IoT and Sustainability

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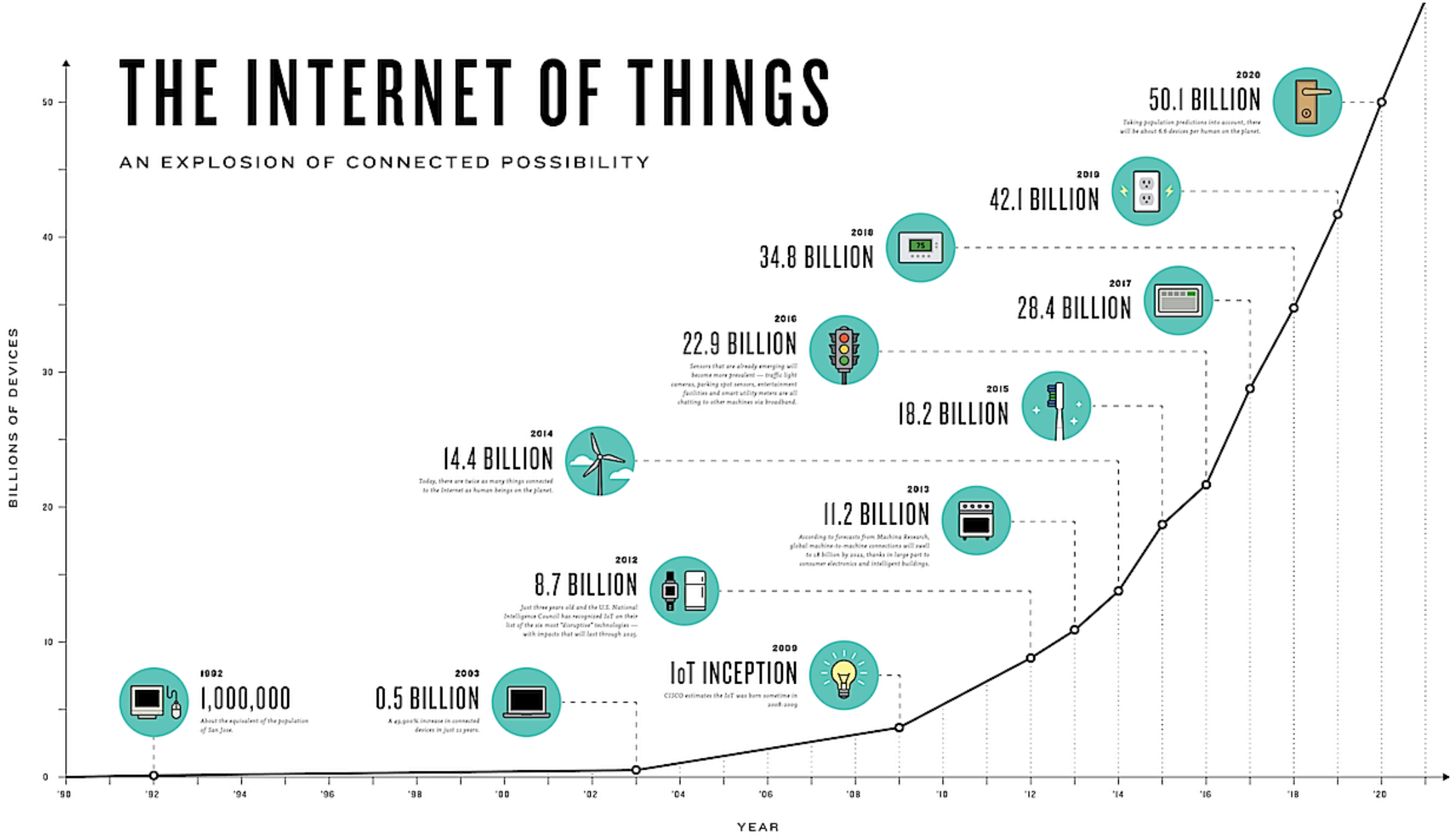
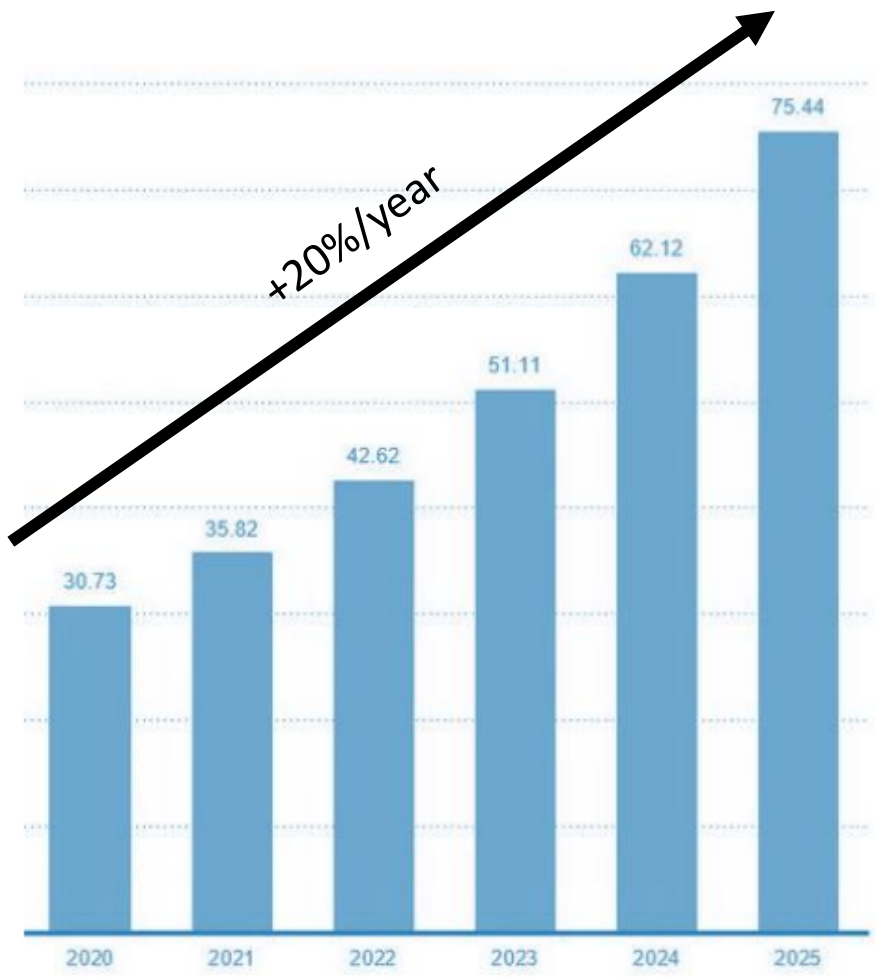
THE INTERNET OF THINGS

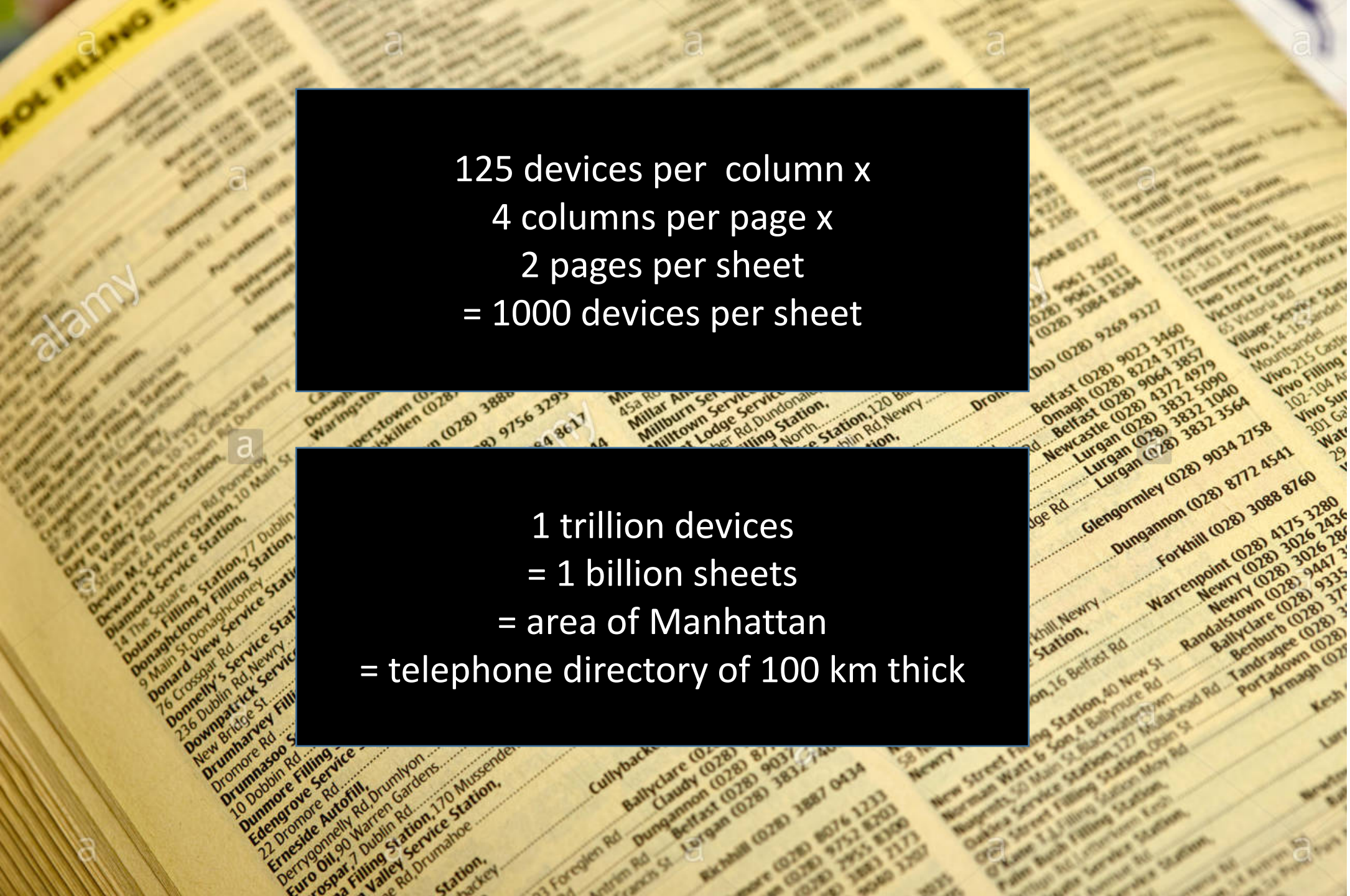
AN EXPLOSION OF CONNECTED POSSIBILITY

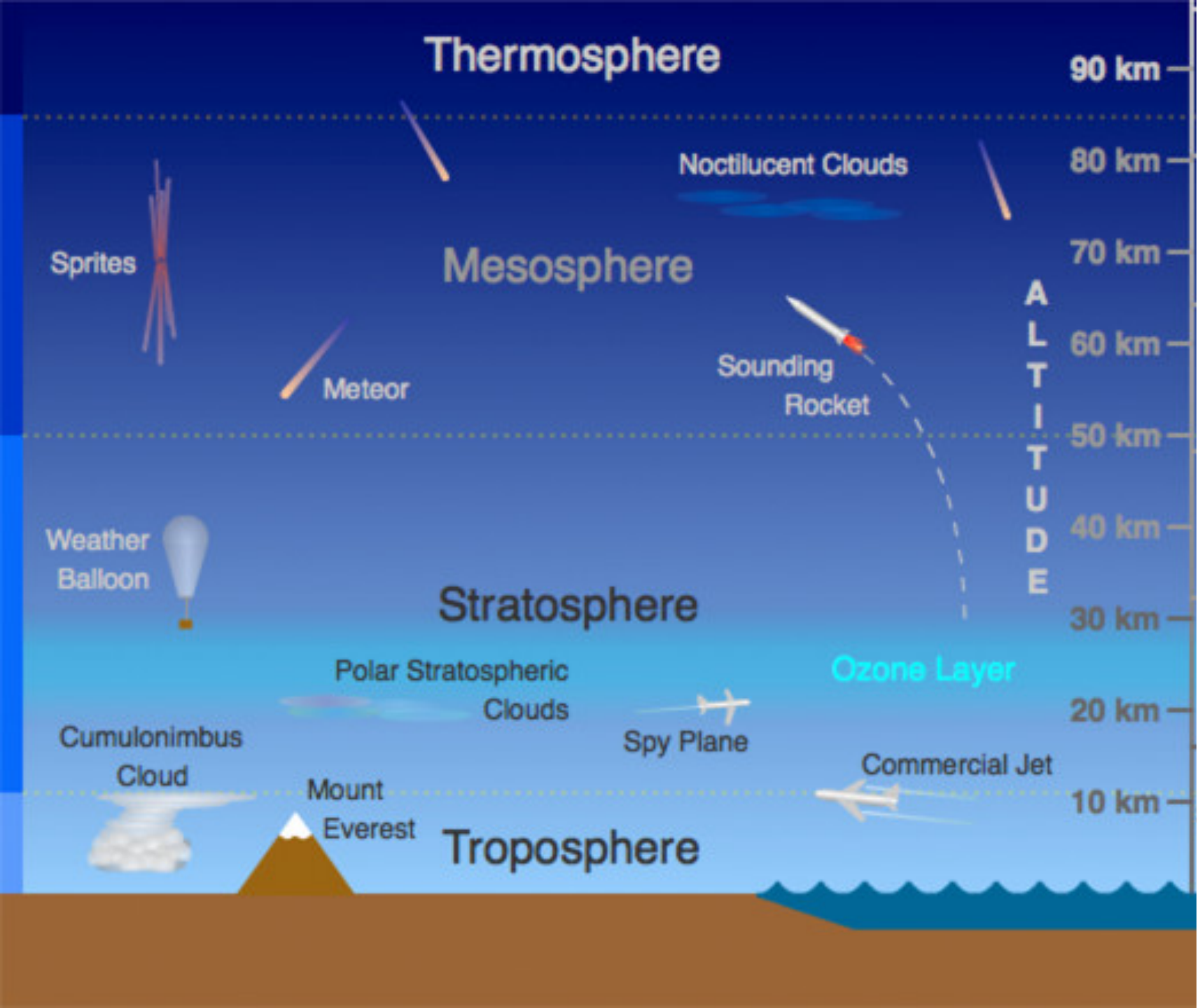


IoT-devices (in bn):

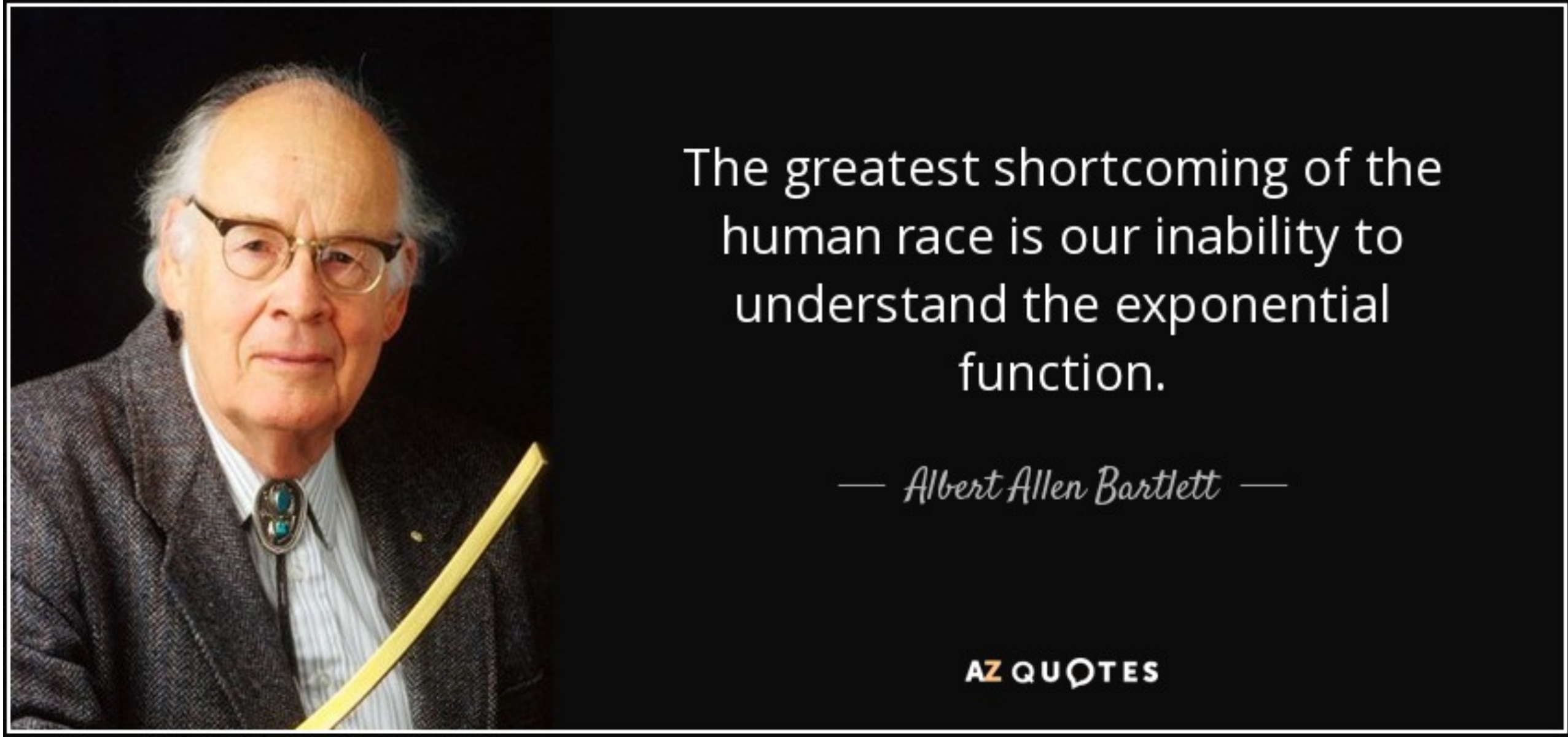


In 2016, Masayoshi Son, the CEO of SoftBank Group Corp., predicted that in the next 20 years there will be a trillion connected devices in the world and orbiting the planet.


125 devices per column x
4 columns per page x
2 pages per sheet
= 1000 devices per sheet
1 trillion devices
= 1 billion sheets
= area of Manhattan
= telephone directory of 100 km thick



Human scale vs terrascale



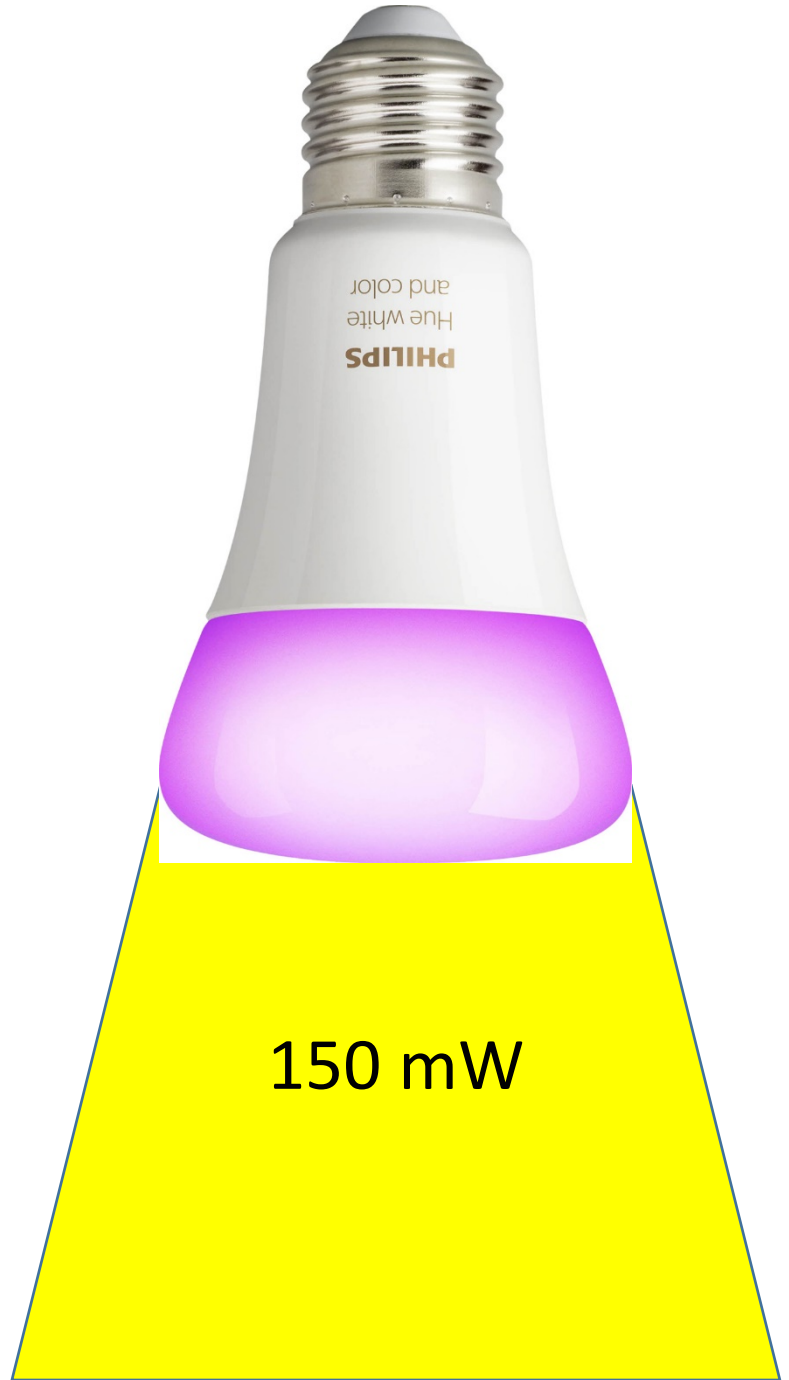
[Exponential Growth Arithmetic, Population and Energy, Dr. Albert A. Bartlett - YouTube]

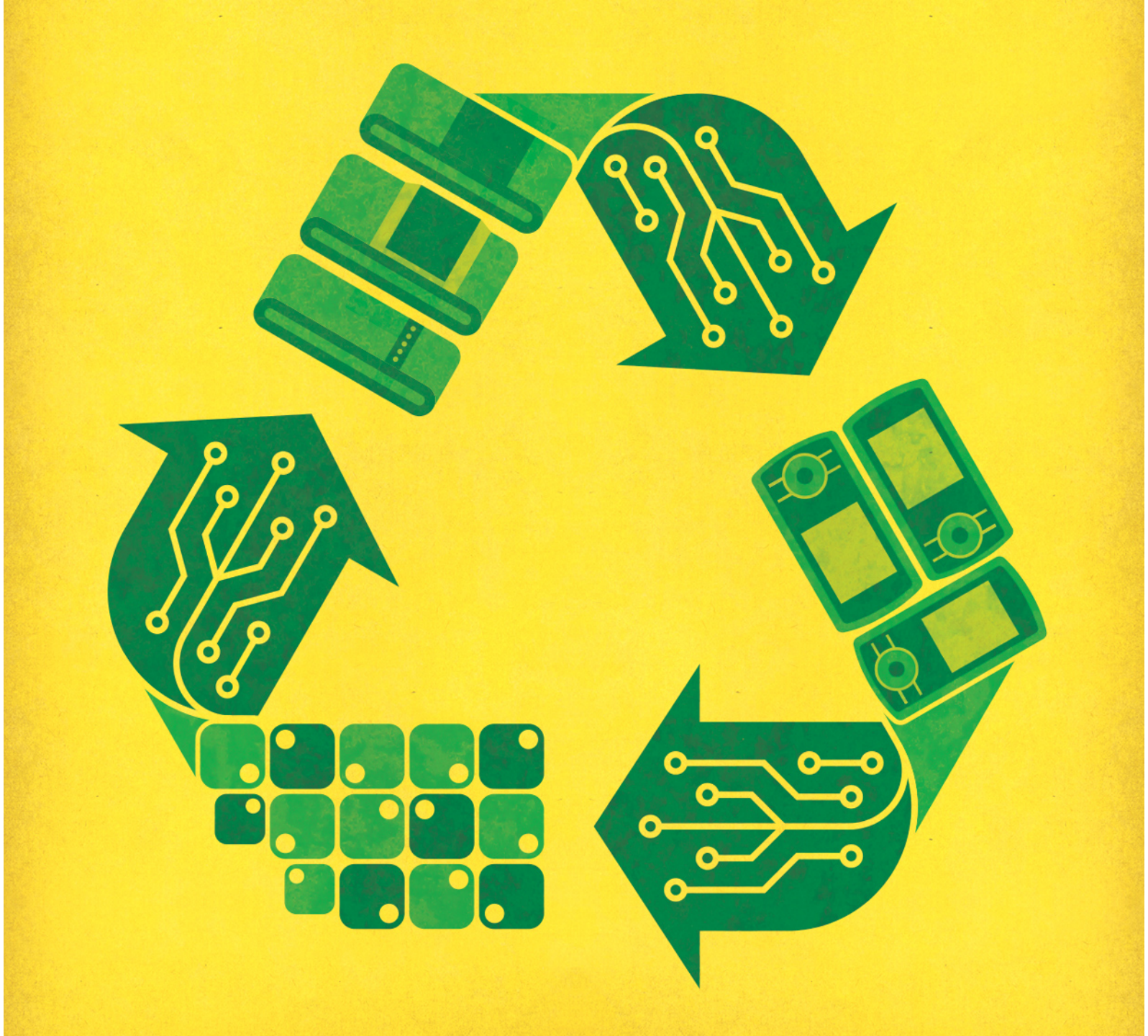
Standby power

Device	Power
Charger in socket	20 mW
Television off by remote	300 mW
Display sleep mode	370 mW
Notebook off	470 mW
Notebook sleep mode	820 mW
Radio	970 mW
Microwave	1400 mW
Timer	1500 mW
Garage door opener	1800 mW
Set top box, off by remote	13240mW
Cable modem standby	3590 mW

[Standby Power Summary Table » Standby Power (lbl.gov)]

1 mW x 1 trillion = 1 GW


PHILIPS
Hue white
and color
150 mW



17 May 2018 | 19:00 GMT

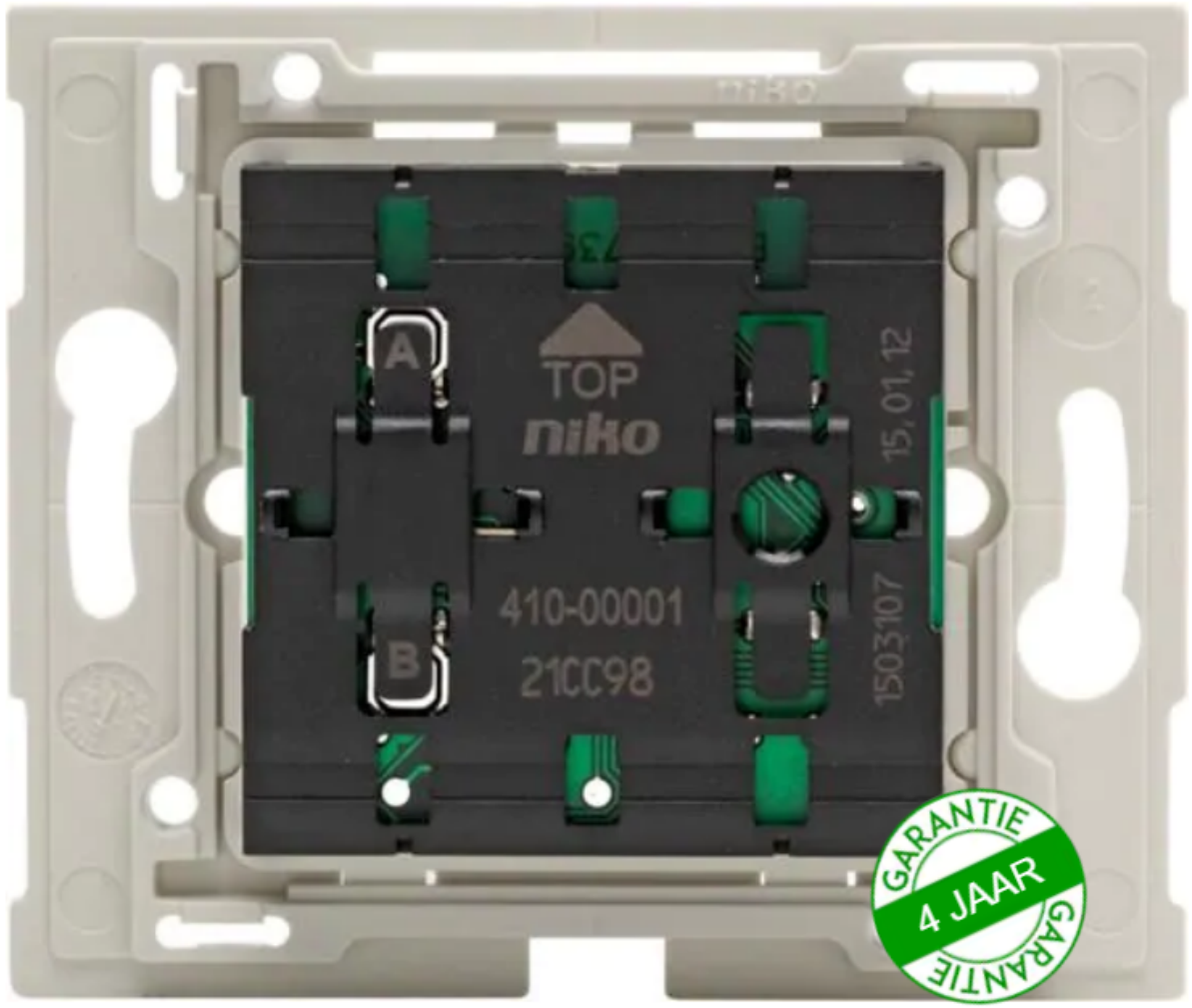
The Internet of Trash: IoT Has a Looming E-Waste Problem

A lack of forethought will leave us with a mountain of obsolete devices and no way to dispose of them

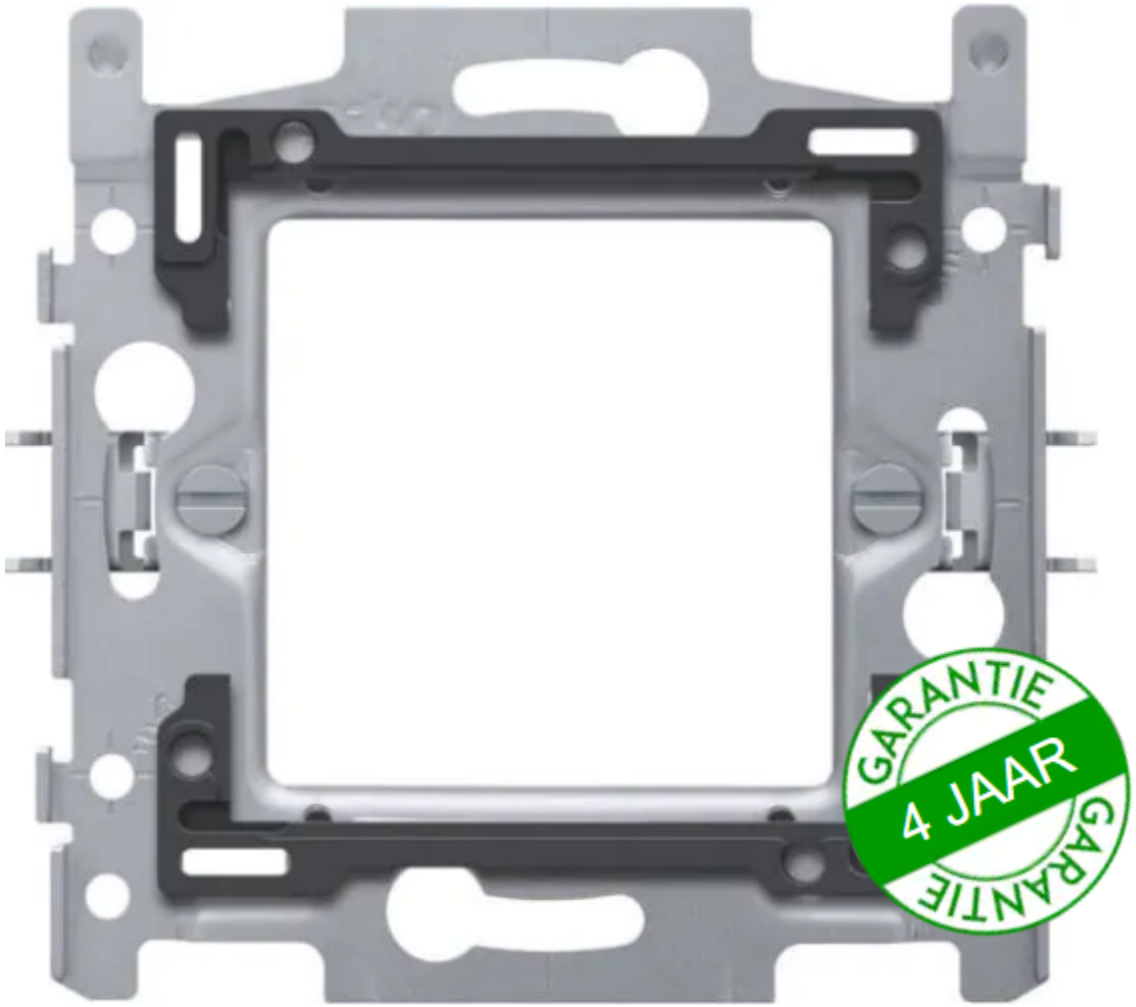
By **Stacey Higginbotham**

The United Nations found that people generated 44.7 million metric tons of e-waste globally in 2016, and expects that to grow to 52.2 million metric tons by 2021.

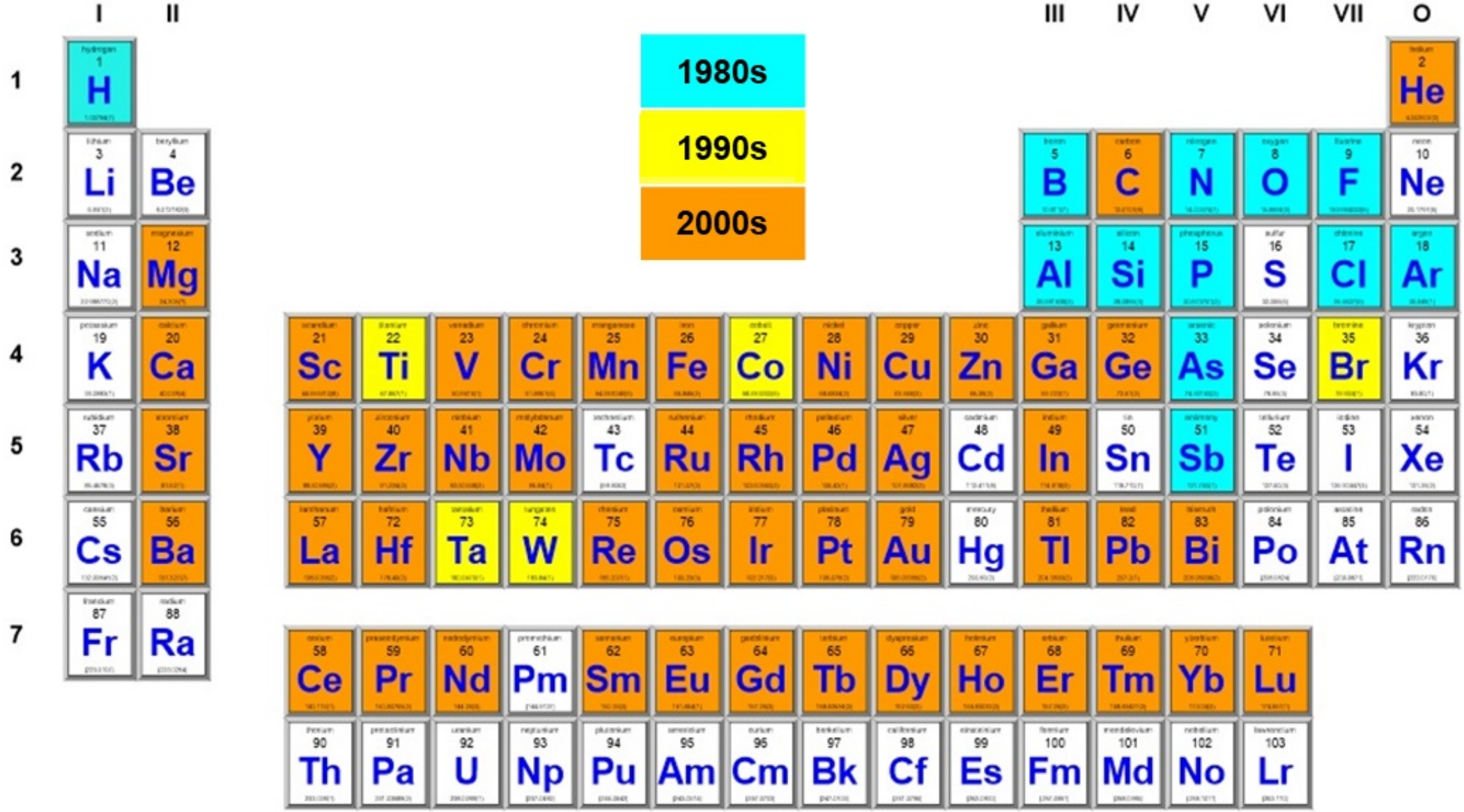
We’re adding semiconductors to products that previously had none, and we’re also shortening the life of devices as we add more computing, turning products that might last 15 years into ones that must be replaced every five years.

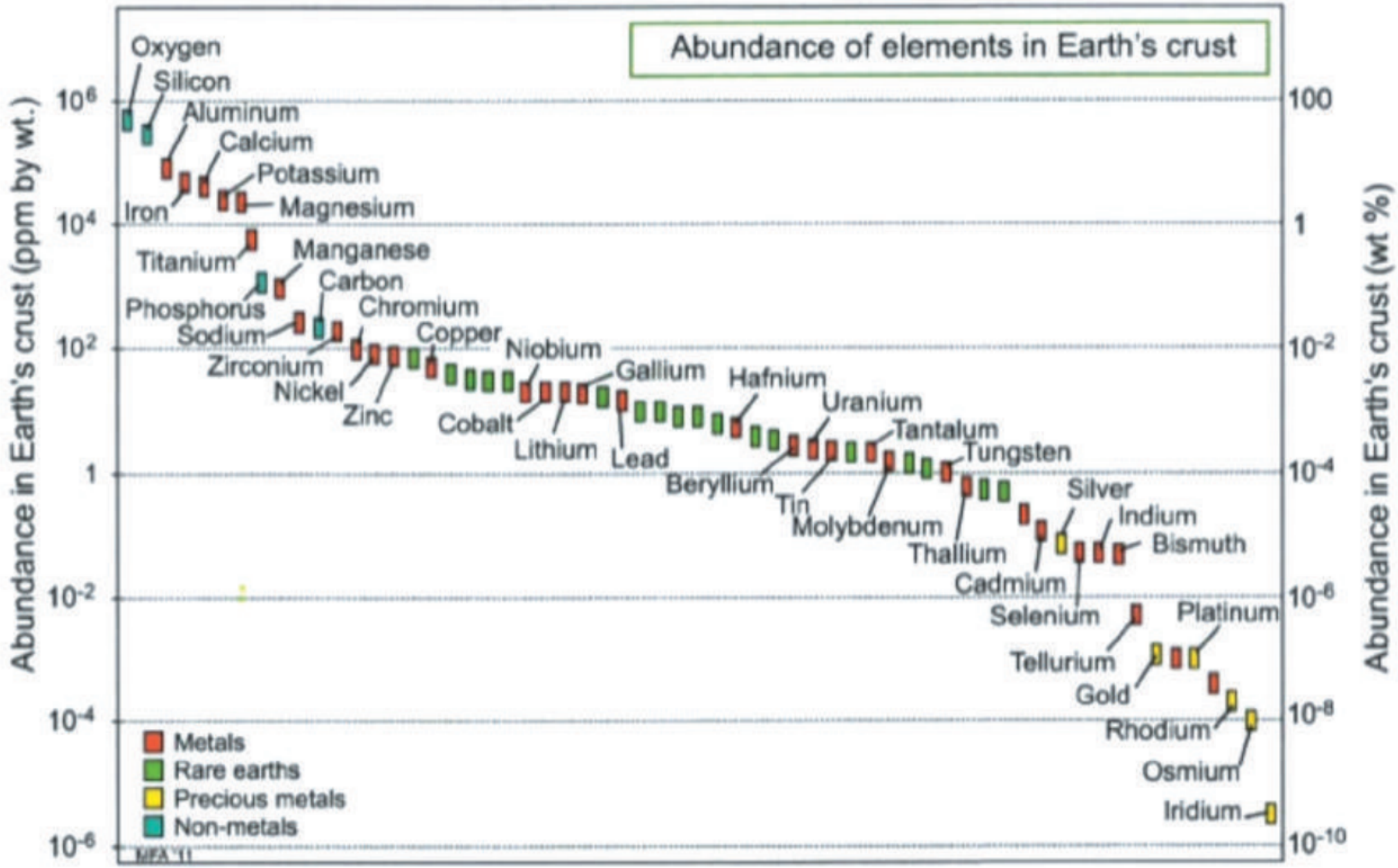

A
TOP
niko
B
410-00001
21CC98
15.01.12
1503107
GARANTIE
4 JAAR
GARANTIE

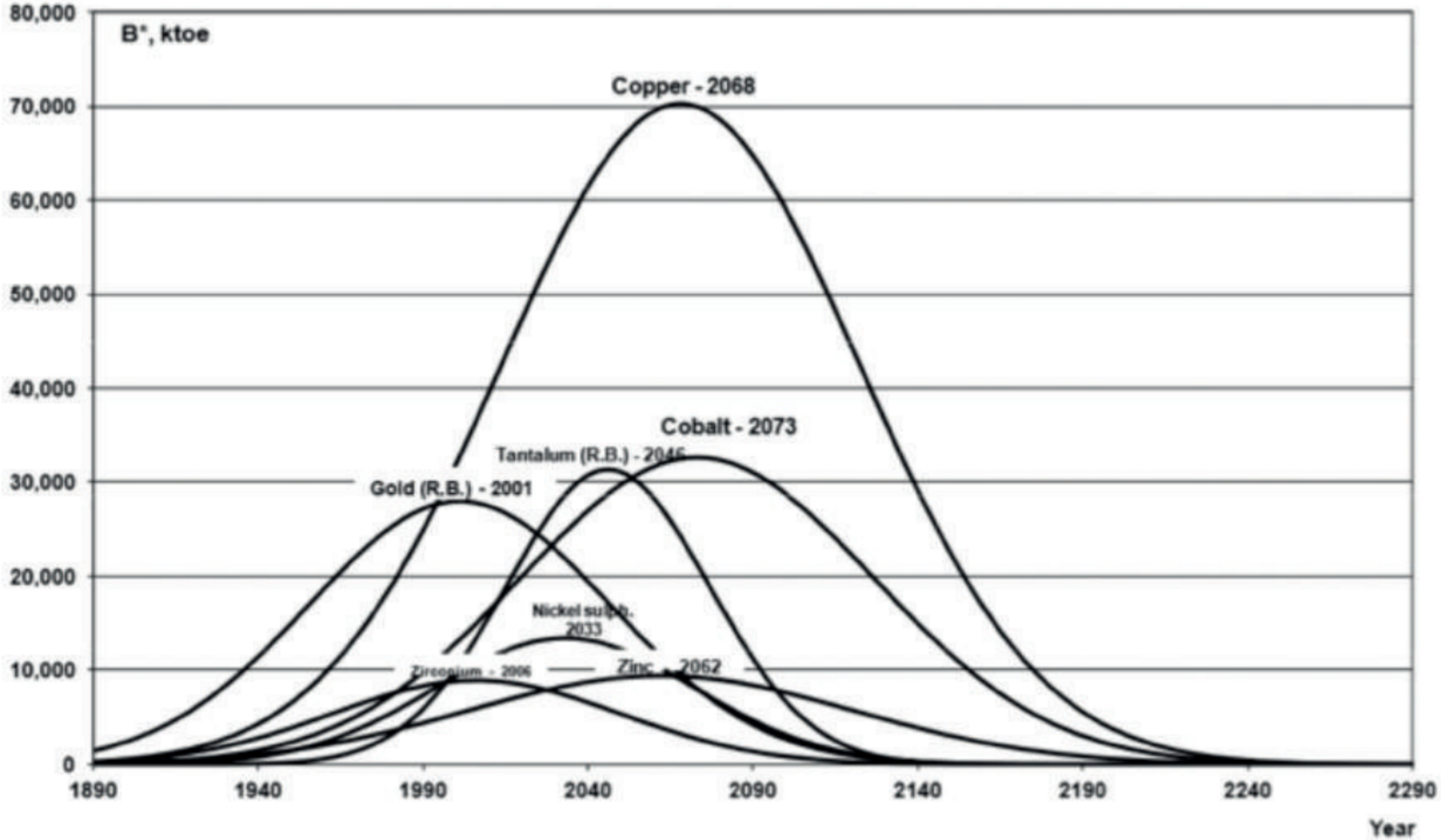
€ 43,04


GARANTIE
4 JAAR
GARANTIE

€ 1,37


I
II
III
IV
V
VI
VII
O
1
2
3
4
5
6
7
1980s
1990s
2000s
H
He
Li
Be
B
C
N
O
F
Ne
Na
Mg
Al
Si
P
S
Cl
Ar
K
Ca
Sc
Ti
V
Cr
Mn
Fe
Co
Ni
Cu
Zn
Ga
Ge
As
Se
Br
Kr
Rb
Sr
Y
Zr
Nb
Mo
Tc
Ru
Rh
Pd
Ag
Cd
In
Sn
Sb
Te
I
Xe
Cs
Ba
La
Hf
Ta
W
Re
Os
Ir
Pt
Au
Hg
Tl
Pb
Bi
Po
At
Rn
Fr
Ra
Ce
Pr
Nd
Pm
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Th
Pa
U
Np
Pu
Am
Cm
Bk
Cf
Es
Fm
Md
No
Lr


Abundance of elements in Earth's crust
Abundance in Earth's crust (ppm by wt.)
Abundance in Earth's crust (wt %)
10^6
10^4
10^2
1
10^-2
10^-4
10^-6
100
1
10^-2
10^-4
10^-6
10^-8
10^-10
Oxygen
Silicon
Aluminum
Calcium
Potassium
Iron
Magnesium
Titanium
Manganese
Carbon
Phosphorus
Chromium
Sodium
Copper
Zirconium
Niobium
Nickel
Gallium
Hafnium
Zinc
Uranium
Cobalt
Tantalum
Lithium
Tungsten
Lead
Beryllium
Silver
Tin
Indium
Molybdenum
Bismuth
Thallium
Cadmium
Selenium
Platinum
Tellurium
Gold
Rhodium
Osmium
Iridium
Metals
Rare earths
Precious metals
Non-metals


B°, ktoe
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Copper - 2068
Cobalt - 2073
Tantalum (R.B.) - 2046
Gold (R.B.) - 2001
Nickel su[illegible]
2033
Zirconium - 2006
Zinc - 2062
1890
1940
1990
2040
2090
2140
2190
2240
2290
Year

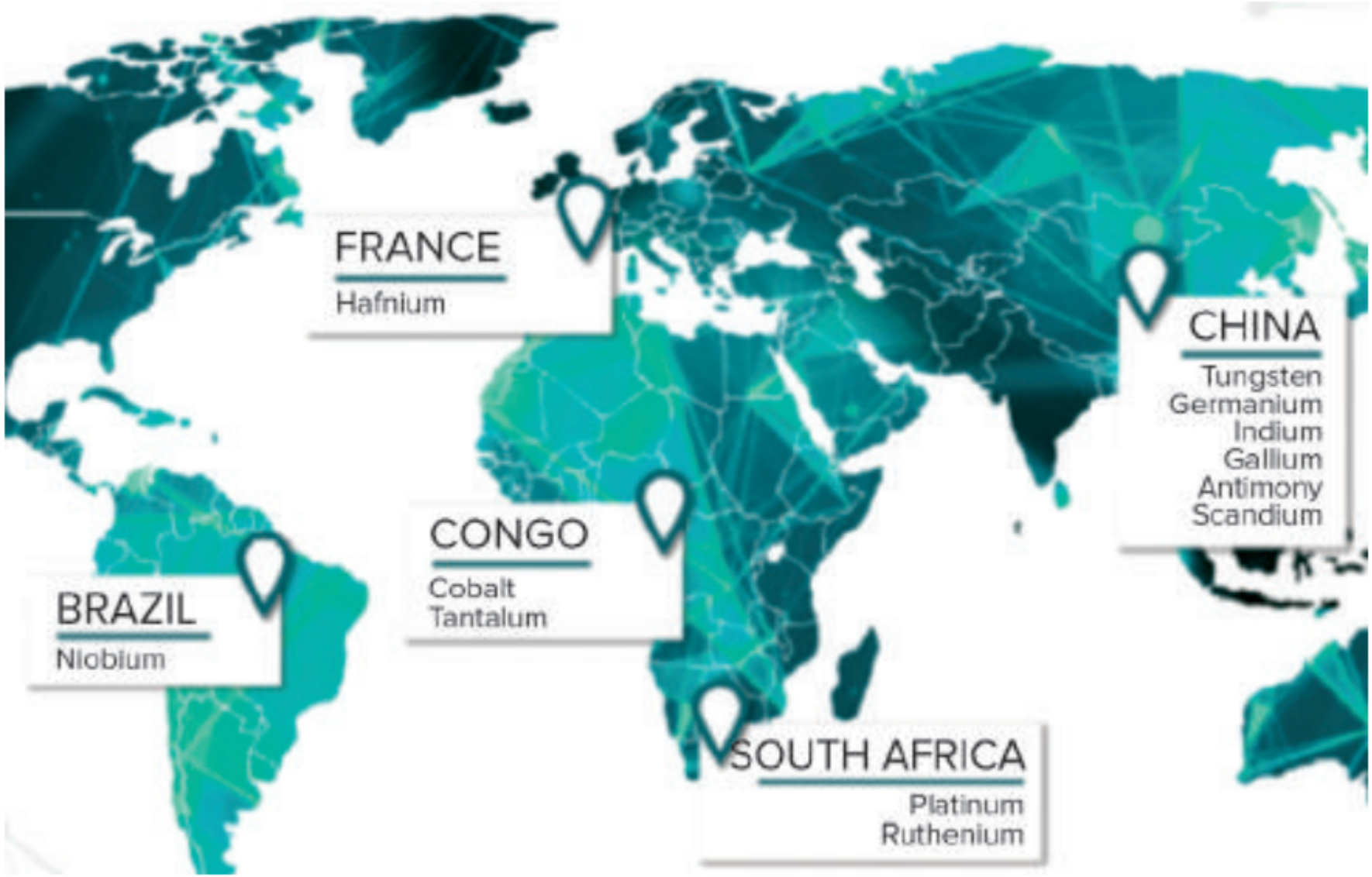


Figure 162: Rare materials that ICT relies on

Umicore, one of the most advanced companies in the field of electronic materials recycling, manages to extract 17 elements out of the 60.

At the end of their life, the recycling rate of electronic equipment is very low (less than 15%).


Tues, Aug 27 | 15 °C
FAIRPHONE


FAIRPHONE
Well done.
You're what progress looks like.
Micro SD
Sim 1
Sim 2
Change is in your hands

THE WAY AHEAD – MAIN PRIORITIES

Economic and Societal Priorities

1. Support for SMEs and start-ups
2. Accurate economic parameters estimate
3. Data and information as critical assets
4. Increase digital skills and competencies
5. Build Trust
6. Identification of the Key Regulatory and Legal Issues
7. Interoperability and Replicability
8. Security and Reliability by Design
9. Innovation procurement
10. Sustainability
11. Cohesion
12. Sovereignty

Research, Innovation & Deployment Priorities

1. Reliable, low-cost, sustainable and scalable IoT networks
2. Next Generation IoT data processing architectures
3. Futureproof security and trust
4. IoT, processes, and data Interoperability
5. IoT, Citizens, Privacy-by-design, and Ethics
6. Real time decision-making for IoT
7. Autonomous IoT solutions
8. Human and Sustainable Development in the loop IoT
9. IoT Data Sharing and Monetization enabling models and technologies
10. Sustainable and biocompatible devices