



**Periodic Table of Smartphones:** Smartphones contain dozens of material inputs, including rare earth elements and conflict minerals (minerals determined to be financing armed conflict in the Democratic Republic of the Congo or an adjoining country).<sup>12</sup>

1 <b>H</b> Hydrogen 1.008																	2 <b>He</b> Helium 4.003
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012											5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.011	7 <b>N</b> Nitrogen 14.007	8 <b>O</b> Oxygen 15.999	9 <b>F</b> Fluorine 18.998	10 <b>Ne</b> Neon 20.180
11 <b>Na</b> Sodium 22.990	12 <b>Mg</b> Magnesium 24.305											13 <b>Al</b> Aluminum 26.982	14 <b>Si</b> Silicon 28.086	15 <b>P</b> Phosphorus 30.974	16 <b>S</b> Sulfur 32.065	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948
19 <b>K</b> Potassium 39.098	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.956	22 <b>Ti</b> Titanium 47.887	23 <b>V</b> Vanadium 50.942	24 <b>Cr</b> Chromium 51.996	25 <b>Mn</b> Manganese 54.938	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933	28 <b>Ni</b> Nickel 58.693	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.631	33 <b>As</b> Arsenic 74.922	34 <b>Se</b> Selenium 78.972	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 84.738
37 <b>Rb</b> Rubidium 85.468	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.906	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.906	42 <b>Mo</b> Molybdenum 95.95	43 <b>Tc</b> Technetium 98.907	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.906	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.868	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.757	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.905	54 <b>Xe</b> Xenon 131.294
55 <b>Cs</b> Cesium 132.905	56 <b>Ba</b> Barium 137.327	57-71 <b>Lanthanide Series</b>	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.948	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.222	78 <b>Pt</b> Platinum 195.084	79 <b>Au</b> Gold 196.967	80 <b>Hg</b> Mercury 200.592	81 <b>Tl</b> Thallium 204.383	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.980	84 <b>Po</b> Polonium [209, 209]	85 <b>At</b> Astatine [209, 209]	86 <b>Rn</b> Radon 222.018
87 <b>Fr</b> Francium 223.020	88 <b>Ra</b> Radium 226.025	89-103 <b>Actinide Series</b>	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [265]	109 <b>Mt</b> Meitnerium [268]	110 <b>Ds</b> Darmstadtium [269]	111 <b>Rg</b> Roentgenium [272]	112 <b>Cn</b> Copernicium [277]	113 <b>Nh</b> Nihonium unknown	114 <b>Fl</b> Flerovium [289]	115 <b>Mc</b> Moscovium unknown	116 <b>Lv</b> Livermorium [293]	117 <b>Ts</b> Tennessine unknown	118 <b>Og</b> Oganesson unknown
		57 <b>La</b> Lanthanum 138.905	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.908	60 <b>Nd</b> Neodymium 144.242	61 <b>Pm</b> Promethium 144.913	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.925	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.930	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.934	70 <b>Yb</b> Ytterbium 173.055	71 <b>Lu</b> Lutetium 174.967	
		89 <b>Ac</b> Actinium 227.028	90 <b>Th</b> Thorium 232.038	91 <b>Pa</b> Protactinium 231.036	92 <b>U</b> Uranium 238.029	93 <b>Np</b> Neptunium 237.048	94 <b>Pu</b> Plutonium 244.064	95 <b>Am</b> Americium 243.061	96 <b>Cm</b> Curium 247.070	97 <b>Bk</b> Berkelium 247.070	98 <b>Cf</b> Californium 251.080	99 <b>Es</b> Einsteinium [254]	100 <b>Fm</b> Fermium 257.085	101 <b>Md</b> Mendelevium 258.1	102 <b>No</b> Nobelium 259.101	103 <b>Lr</b> Lawrencium [262]	

**KEY:**

- Select substances of concern
- Rare earth element
- Conflict mineral
- Commonly used in advanced electronics

# DID YOU KNOW?



**Nearly 2 BILLION SMARTPHONES**  
are made and sold each year



The average adult  
can expect to own  
**27 SMARTPHONES**  
**14 TABLETS**  
**19 LAPTOPS**  
over a lifetime



To obtain the raw materials  
needed for one 4.5-ounce  
smartphone, miners  
must dig through  
**75 POUNDS OF ROCK**

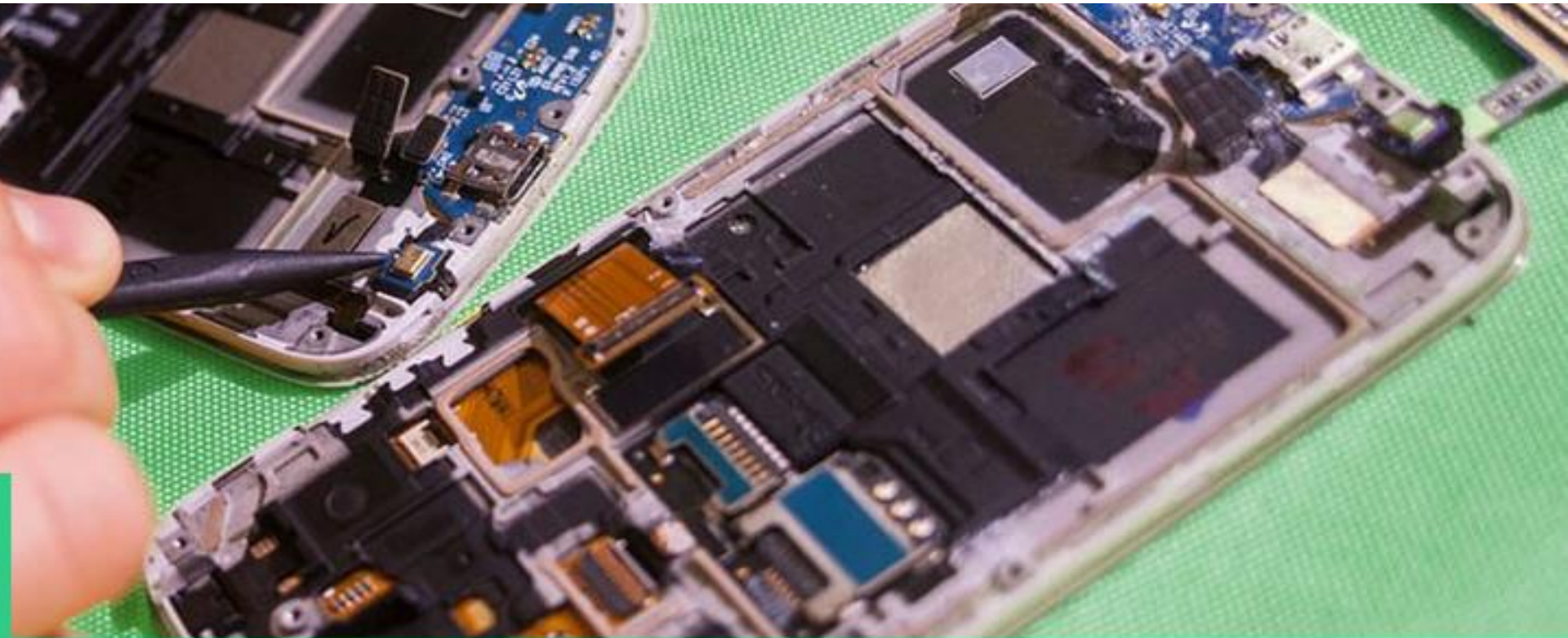


In 2017, **E-WASTE**  
is expected to hit  
**65 MILLION TONS**  
— enough to cover  
San Francisco to 14 feet



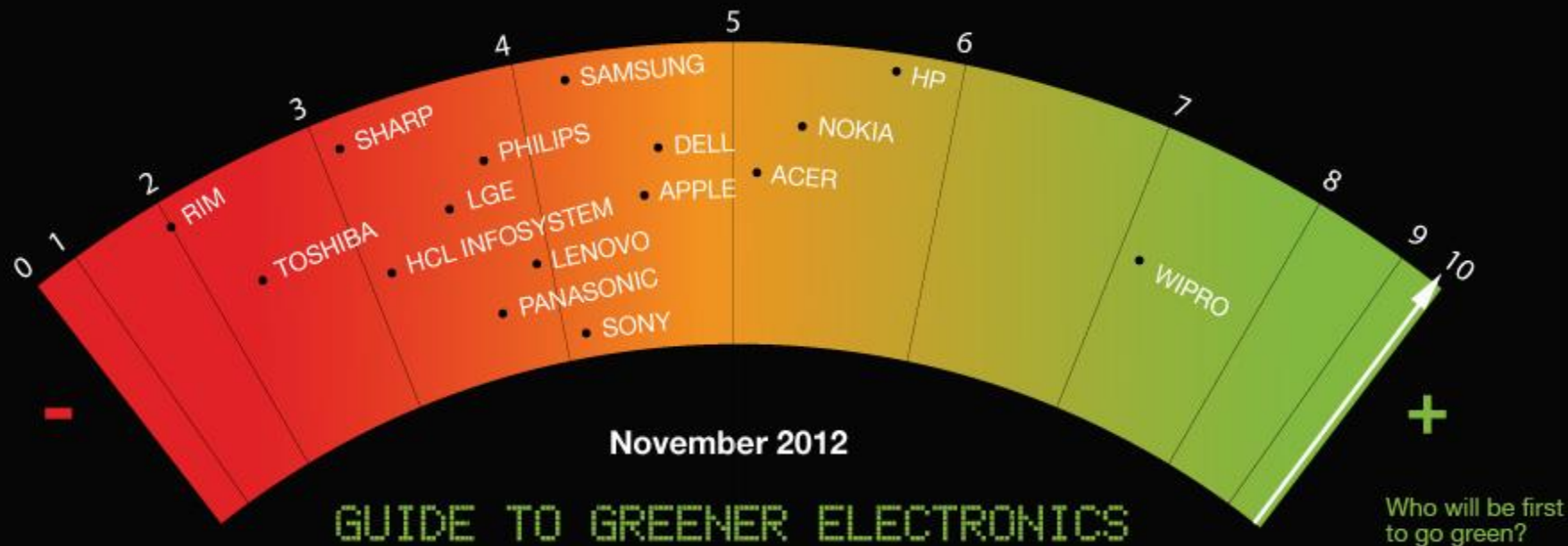
Since 2007 the amount  
of **ELECTRICITY USED**  
**TO MANUFACTURE**  
**SMARTPHONES**  
is just under the  
annual electricity  
consumption of Japan

# Cleaning, closing and slowing the loop: the environmental imperative for innovation in the IT Sector - ReThinkIT



Greenpeace - Guide to Greener Electronics 2017

# Guide to Greener Electronics – 2006 til 2012



# Achievements of the Guide 2006-2012

- Some progress in phasing out of PVC and BFRs in products, esp. mobile phones
- Partial phase out of other hazardous substances e.g. beryllium, antimony oxides, phthalates
- Extensive global voluntary take-back programmes, esp. for mobile phones and pcs
- Some reporting on recycling volumes and use of recycled plastics in new products
- Reporting on greenhouse gas emissions from own operations and increased use of renewable energy
- Avoiding illegally logged forest products and conflict minerals

# Some of the work still left to do

- Transparency on use of hazardous chemicals and energy in supply chain
- Elimination of hazardous chemicals in supply chain and product
- Switch to renewable energy in supply chain
- Taking responsibility for end-of-life chain to ensure clean and efficient recycling
- Shift from use of virgin materials to secondary materials
- Increasing product lifespans e.g. improving possibilities for repair & refurbishment

# The return of the Guide to Greener Electronics - 2017

F

D

C

B

A

SAMSUNG

SONY



FAIRPHONE

oppo



HUAWEI

Lenovo.



vivo

ASUS®

Microsoft

MI

acer



amazon

Google

LG

#GreenerGuide





# The big three in electronics – a giant global footprint

**Energy:** Reduction of greenhouse gases through efficiency and renewable energy

**Resource Consumption:**  
sustainable design and use of recycled materials

**Chemicals:** Elimination of hazardous chemicals from both the product itself and manufacturing

⌵ Take a look inside

# Methodology

- An analysis of what 17 of the leading consumer electronics companies are doing to address their environmental impacts
- publicly available information from each company
- including corporate communications and CSR reports
- 17 companies included, Greenpeace engaged with 14
- Companies we did not meet with were Oppo, Vivo, Xiaomi
- overall grades awarded for each company are derived by an equal weighting of impact area grades (1/3 each: energy, resources, chemicals)
- Impact area grades are derived by weighting of criteria: Transparency (30%), Commitment (30%), Performance (30%), and Advocacy (10%)



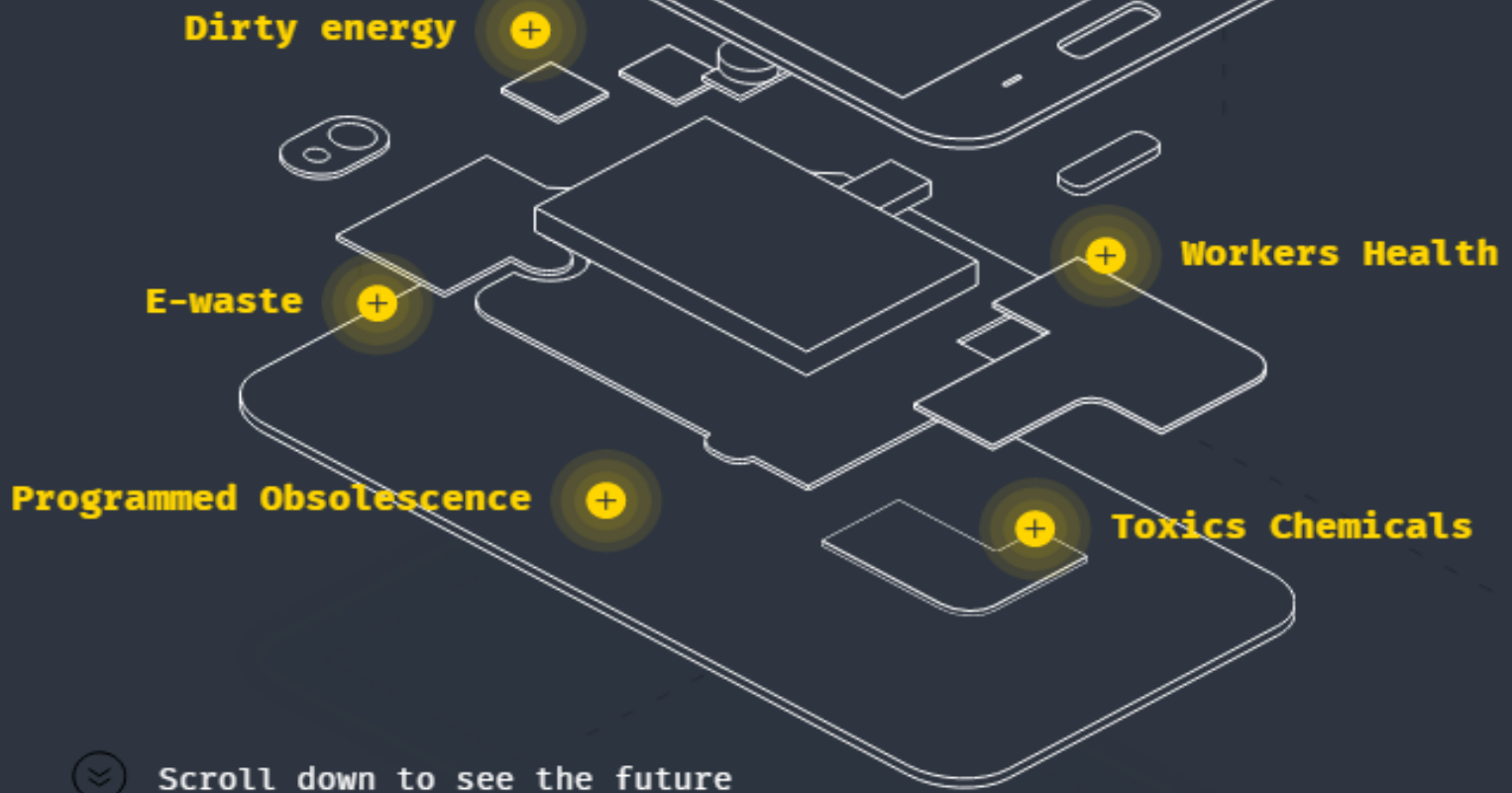
TRUE INNOVATION


CLOSED LOOP

TAKE THE QUIZ!

TUTORIAL

# Major Findings



Overall Grades		ENERGY	RESOURCES	CHEMICALS
<b>FAIRPHONE</b>	B	B	A-	B-
	B-	A-	C	B
	C+	C+	B-	C+
	C+	B	B-	C+
	C-	C	C	D
	C-	D+	D+	C
	D+	C-	C-	D
	D+	D	C-	D+
<b>SONY</b>	D+	C-	C-	D
	D+	C-	D	C-
<b>HUAWEI</b>	D	D	D+	D
	D	D	D	D+
<b>SAMSUNG</b>	D-	D	D	D-
	F	D	D-	F
	F	F	F	F
	F	F	F	F
	F	F	F	F

Sustainable Design & Resource Reduction		TRANSPARENCY	COMMITMENT	PERFORMANCE Circular Production	PERFORMANCE Product Life Extension	ADVOCACY
<b>FAIRPHONE</b>	A-	A	A	B	A	A
<b>DELL</b>	B-	B	C	B	A	C
<b>HP</b>	B-	B	C	B	A	C
<b>APPLE</b>	C	B	B	C	D	F
<b>LENOVO</b>	C	B	D	C	C	B
<b>ACER</b>	C-	C	D	C	C	-
<b>LG</b>	C-	C	D	C	C	-
<b>SONY</b>	C-	B	D	C	D	-
<b>MICROSOFT</b>	D+	C	D	C	D	D
<b>HUAWEI</b>	D+	D	D	C	D	B
<b>GOOGLE</b>	D	D	D	C	D	D
<b>ASUS</b>	D	D	D	C	D	-
<b>SAMSUNG</b>	D	C	F	D	D	D
<b>AMAZON</b>	D-	D	F	D	D	D
<b>XIAOMI</b>	F	F	F	D	D	-
<b>OPPO</b>	F	F	F	F	D	-
<b>VIVO</b>	F	F	F	F	D	-

# Major Findings

## Lack of transparency in supply chain:

- most companies publish little information on their suppliers, keeping environmental performance and impacts hidden
- Out of 17 companies evaluated, only six publish a basic list of suppliers
- only Fairphone and Dell provide details on the products or services from each supplier
- Huawei is among the top 3 the only brand reporting nothing about its supply chain greenhouse gas emissions





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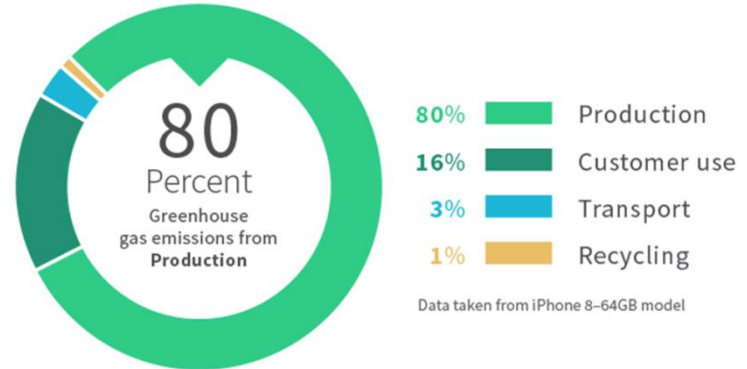
[www.greenpeace.de](http://www.greenpeace.de)

GREENPEACE

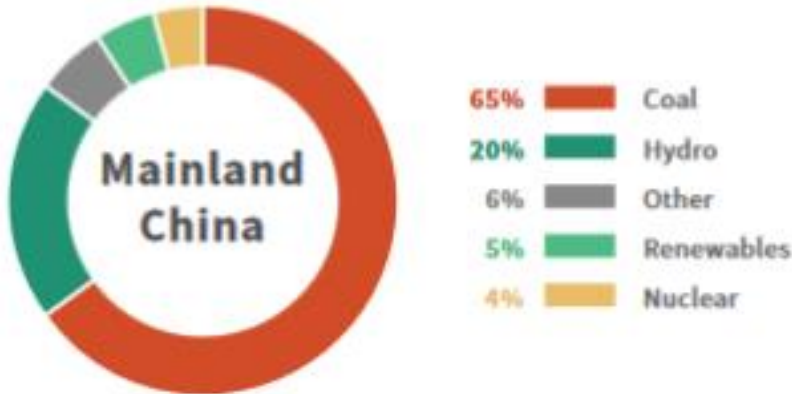
# Fueling Climate Change

- manufacturing remains largely powered by coal and other forms of dirty energy in China and Southeast Asia

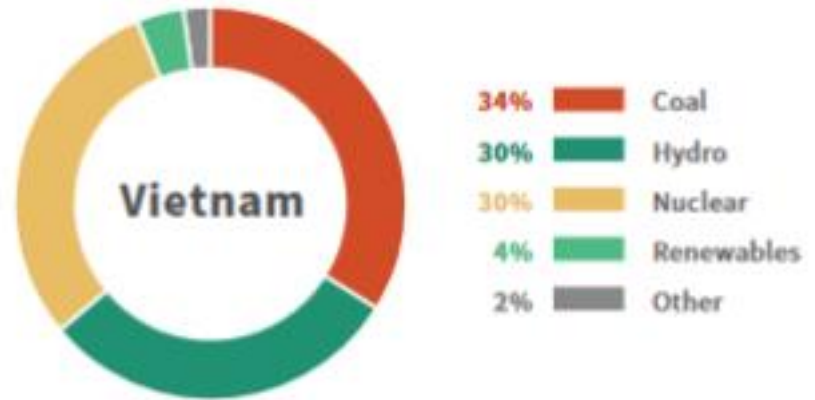
Greenhouse Gas Emissions of a Smartphone



Mainland China



Vietnam





# Major Findings

## Supply chain driving demand for dirty energy:

- nearly all companies have yet to address the rapidly growing carbon footprint and dependence on dirty energy
- **Apple** is the only company that has committed to 100% RE
- **Samsung** is largest manufacturer of smartphones worldwide and a supplier of key components to many of other brands
- Samsung used more than 16,000 GWh of energy in 2016, with just 1% coming from renewables



© Sonja Och / Greenpeace

Greenpeace volunteers organise a smartphone repair event in Hamburg, where visitors can repair their smartphones.

[www.greenpeace.de](http://www.greenpeace.de)

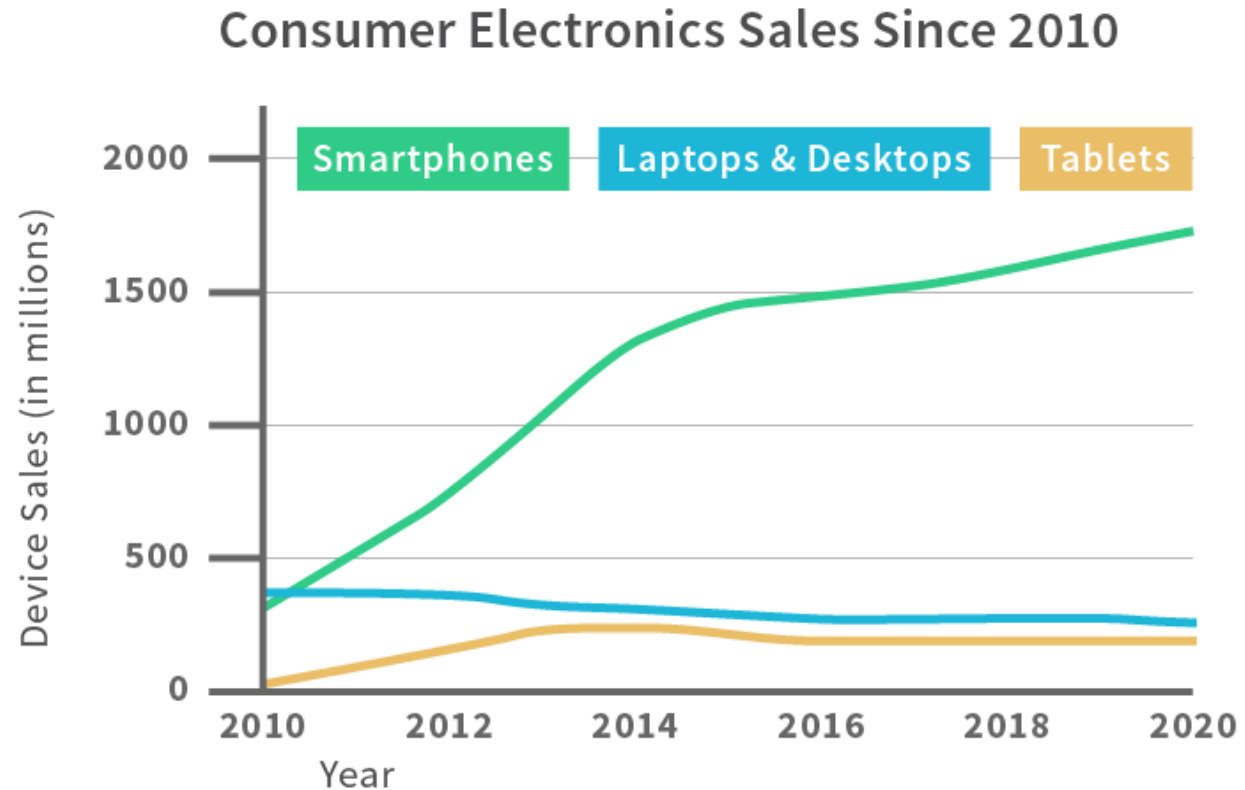
**GREENPEACE**

# Major Findings

## Planned obsolescence as design feature:

- Facing market saturation companies have changed the design of their products and made them difficult to service or upgrade  
shortening the useful life of otherwise functional devices, accelerate the replacement cycle
- **Apple, Microsoft, and Samsung** are among the companies moving in the wrong direction on sustainable product design
- **HP, Dell, and Fairphone** are notable exceptions, producing products that are repairable and upgradable

# Planned Obsolescence – Driving Consumption, Fueling Waste



More than 1.5 billion smartphones are expected to be produced every year from 2017.



# Mounting Electronic Waste

## Annual E-Waste Generation



Each year, enough e-waste is produced globally to cover all of Hong Kong Island.

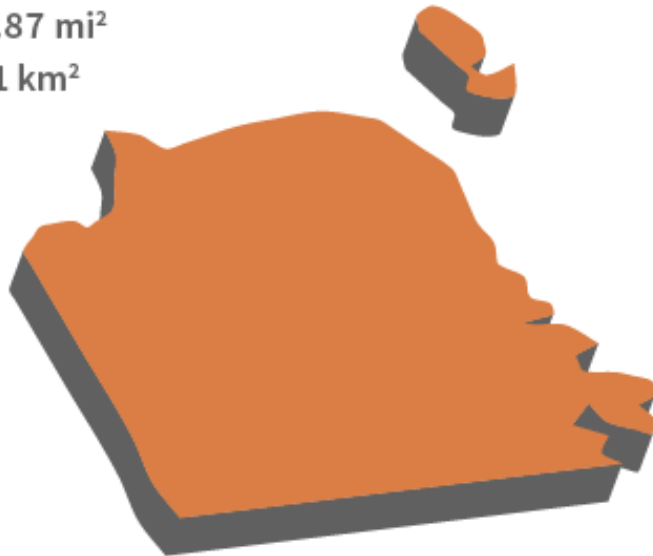
# Mounting Electronic Waste

## Annual E-Waste Generation

San Francisco

46.87 mi<sup>2</sup>

121 km<sup>2</sup>



Each year, enough e-waste is produced globally to cover all of San Francisco.

# Major Findings

## Lack of urgency, transparency in tackling global e-waste problem:

- Worldwide e-waste volumes are expected to surpass 65 million metric tons in 2017<sup>1</sup>
- less than 16% of global e-waste volumes are estimated to be recycled in the formal sector
- Often “recycled” e-waste ends up at informal recyclers, handled in ways that endanger worker health and the local environment



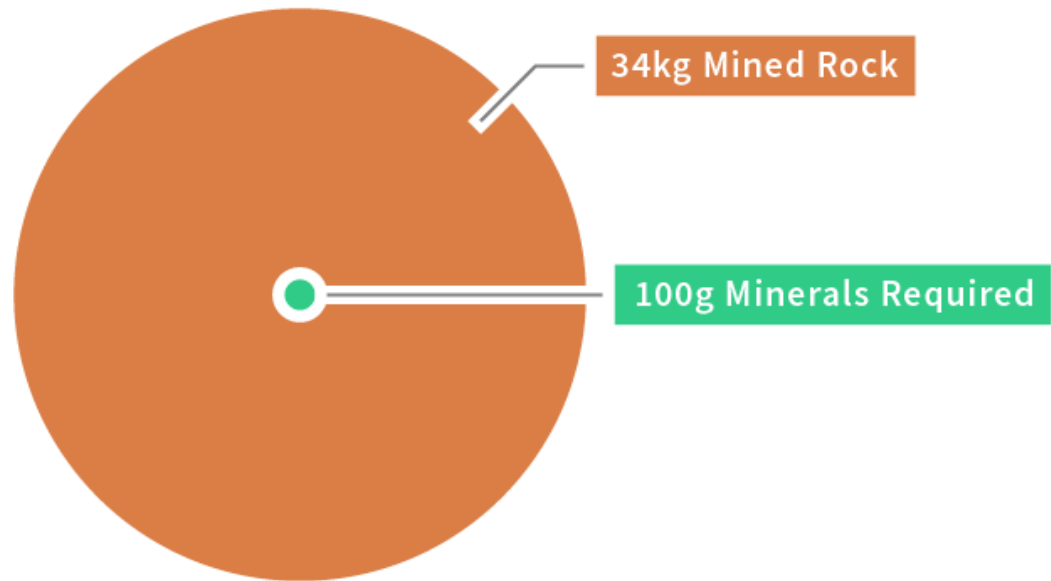


Many women, some with babies and young infants, wash and sort mineral ore on the shore and in the shallow waters of Lake Malo, Kapata on the outskirts of Kolwezi, DRC, May 2015 © Amnesty International and Afrewatch

# Highly Resource-Intensive Products

- Cobalt and the 3TG (Tin, tantalum, tungsten and gold) have been tied to armed conflict in the DRC.

Resource Intensity of a Smartphone



More than 340 times as much rock must be mined to extract the minerals required for a typical smartphone.

# Material requirements of smartphones/tablets in relation to world primary production

Material		Content in all smartphones and tablets 2014	World Primary Production in 2014	Percentage of Smartphone & Tablet Demand of World Primary Production
Aluminium	Al	41,845 t	49,300,000 t	0.085 %
Cobalt	Co	10,572 t	112,000 t	9.4 %
Tantalum	Ta	32 t	1,200 t	2.7 %
Palladium	Pd	17 t	100 t	8.9 %

# Major Findings

**Use of secondary materials remains limited, with some recent progress:**

- very little progress in sourcing other secondary materials
- **Fairphone** incorporates recycled tungsten
- few IT companies have incorporated recycled plastics
- **Dell** has shown success in using closed-loop plastic collected from its take-back channel
- **Apple** recently committed to “closing the loop” for its materials, starting with tin and aluminum



반도체 노동자의 건강과 인권지킴이 반올림

# Major Findings

## Lack of transparency and monitoring of workplace chemicals:

- eliminate hazardous releases to the environment from manufacturing facilities
- improve worker health and develop safe substitutions
- identify and eliminate hazardous chemicals
- **Apple, Dell, Google, HP and Microsoft** are the only companies that publish their list of substances that must be restricted in the manufacturing of their devices (MRSL)

# Major Findings

## Stalled commitments to product detox:

- Numerous companies, including Acer, Apple, Samsung, LG, Lenovo, Dell and HP made commitments in 2009/2010 to phase out PVC and BFRs from their products and reduce toxic e-waste
- Now in 2017, only **Apple and Google** products are free of BFR and PVC across their product lines.



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# How to Rethink IT's Business Model

- Responsibility for the Supply Chain

- Design Sustainable Products

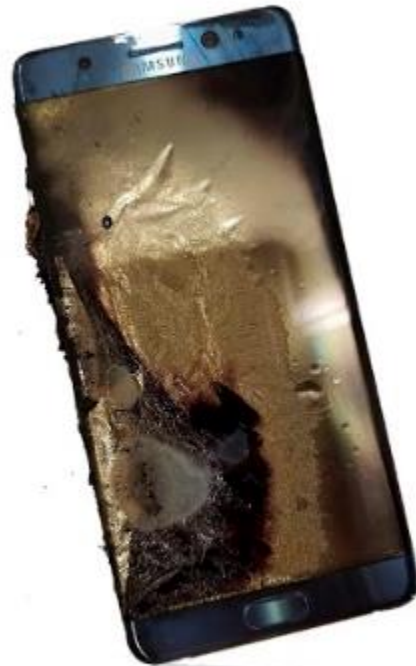
- Responsibility for end-of-life

☺ Take a look inside



# How to Rethink IT's Business Model

- IT business should be at the cutting edge when it comes to sustainable product design and innovative manufacturing
- the rapid transition to renewable energy (RE)
- substitution of hazardous chemicals - worker health protection
- the prevention of environmental pollution and human rights abuses at its source and once products become waste
- reinvent the way electronic devices are made and used  
reverse the ever-increasing environmental impacts driven by the growth of the sector



**SAMSUNG**  
**Galaxy Note7**

Rethink **what a phone can do!**

# SAMSUNG GALAXY NOTE 7

## Tons of effort for a smartphone



129 kg

**Au**

Gold

95.501 t

1.3 tons

**Ag**

Silver

9.111 t

27.3 tons

**Co**

Cobalt

1.553 t

soil, ore,  
fossile energy

**4.3 Million  
Samsung Galaxy Note 7**

So much effort for a smartphone - sample calculation Samsung Galaxy Note 7:  
For 129 kg of gold contained in 4,3 Million broken devices 95.501 tons of  
soil, ore and fossile energy had to be excavated.  
Source: Oeko-Institut e.V. / Greenpeace



# SAMSUNG

KEEP

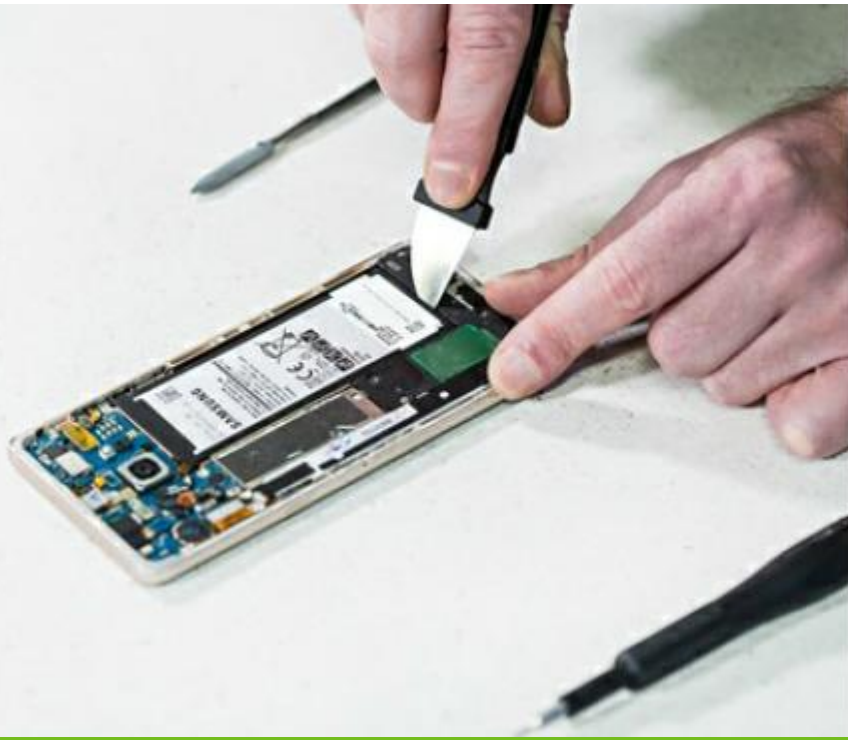
# CALM

AND

# SAVE

## 4.3 MILLION GALAXIES

# Repairability



# Our Role in Rethinking IT

- Choose a well-made, long lasting, repairable products
- Hold on to your device as long as it works
- Repair, rather than replace
- When you must replace, make sure you recycle your old device
- Let IT brands know you want devices designed with our planet in mind



It's time tech companies put the smart back into smartphones [act.gp/2xYwDUA](https://act.gp/2xYwDUA) #iPhoneX (gif by @JoeMohrToons )

🌐 Original (Englisch) übersetzen



<https://twitter.com/Greenpeace/status/926335674147594240>



**REPAIRCAFÉ**

**Handy kaputt?**

**Wir helfen Dir!**

**GREENPEACE**





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<https://twitter.com/twitter/statuses/925691005352992769>

**Any questions?**

**Thank You!**

<http://www.greenpeace.org/greenerguide>

 Take a look inside