Evaluate the environmental impact of ICT
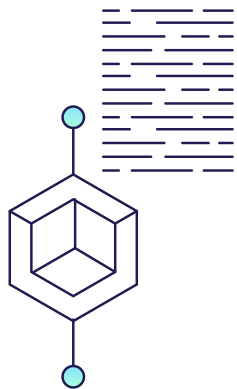
With open data, methods and tools

hubblo

PRÉSENTATION

David Ekchajzer

Research ⇒ Action

Co-founder of Hubblo.org

Contributor at Boavizta.org

HUBBLO

Open-Source products
Integrate and automate environmental evaluation

Engineering and consulting firm
Evaluate environmental impact of ICT

Open R&D
more systemic consideration of impacts

Boavizta - evaluation of the environmental impact of IT

Working group

Organizations
Researchers
Freelancers

Themes

Data Repository
Cloud measurement
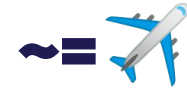Calculation methods
Convince top-management
Open-source tools

https://boavizta.org/

The environmental impacts of digital technology

2020 :   **2,1 to 3,9%**   ~= ✈️

2025 :   **6 to 8%**   ~= 🚗

%	Energy	GHG	Water	Electricity	Resources
Users	60%	63%	83%	44%	75%
Networks	23%	22%	9%	32%	16%
Datacenters	17%	15%	7%	24%	8%

Répartition des impacts du numérique mondial en 2019

Source : green**IT**.fr
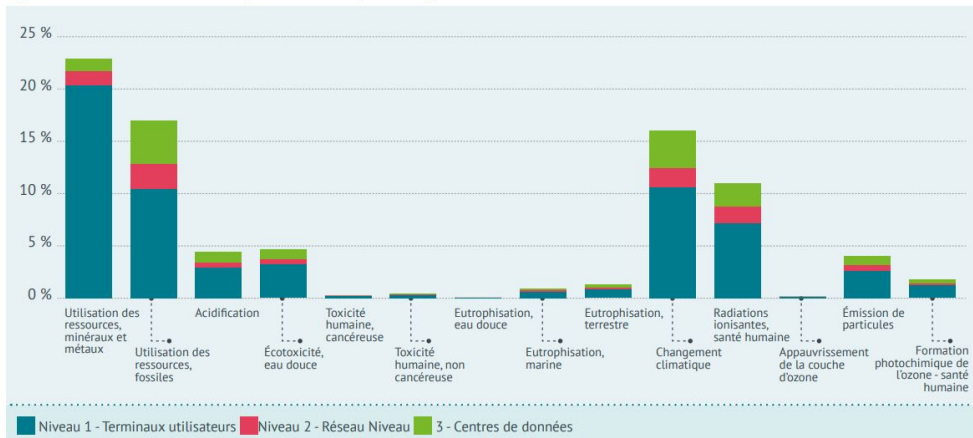
How to evaluate them ?

Perimeter

Mutli-steps

Multi-perimeters

Multi Criteria

Figure 1 - Distribution normalisée et pondérée de l'impact le long des 3 niveaux

The Green / EFA - Ponderation of 13 impacts criteria

EF Impact Category	EF Impact Assessment Model	EF Impact Category indicators	Source
Climate Change	Bern model - Global Warming Potentials (GWP) over a 100 year time horizon.	kg CO_2 equivalent	Intergovernmental Panel on Climate Change, 2007
Ozone Depletion	EDIP model based on the ODPs of the World Meteorological Organization (WMO) over an infinite time horizon.	kg CFC-11 equivalent	WMO, 1999
Ecotoxicity for aquatic fresh water	USEtox model	CTUe (Comparative Toxic Unit for ecosystems)	Rosenbaum et al., 2008
Human Toxicity - cancer effects	USEtox model	CTUh (Comparative Toxic Unit for humans)	Rosenbaum et al., 2008
Human Toxicity - non-cancer effects	USEtox model	CTUh (Comparative Toxic Unit for humans)	Rosenbaum et al., 2008
Particulate Matter/Respiratory Inorganics	RiskPoll model	kg PM2.5 equivalent	Humbert, 2009
Ionising Radiation – human health effects	Human Health effect model	kg U^{235} equivalent (to air)	Dreicer et al., 1995
Photochemical Ozone Formation	LOTOS-EUROS model	kg NMVOC equivalent	Van Zelm et al., 2008 as applied in ReCiPe
Acidification	Accumulated Exceedance model	mol H+ eq	Seppälä et al.,2006; Posch et al., 2008
Eutrophication – terrestrial	Accumulated Exceedance model	mol N eq	Seppälä et al.,2006; Posch et al., 2008
Eutrophication – aquatic	EUTREND model	fresh water: kg P equivalent marine: kg N equivalent	Struijs et al., 2009 as implemented in ReCiPe
Resource Depletion – water	Swiss Ecoscarcity model	m^3 water use related to local scarcity of water	Frischknecht et al., 2008
Resource Depletion – mineral, fossil	CML2002 model	kg antimony (Sb) equivalent	van Oers et al., 2002
Land Transformation	Soil Organic Matter (SOM) model	Kg (deficit)	Milà i Canals et al., 2007

Default EF impact [...] for PEF studies

Life Cycle Assessment
ISO 14040
ISO 14044

Multi Criteria analysis

https://pre-sustainability.com/

Why make open evaluations ?

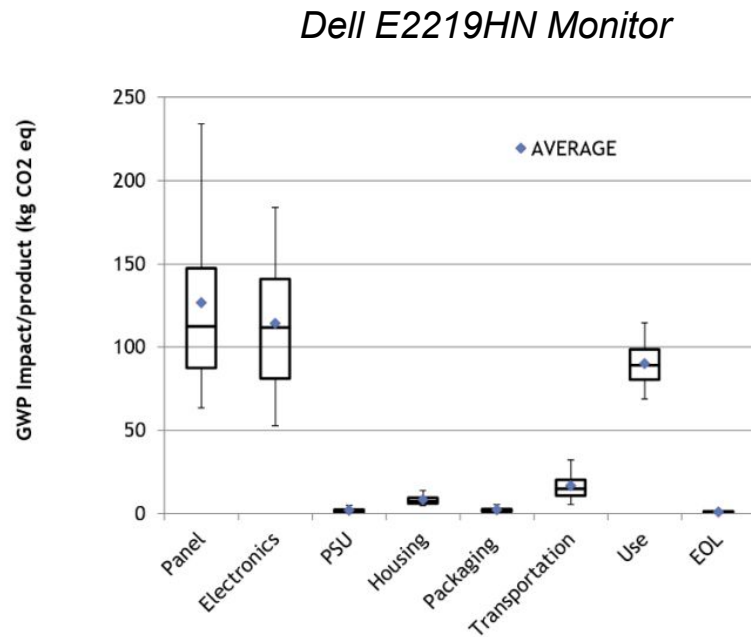# 🗳️ Because it is a democratic necessity

Political orientations

Environmental labeling

Because the measurements are of poor quality

Average GWP impact of screen manufacturing (kgCO2e/inch)	
Dell (PAIA)	11,4 to 26,7
Lenovo (PAIA)	5,7 to 24,5
HP (Other)	3,3 to 8,6
NegaOctet	2,94
Base Impacts (ADEME)	≈ 2,7

Dell E2219HN Monitor

Is it possible?

Spoiler : Hardly

🛡️ The allies

Measuring the impact of user terminals

Perimeter

	End-user equipments	Network	On-prem infra	Cloud (As a service)
Manufacture	❌			
Transport	❌			
Use	❌			
Waste	❌			

datavizta.boavizta.org

⚡ **Measure the impacts related to usage.**

Perimeter

End-user equipments

Network

On-prem infra

Cloud (As a service)

Manufacture

Transport

Use

Waste

kWh * Co2eq./kWh

kWh : Power consumption
Co2eq./kWh : Impact of a kwh of electricity

kWh : Power consumption

Open-methodology   **Open-Source**

Physics

Software sensor

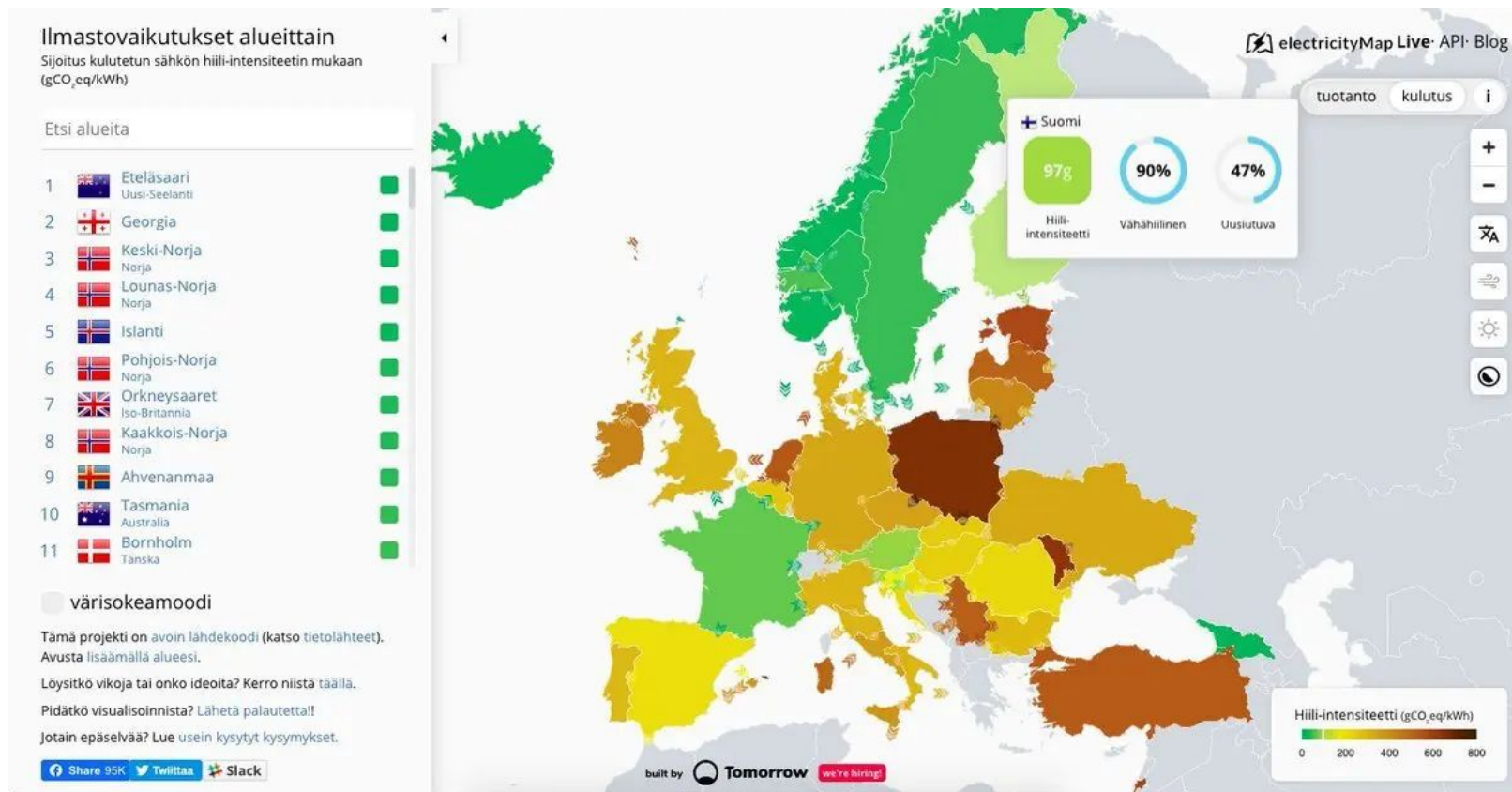# Impact of a kwh of electricity : Electricity map

What about the cloud ?

Perimeter

End-user equipments   Network   On-prem infra   Cloud (As a service)

Manufacture

Transport

Use ❌

Waste

Where to connect my power meter?
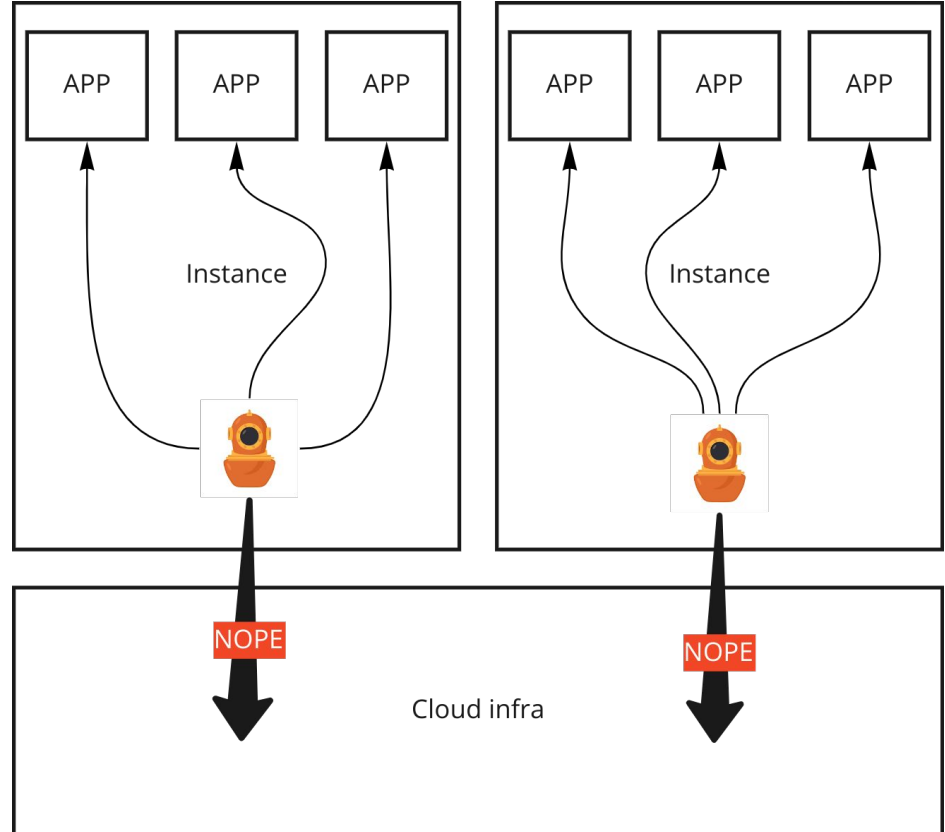
Modeling electrical consumption

Open Science

Let's build it together !
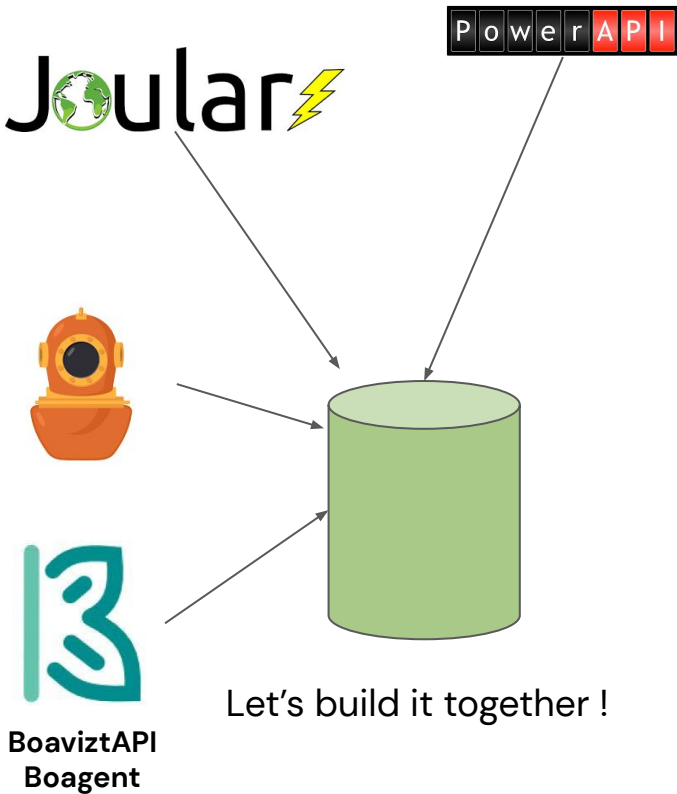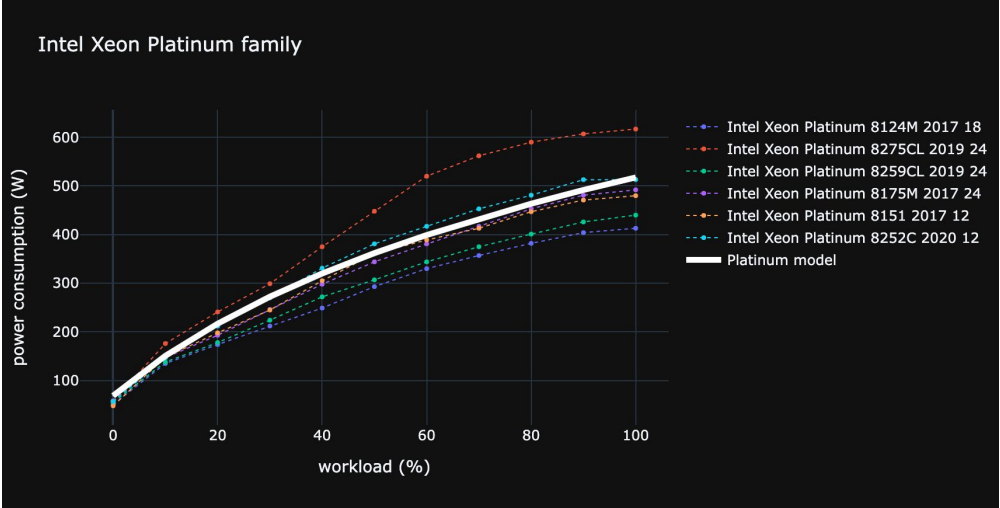
Measuring the impacts of manufacturing

Perimeter

End-user equipments

Network

On-prem infra

Cloud (As a service)

Manufacture

Transport

Use

Waste

Die size

Wafer

Die
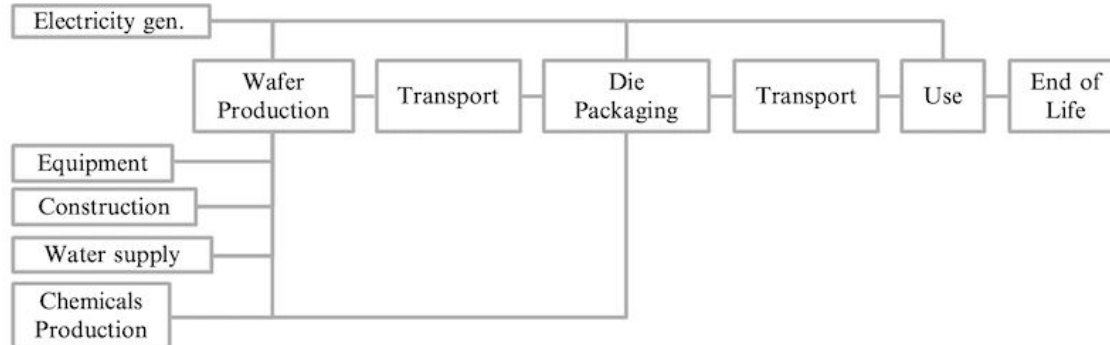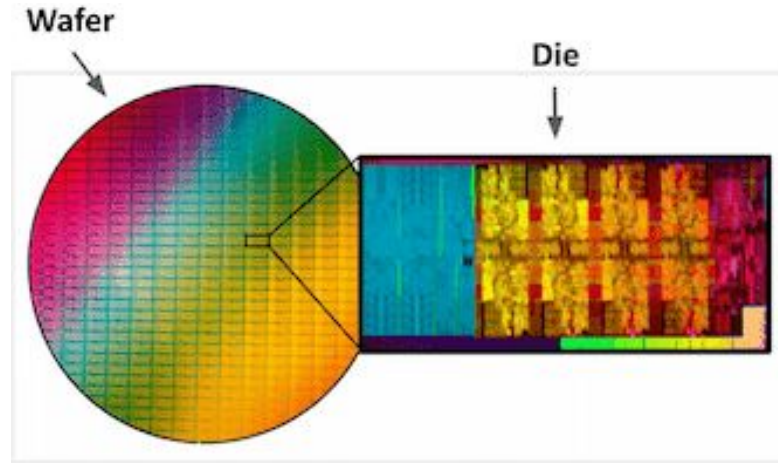

Electricity gen.

Wafer Production

Transport

Die Packaging

Transport

Use

End of Life

Equipment

Construction

Water supply

Chemicals Production

BoaviztAPI : api.boavizta.org/docs

```json
{
  "core_units": 24,
  "name": "Intel core i7-9800x"
}
```

```json
"die_size_per_core": {
  "value": 0.289,
  "unit": "mm2",
  "status": "COMPLETED",
  "source": {
    "1": "https://en.wikichip.org/wiki/intel/mi
  }
},
"model_range": {
  "value": "core i7",
  "unit": "none",
  "status": "COMPLETED",
  "source": null
},
```

```json
{
  "gwp": {
    "manufacture": 23.8,
    "use": 1200,
    "unit": "kgCO2eq"
  },
  "pe": {
    "manufacture": 353,
    "use": 40770,
    "unit": "MJ"
  },
  "adp": {
    "manufacture": 0.02,
    "use": 0.000203,
    "unit": "kgSbeq"
  }
}
```

Congratulations! You have the least bad evaluation
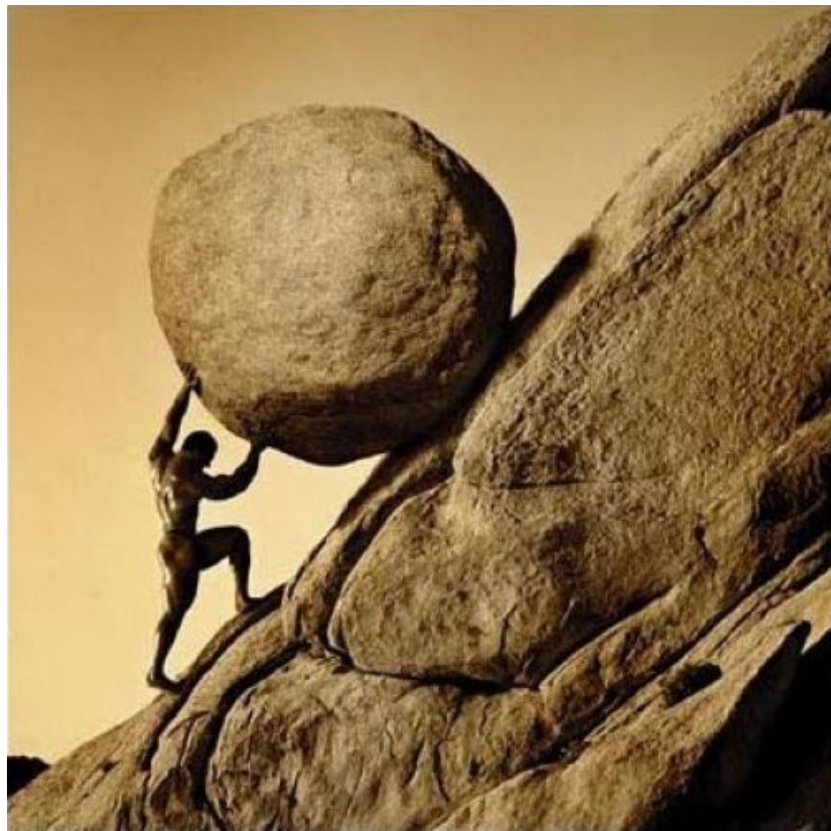
In the meantime

1. Refuse
2. Reduce
3. Reuse
4. Recycle
5. Return