

Challenges in Evaluating the Life Cycle Environmental Impact of Electronic Devices

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Nokia's Approach to LCA

- Rising demand from customers and other stakeholders for improved environmental performance and to be able to present viable proofs
- Life Cycle Assessment (LCA) is a tool giving sustainability programs a quantitative basis and assisting companies to continuously improve environmental performance
- Nokia has long experience in LCA front and have been making assessments since middle of the 1990's
- Nokia is constantly improving inventory data and LCA methods used, and supporting related (cross) industry initiatives

Nokia's Eco Profile Project

- First Eco profile, inc. information on the environmental impact of the product, published in summer 2010
- Focus on **greenhouse gas emissions** and **energy use** that emerge from the entire life cycle of the product; cradle to grave
- Other environmental impacts have also been assessed (not publicly disclosed) to avoid environmental burden shifting to e.g. resource depletion
- We use the ISO 14040 and ISO 14044 standards as a framework for LCAs and methodology has been audited by a third party
- Impacts methods are:
 - Cumulative Energy Demand
 - IPCC 2007 GWP 100a
- LCI data is measured at our own factories and operations and collected from suppliers. In addition, we use internationally available LCI databases

we:create 17.05.2011 **NOKIA**



Nokia N8-00
Eco profile

Product:	Nokia N8-00
Product type:	Mobile device
Weight:	135 grams (including battery)
Dimensions:	Length: 113.5 mm x Width: 59 mm x Height: 12.9 mm
Volume:	86 cc (cm ³)

Package:	142 grams
Weight:	Length: 185 mm x Width: 195 mm x Height: 35 mm
Dimensions:	1263 cc (cm ³)
Volume:	Material: Corrugated board 78 g + PS 64 g

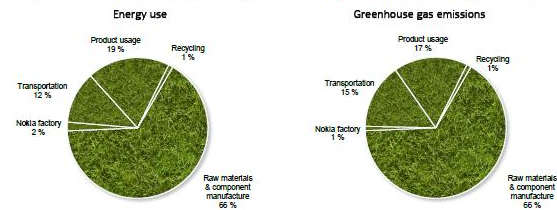
Environmental features

MATERIALS AND SUBSTANCES:	PACKAGING:	RECYCLING:
Free of PVC, free of brominated & chlorinated compounds and free of antimony trioxide as defined in Nokia Substance List; bio-based materials in inner parts of the product	Made of renewable, 100 % recyclable	All materials of the device can be recovered as materials and energy
USER GUIDE:	ENERGY EFFICIENCY:	ECO CONTENT AND SERVICES:
Interactive user help in device and online, only Quick Guide in the box, eco tips on Green Page	Power Save mode, ambient light sensor, unplug charger reminder, Compact Travel Charger AC-15	Available at Ovi, preinstalled eco wallpapers, maps for route optimization and pedestrian navigation

Environmental impact

Energy use: 278 MJ³
Greenhouse gas emissions: 16 kg CO₂-eq.³

These figures represent the estimated environmental impact of this device over a product life cycle including 3 years of usage. This impact is equal to driving 96 km in a typical family car. The mobile phones with basic functionalities have typically smaller environmental impact than the devices with wide range of features. However, the latter ones provide the user with more opportunities to reduce the personal environmental footprint by reducing the need to buy, use and charge multiple devices.



Wouldn't It Be Nice to Compare, but...

- Currently, inconsistency between impact figures across the industry disabling justified comparison between mobile devices
 - Lack of common calculations criteria for ICT products
 - ISO14040 & ISO14044, not sufficient
 - Many initiatives ongoing e.g. ITU and ETSI upcoming standards
 - LCI data reliability, scope and variance between databases

Challenges in Conducting LCAs

- Rapidly changing and developing technologies
 - Methodologies and LCI data falls easily behind
- Long and complex supply chain
 - Easily hundreds of direct suppliers with several production sites
 - Typically 4-8 layers of suppliers between consumer electronics companies and any mining activity
- High number of components
 - Same component may have different suppliers, geographic locations differ
 - Suppliers change continuously over product lifetime based on price, quality etc.
 - Overall uncertainty increases with the complexity of products as each data point has a level of uncertainty making also results comparison challenging

Challenges in Conducting LCAs

- Use phase
 - Life time (Motorola 2a, SonyEricsson 3,5a, Apple & Nokia 3a...)
 - Consumers all over the world, energy mixes
 - The use scenario heavily dependent on consumer behavior (applications & features used etc.)
- End of Life scenario
 - Future processes are principally unknown and significant variations between regions exist



Unplug charger from power supply to save energy

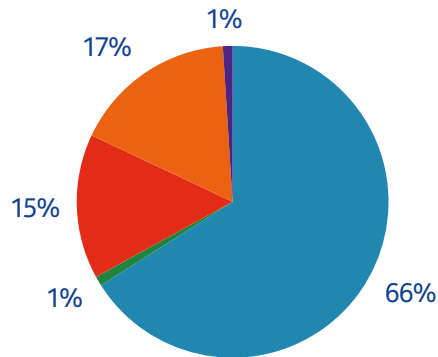
Changes in LCD Data in Ecoinvent v2.2

- The amount of NF_3 and SF_6 emissions to air, emitted during the assembly of the LCD module and the LCD screen, are too high, in the two datasets “assembly, LCD module” resp. “assembly, LCD screen”, due to an error in the original data source
- According to the IPCC guidelines (Bartos et al. 2006) the LCD manufacturing industry has the following tier 2b emission factors: NF_3 0,3 g/m², SF_6 1,2 g/m²

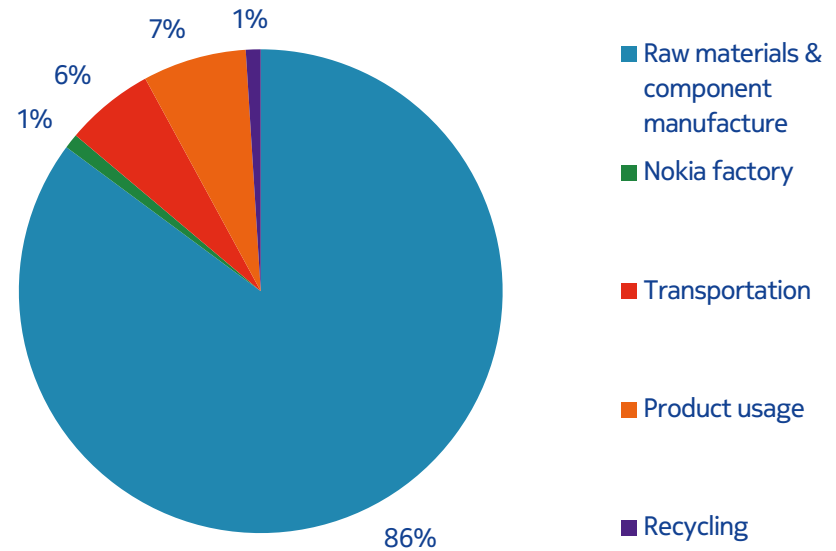
	Assembly, LCD module		Assembly, LCD screen	
	Value in v2.1	Corrected value	Value in v2.1	Corrected value
Sulphur hexafluoride, SF_6 , to air	1,90E-3	2,79E-5	4,87E-4	7,15E-6
Nitrogen fluoride, NF_3 , to air	6,38E-2	6,98E-6	1,63E-2	1,79E-6

Nokia N8-00, GHG Emissions

16 kg CO₂ e
(LCD data Ecoinvent v2.2)



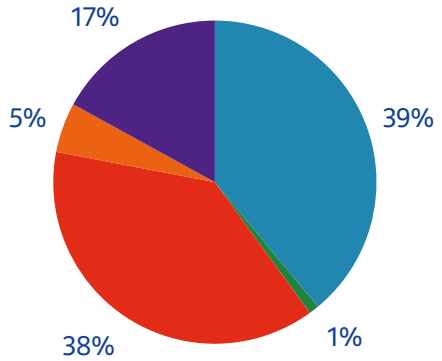
40 kg CO₂ e
(LCD data Ecoinvent v2.1)



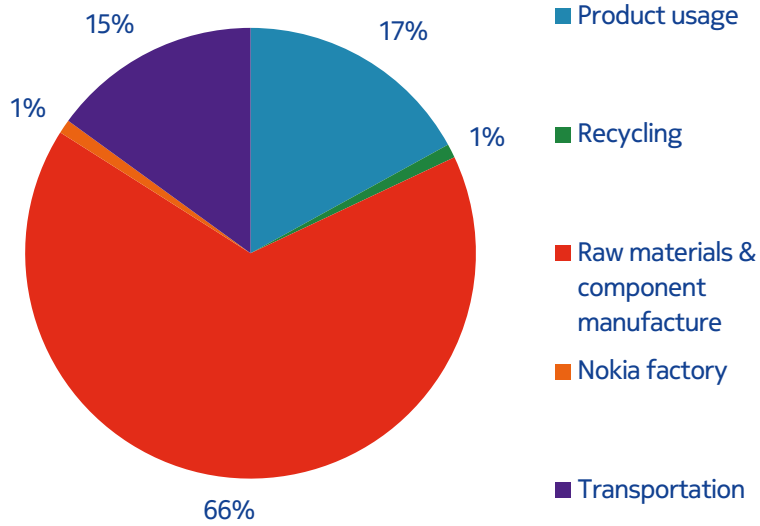
- Functional unit: mobile device, inc. battery, 3 years use
- Multicriteria approach essential and trustworthiness of LCI data

Basic Phone vs. Multifunctional Device

- The mobile phones with basic functionalities have typically smaller environmental impact than the devices with wide range of features
- Convergence reduces the need to buy, use and charge multiple devices



Nokia C1-01, mass 78,8g
 GHG emissions: 8 kg CO₂e, equal to driving 53 km in a typical family car



Nokia N8, mass 135g
 GHG emissions: 16 kg CO₂e

Convergence of Devices Reduces Environmental Burden



Conclusions

- Results of an LCA are always model based representations of the actual environmental impact for a defined functional unit. Especially for complex devices
 - Very high coverage and accuracy of the product life cycle model challenging and time consuming
 - Primary data collection for all bits and pieces not possible
- Main attention lately been on developing common methods to assess environmental impacts, next step to tackle LCI data
- Commonly agreed methods and trustworthy, consistent LCI data would enable better identifying the impacts and measuring the improvements, leaving little room for green washing and making consumers product selection easier

For More Information

- www.nokia.com/lca

- The webpage provides general information on the environmental impact of our products and the calculation methodology behind



Creating our products

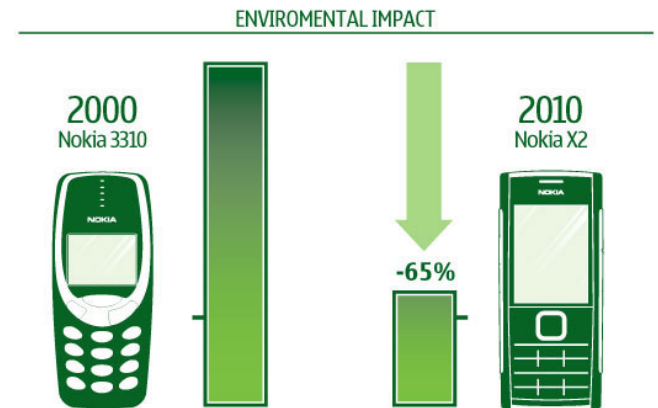
- Life cycle thinking
- Environmental impact
- Materials and substances
- Energy efficiency

Devices and accessories

- Energy efficiency
- Services
- Packaging
- It's easy to be green

Environmental impact

Over the years, we have been able to reduce the environmental impact of our products significantly. For example, the environmental impact of the Nokia X2 and similar recently launched devices is just a third of the impact of the Nokia 3310 which was launched a decade ago.



Calculated as the energy use over the [product life cycle](#).

Today, many manufacturers report the environmental footprint of their products. At Nokia we use life cycle assessment (LCA) for calculating the environmental impact of our products and processes. Our calculations include the entire mobile device life cycle, from raw material acquisition to the end of the product life. Our life cycle assessment method has been externally audited.

The pictures below visualize the average environmental impact of a Nokia mobile device. The impact is reported in terms of energy use and greenhouse gas emissions, and is split between the different device life cycle phases. The total energy consumption for creating, using and recycling a typical Nokia mobile device is 210MJ and the total emissions are 12kg CO₂e. This equals to driving 71 km in a typical family car.

Thank You