE is being forced to operate a “take back” system, i.e. when selling an item retailers would be obliged to take back an equivalent equipment. Such a system would result in storage and collection problems for the obsolete items at the retailers’ premises.

Regarding a tagging system, the biggest issue is the number and diverse nature of retailers and the high cost of equipping all outlets with reading equipment. The use of the equipment would be mainly in “other applications”. Retailers are not seen as a primary stakeholder in the WEEE directive unless they are called upon to complete the paperwork for “up-front “ tax payment or forced to operate a “take back” system.

6.5 Disposal and Recycling and Processing companies

Clearly one of the prime stakeholders on whose business WEEE and RoHS will have a major impact is the disposal and recycling and processing companies. To gather an understanding of how this industry operates and gain a view on its preparation for WEEE SG visited sites in UK, Holland and Germany. A full report of these visits and their findings is given in Appendix I.

The overriding finding from these studies is that the industry is at a very early stage of development in terms of being able to sort and separate out different types of product and materials. The stage of development of the industry is very variable from country to country, ranging from very rudimentary disposal facilities

(basically landfill) through to full dismantling and separation of materials to maximise material recovery and reprocessing to minimise waste as observed in Holland for example. Currently disposal of high ferrous metal content products such as cars or washing machines is well developed in several countries and frequently automated.

A major concern of the industry is any legislation that increases its labour costs. Currently the industry sees WEEE and RoHS directives very much in this light.

Legislation has forced the industry to adopt labour intensive methods for the disposal of refrigerators the cost being borne by the local authorities.

Disposal of other items, for example televisions or small electrical goods, varies considerably from country to country and even between companies from landfill to full dismantling.

Adoption of tagging technologies does not lend itself to the majority of practice today, there would need to be a major economic or legislative change to force the industry to adopt practices that involved sorting and reading of tags on individual items. It is likely that this will only come about by legislation at a national level.

7 SYSTEM INFRASTRUCTURE AND INTEGRATION

In order to implement a tagging solution to identify producers and hazardous product content a data management system will have to be created. This system would be independent of any tagging technology adopted, however the interfaces between the system and tagging technology would need to be defined.

The cost and complexity of any such system should not be underestimated. The system would have to be accessible at several levels depending on the user. Clearly there would be sensitive commercial data regarding life-cycle information on competitors' products accumulated over time so one manufacturers' information would need to be ring fenced from other producers. Databases would need to be created that hold the hazardous material data on individual products so that when the item arrives for disposal the operator can handle it correctly.

Fraud prevention will be controlled mainly by the software preventing multiple or spurious claims, therefore, a high level of security will be required. Due to the complexity and size of the database an organisation will be needed to oversee, manage and maintain the system. In addition, due to the longevity of the data and the rapid development of IT software and hardware, to maintain efficiency there will have to be regular reviews and updating of the system. It is likely that a central organisation will have to be responsible for this.

In order to establish electronic tagging as the norm for any group of products, such as electronic and electrical goods, a number of groups have recognised that the first step has to be to establish a data standard for tagging. Two such groups

are the AutoID Center at MIT in the US and an EU-sponsored group called ELIMA.

The goal of the AutoID Center is to give all products including the most mundane such as a “Coke” can a unique identification number. It is proposed that the coding scheme to do this will be announced in September 2003. The AutoID Center web site contains a graphic illustration of a tagging system using RFID tags. However, in our opinion the technology is not yet available to implement such a system in practice. Whether such a system could ever be available is open to question. There are physical barriers such as reading tags through metal or reading tags at the ranges suggested that it is difficult to contemplate any technology currently available or available in the foreseeable future being able to achieve in the manner described. The proposed system can be viewed on the AutoID website www.autoidcenter.org.

A different approach has been taken by the ELIMA group. Here the ambitions are more limited in that they are developing a data management system specifically to address the WEEE and RoHS directives. The group consists of Universities and commercial concerns and is sponsored by the EU.

ELIMA is a research based project developing an Identification and Data Unit (IDU) and product environmental life-cycle information management system. Two trials are currently underway one using RFID tags as the ID unit in brown goods. In addition to product identification ELIMA has added a PCB to allow “Dynamic Data Acquisition” to acquire operational information that it is hoped will be useful to the producer.

Once developed the aim is to licence the Management Information System (MIS) for commercial use and if successful should be a cost-effective way for companies to address the requirements of the EU waste directives.

It is recommended that CECED investigate this and any other similar schemes in detail to determine whether adopting this or a similar scheme would be the most cost effective means of addressing the Management Information System issue.

8 COST BENEFIT ANALYSIS

8.1 Overview

The adoption of any tagging system carries with it a set of costs specific to the technology adopted. There are also benefits associated with the tagging system, which may, or may not differ according to the technology selection.

The aim of the cost benefit analysis is to compare the financial positions of the various tagging options. These are in turn compared to a possible baseline of minimal manual sampling of the waste at disposal centres. It is not implied that the sampling methodology illustrated will yield similar accuracy in determining

product source it is merely an example of one alternative scenario being proposed by the recycling industry.

It must be stated that although the use of tagging may allow for the unique identification of a manufacturer's products, it does not preclude the manufacturer from carrying the charge of another (possibly unidentifiable) manufacturer's waste (so called 'free-riders'). The exact mechanism of apportioning the cost of the free-riders across the remaining manufacturers will be down to legislation, and only this can determine whether any technological solution can be of real benefit. For this reason, the benefit of free-riders is presented separately from the cost of the various technology options.

8.2 Model construction

8.2.1 Scenarios

The model presents the costs of the following technology scenarios:

- Random sampling of all incoming waste at recycling by a single operative full time.
- Use of a bar code labelling to uniquely identify 100% of products.
- Use of a low frequency read only (LFRO) RF tag to uniquely identify 100% of products, based on the lowest estimate of tag cost.
- Use of a high frequency ISO14443 RF (HF) tag to uniquely identify 100% of products, based on the highest estimate of tag cost.

The scenario illustrated for sampling is only the minimum as proposed to SG by recycling companies. As an analysis of sampling is outside the scope of this project we have not determined whether this would be sufficient to achieve the required accuracy to apportion producers' commitments.

The illustration used herein is based on each centre employing a single operative full time to carryout sampling of incoming waste. This does not imply that the same level of accuracy in apportioning waste to producers can be achieved using this method compared to tagging. If more operators are required to obtain an acceptable accuracy the costs shown would increase by multiples of the figure shown. In addition, if it was decided that a robust bar code was required to facilitate sampling then costs of adding that tag should be incremented accordingly.

Although sampling methodology is not part of this study it is being considered by others in CECED.

The RFID tags selected provide the lower and upper cost bounds of the RFID technologies that are appropriate for the application under consideration. Tagging costs were not subjected to inflation – this reflects the general trend of technology to fall in price.

The technology scenarios are then mapped onto the cost of free-riders at 10%, 20% and 30% of the CECED membership volumes (CECED stated that it expected a level of 20%). This allows a direct comparison between the cost of tagging and bearing the cost of the free-riders. The use of CECED membership volumes reflects an assumption that the future membership of CECED will have a more or less constant market share over the lifetime of the model.

Other scenarios, including use of tagging in logistics, were considered for the model, but were rejected as either being impractical (due to existing adequate mechanisms) or not achievable using the technology under consideration.

8.2.2 Product classification

For the purposes of the model, products have been split into the following categories:

Class 1

- Refrigerators
- Freezers

Class 2

- Wet
 - Washing machines
 - Clothes dryers
 - Dish washing machines
- Hot
 - Cookers
 - Electric ovens
 - Electric hot plates

Class 3

- Microwaves
- Vacuum cleaners
- Cooker hoods

Class 4

- Irons and other appliances for ironing, mangling and other care of clothing
- Toasters
- Fryers

- Grinders, coffee machines and equipment for opening or sealing containers or packages
- Blenders, food processors and mixers

Class 5

- Appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances

The above groupings were agreed with CECED.

The model was constructed to reflect two groupings:

- Class 1 and Class 2
- Class 3, 4 and 5

These groupings reflect the different reading requirements of the product types: Class 1 and Class 2 items need only be read at the disposal centre; Classes 3, 4, and 5 need to be read at the collection centre, as it is unlikely that they will be subject to individual handling beyond this point.

8.2.3 Input data and model coverage

The model is based around data from the CECED publication “European Panel Sell-in Statistics 4th Quarter 2002”. This publication sets out data for all Class 1 and Class 2 items, and a subset of Class 3. It does not provide data for vacuum cleaners, or any Class 4 and Class 5 items.

Due to the lack of consistent data for vacuum cleaners and the Class 4 and 5 items, these have been omitted from the model. The remaining Class 3 items have also been omitted from the model as any scenario generated from them would be incomplete and therefore misleading.

8.3 Model outputs and analysis

8.3.1 Cost scenarios

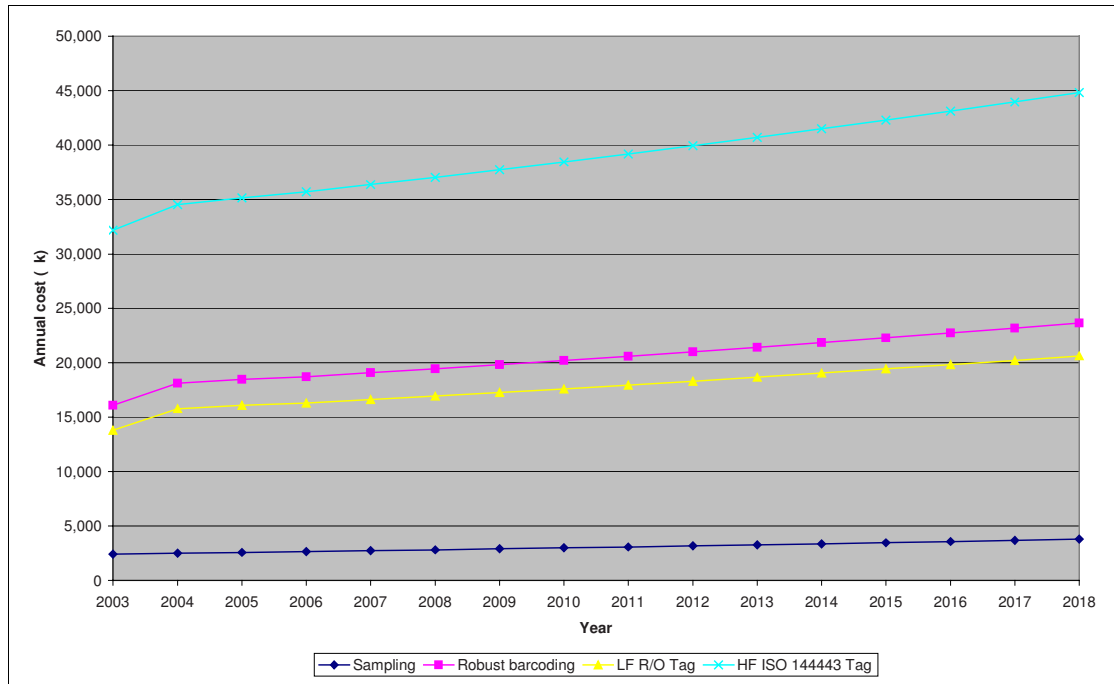


Figure 1 – Comparative cost of tagging options

Figure 1 sets out the comparative costs for the adoption of the technology options. The cheapest option shown is manual sampling of the waste at the disposal centres based on a single person per site. This is due to the relatively low number of disposal centres versus the high number of tags that are required to tag all the white goods produced during the same year. However, it should be borne in mind that the accuracy of apportionment using this sampling method may not be equivalent to the tagging options.

Figure 2 sets out the net present value¹ (NPV) of the technology options.

¹ Net present value is a method of using a single figure to present a time series of monetary values, reflecting the decreasing value of money over time.

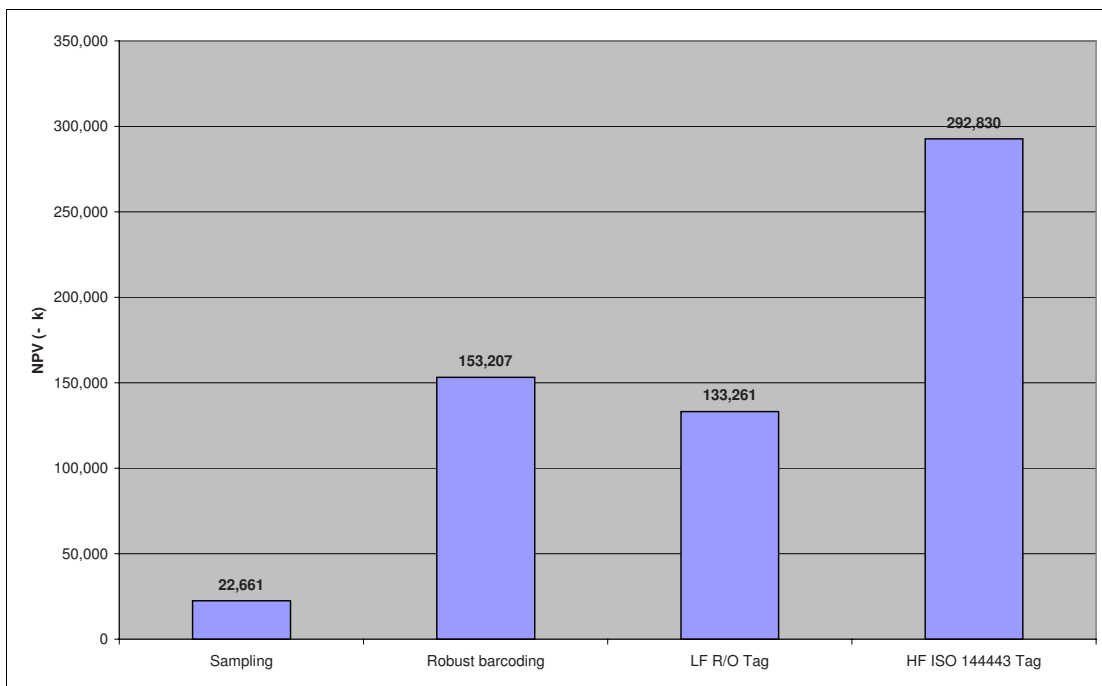


Figure 2 – Net present value of tagging options. Sampling assumes the minimalist approach described above.

8.3.2 Incorporation of free-riders

Figure 3 compares the year by year cost of the tagging options and the effect of free-riders. As can be seen, there is little cost from free-riders until 2013, when new waste starts to reach the disposal centres. However, after this point, the cost of free-riders builds up quickly so that even in the lowest case (10% free-riders), it is more cost effective to add tagging of any type (at the time of production) than to pay for the free-riders at the time of disposal.

Figure 4 shows a more realistic figure for the 15 years of the model. It can be seen that only in the worst case (30% free-riders) is the NPV of the cheapest tagging option lower. This is due to the necessity to spend highly in the early days to receive a significantly deferred benefit. In pure financial terms, the use of tagging to potentially avoid the cost of free-riders is not a good investment over the period of the model.

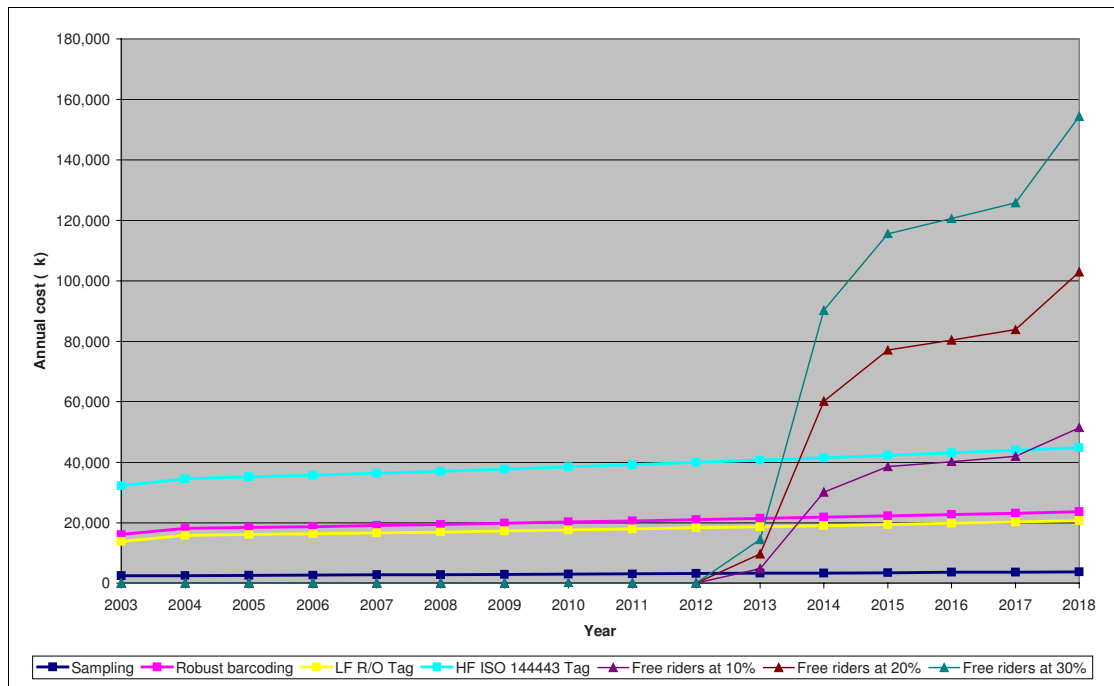


Figure 3 – Comparative cost of tagging versus cost of free-riders

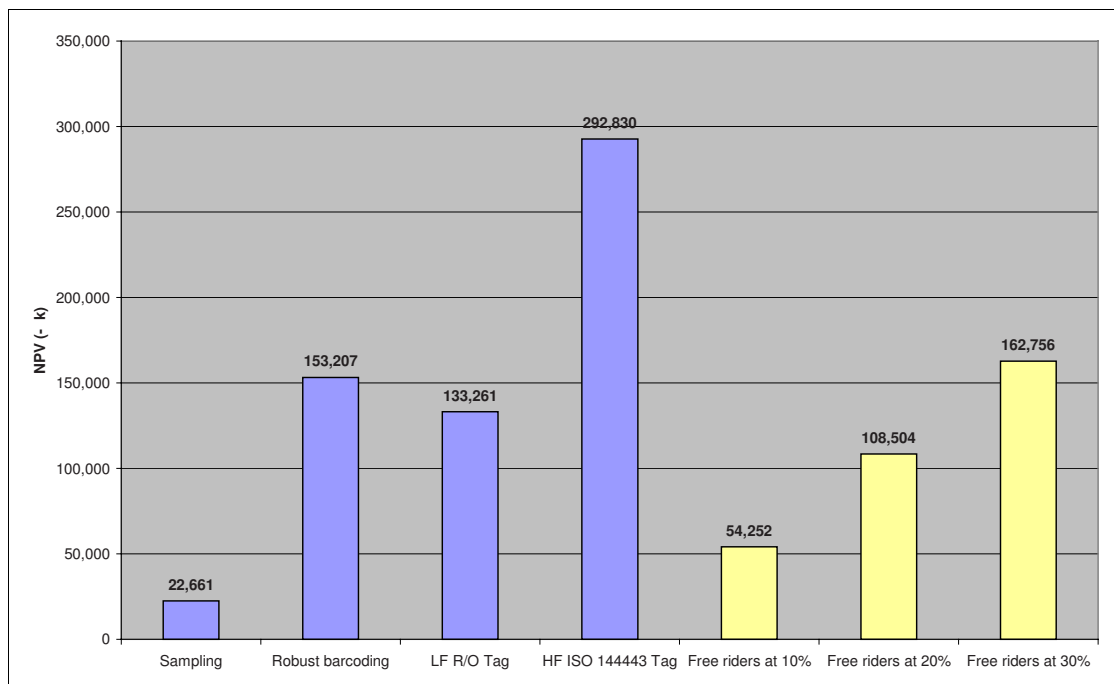


Figure 4 – Comparative NPVs of tagging options and free-riders

8.3.3 Incorporation of Class 3, 4 and 5

The charts presented so far only take into account waste of Classes 1 and 2. These are bulky items that need to be dealt with individually at the disposal centres. Items of the other classes will arrive at the disposal centres in large containers and are unlikely to receive individual treatment. It is therefore necessary to read the tags at an earlier stage in the disposal process, namely at the local collection point before the item is put into the large container. This will require scanning, IT and networking equipment at each collection point, which adds an enormous cost, as can be seen in Figure 5 and Figure 6.

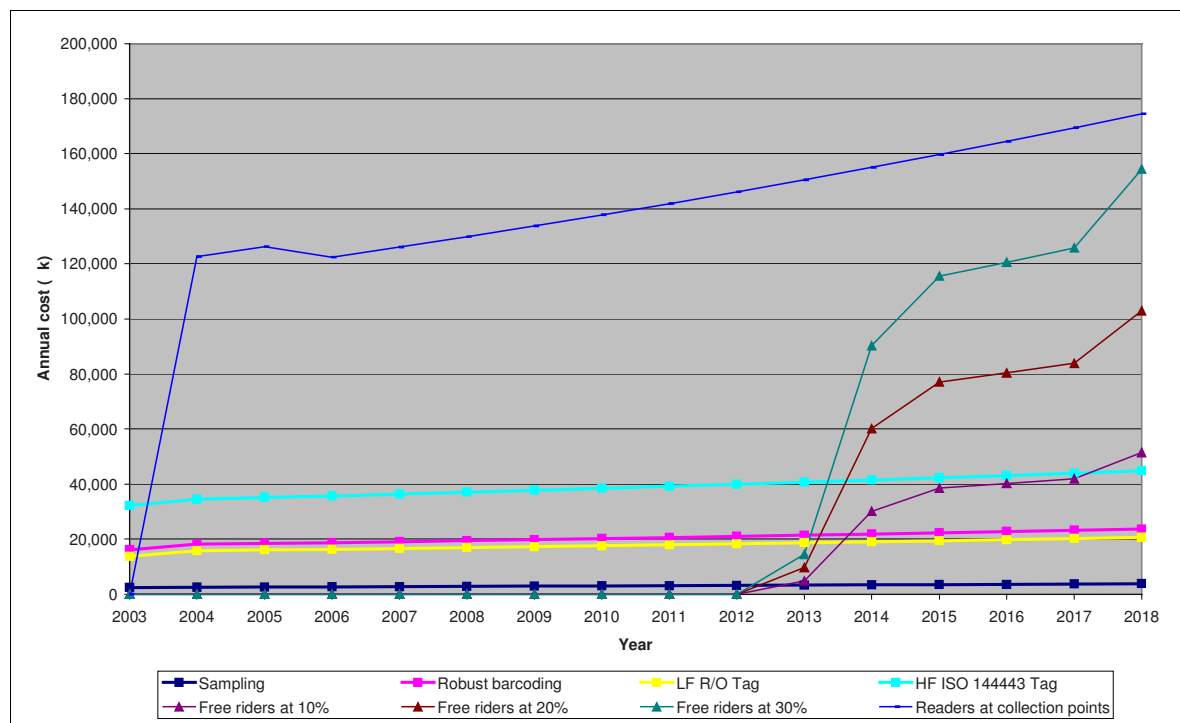


Figure 5 – Comparative costs including cost of equipping collection points

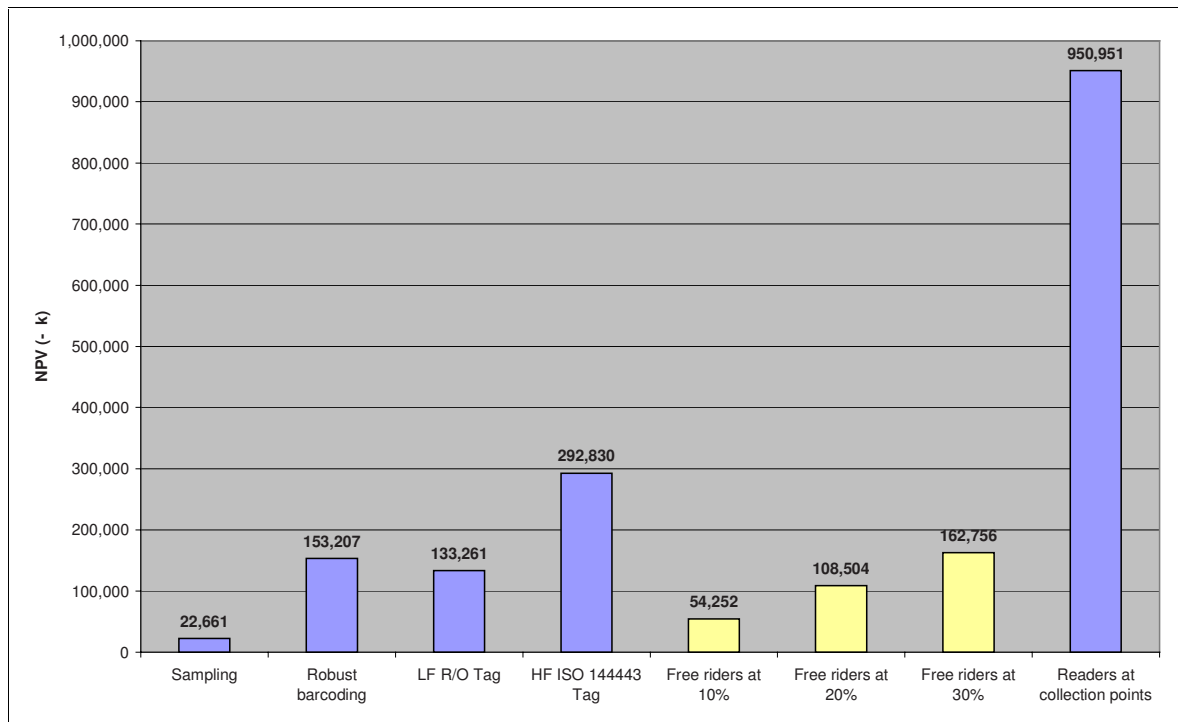


Figure 6 – Comparative NPVs, including cost of equipping collection points

Using tagging to identify products of Class 3, 4 and 5 will be highly problematic.

- The products are sold in much greater volumes than those of Classes 1 and 2, and therefore the total cost of tagging will be higher.
- A lower proportion of products will end up at the disposal site, as many of the smaller products will be disposed of through normal refuse or be retained as spares (estimates vary between 15% and 50%, compared to 85% of Class 1 and 2 items).
- On arrival at the disposal site, there are two additional difficulties associated with reading the tag. Firstly, the items themselves are far less robust than the larger items, and the tags are more likely to be damaged. Secondly, the items are likely to arrive in bulk containers, making the reading of individual tags highly problematic.

Given the above difficulties, it is likely that tagging Class 3, 4 and 5 items is neither practical, nor cost effective. Given this, it is unlikely that a tagging solution to identify free-riders (the primary benefit) will be acceptable to the legislature.

8.3.4 Sensitivity to tag price

As with any evolving technology, the price of RF tags is expected to fall. Given this, a separate scenario has been constructed around a non-specific tag that falls in price from €0.3 in 2003 to €0.05 in 2012.

Figure 7 shows the effect of the falling price of the tag on a year by year basis. Due to this fall in price, the crossover points between the cost of free-riders and the cost of tags happen earlier, making the option more cost effective. When comparing NPVs (Figure 8), tagging becomes an effective option both at the highest (30%) and expected (20%) rate of free-riders.

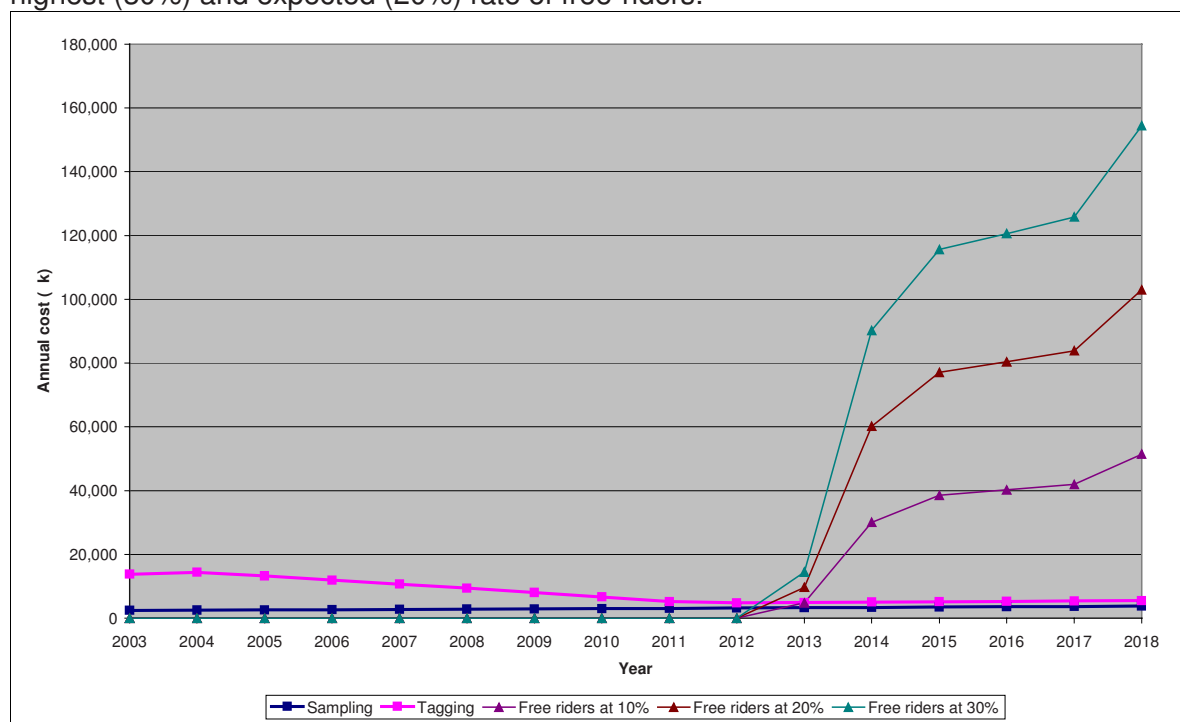


Figure 7 – Effect of decreasing price of tag

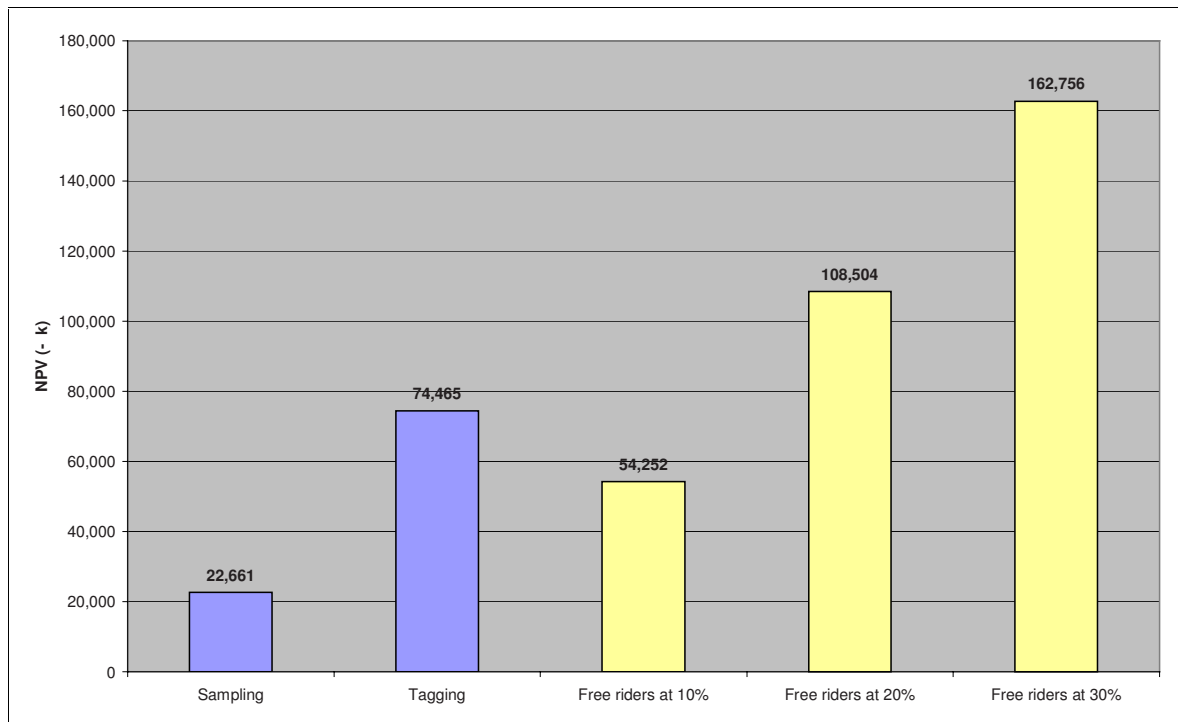


Figure 8 – Effect of decreasing price of tag on NPV

8.4 Conclusions

Over the period of the model, there is no clear, compelling financial reason for the adoption of tagging or barcoding. Only in the case of the cheapest tag offsetting the highest percentage of free-riders is there a benefit. The case for tagging becomes stronger if one assumes that prices will fall by an order of magnitude over the next decade, but this cannot be guaranteed. If the period under consideration were extended to 20 years, then tagging would become a more favourable option approaching the costs of sampling.

Of particular concern is that no tagging solution appears to be able to offer bulk reading of smaller (Class 3, 4 and 5) goods at the disposal centres. The implication of this is that for tagging to be extended to these smaller products, each collection point would need to be equipped with scanners and supporting infrastructure – at a very high cost. From a financial viewpoint, tagging is only a real option for the larger goods.

According to CECED, the main perceived benefit of any tagging system is the removal of the need to pay for other manufacturer's waste. Whilst tagging may allow the identification of own waste, the exact manner in which unidentifiable, or orphan waste is paid for is likely to be decided at a legislative level, rather than a technological one. Therefore, careful consideration as to whether the technology could be built into the legislation should be given before embarking on a potentially expensive technology programme.

9 SPECIFIC CONCLUSIONS

The conclusions drawn from the study are captured below as the technical feasibility and the commercial implications. A short additional section has been added regarding the political implications for deciding on a route to producer identification. This last section has been included because, although strictly outside the study, in discussions with interested parties outside of CECED it became apparent that perhaps the greatest hurdle to introducing a tagging system is the political will of all concerned to implement such a system.

9.1 Technical Conclusions

A tagging system could be introduced to provide access to data on the identity of the producer, the product category and any hazardous material contained in the product. There are tagging systems that have sufficient data capacity and are commercially available. This could be a bar code system or one of the RFID systems currently on the market or close to launch.

However, considerable compromise would have to be made regarding the implementation of the technology compared to the requirements stated by the CECED members. Technologies that claim large read ranges over 2 meters are referring to ideal conditions and these ranges will be severely reduced if the tag is placed on or near metal parts. Furthermore, none of the tags can be read through any thickness of metal likely to be encountered in a product casing or component. Therefore, in order to successfully read the majority of tagged electrical or electronic items they would need to be separated and orientated to the reader to allow a tag to be read regardless of type of technology. Such manipulation would mean almost certainly manual intervention. Although it is possible to conceive of an automated sorting system it is likely to be very expensive. The cost of processing items would be much higher than the current system.

9.2 Commercial Conclusions

From the data available regarding markets, technology costs and disposal costs there is no clear compelling financial argument to adopt tagging over the first fifteen-year period. This is because of the time lag between introducing tagging and those items arriving at disposal sites.

The case becomes more compelling over a longer time period of say 20 years from initiating a system.

An established tagging system would offer financial benefits assuming that politically the disposal "freerider" and "orphaned" products do not either directly or

indirectly (e.g. by increased overall disposal costs for example) end up being paid for by the identified producers.

These results assume that the technology allows identification of individual items at the disposal point. If that identification is moved to collection points then the increase in equipment volume required to read and record tags makes the financial situation significantly less attractive.

9.3 Political implications

There are several groups, for example ELIMA, trying to find ways of addressing the EU directives. It is certain that most countries in the EU will have an equivalent of the DTI initiative developing individual country approaches to the WEEE and RoHS directives. The EU directives are creating a great deal of debate and a lot of initiatives. In addition, other parties such as the AutoID Center are energetically promoting RFID as a solution to product identification and tracking.

CECED products cover a significant proportion of waste electronic and electrical goods but there are many other large sectors not covered by CECED, for example IT equipment. It is outside the scope of this study to assess all products covered by WEEE, however, it is felt by the authors that it is unlikely that CECED alone can determine a pan-European solution. We see perhaps the major hurdle to implementing any tagging system would be persuading all the other parties affected that tagging was the best route forward, despite all the infrastructure costs involved.

10 GENERAL CONCLUSIONS AND RECOMMENDATIONS

- A tagging solution and database could be adapted to address the administration requirements of identifying producer, article and hazardous materials in any product produced by the CECED members. However, major compromises would need to be made in the performance requirements of the tags and readers to allow the tags to be read with any consistency within the disposal and logistics environments. (e.g. reduction on read range and separation of items to be read)
- There is no one candidate technology that clearly has major advantages over other technologies. A system could be devised using bar codes or RFID tags. Of the RFID technologies the LF systems are the best suited for WEEE applications given the proviso that all the technologies read performances are detrimentally affected by the presence of metal. No technology can operate through metal.

- To gain any real financial benefits from tagging, CECED members need to look long term to 20 years or more from the implementation of a tagging system. Even then the costs will be significantly more than sampling.
- The major hurdle to overcome in implementing a tagging solution is its acceptance, with all its implications to change of operation methodology and financial investment, by other stakeholders such as the disposal companies and those responsible for collection (usually local authorities)
- It is likely that implementation of a tagging solution will only occur through National or European legislation.
- It is recommended that CECED members do not adopt a tagging solution to address the WEEE and RoHS for the present.
- It is recommended that CECED members maintain a long term strategy that leaves open the opportunity for tagging to be incorporated into their products if legislation demands adoption.
- Due to the immaturity of RFID tagging at present it is recommended that a watching brief is adopted on the developments of the new technologies in particular to see whether the prices and performance promised can be realised once available commercially.
- If CECED decides to adopt an individual product identity system then it is recommended that further investigation be made of solutions being developed by third parties such as ELIMA or the AutoID Center.



Electronic Product Identification

Study into the feasibility of technologies that enable the identification of producer and product characteristics

6 March 2003