QARNOT

more IT, less energy, less carbon

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The context

IT infrastructure resource consumption is going exponential.
It's urgent to find a paradigm shift!

The IT infrastructure industry is already talking of:

- 20% of the world's electricity consumption by 2030
- metaverse needs for a thousand times more computing power
- the devastating impacts of cryptos on the electricity grids

Current model is already out of breath and can't sustain its ambitions:

- **PUE** (Power Usage Effectiveness) has stalled at 1.57, implying 36% of the electricity is still used for cooling purpose
- **WUE** (Water Usage Effectiveness) of 1 liter per kWh hides billions gallons of water behind a lot of low PUE data centers
- **ERE** (Energy Reuse Effectiveness) values the reuse of waste heat generated by the IT and is probably the most promising strategy
- Facing the dead end of PUE/WUE, the industry focuses on compensation or renewable energy purchases, a limited strategy

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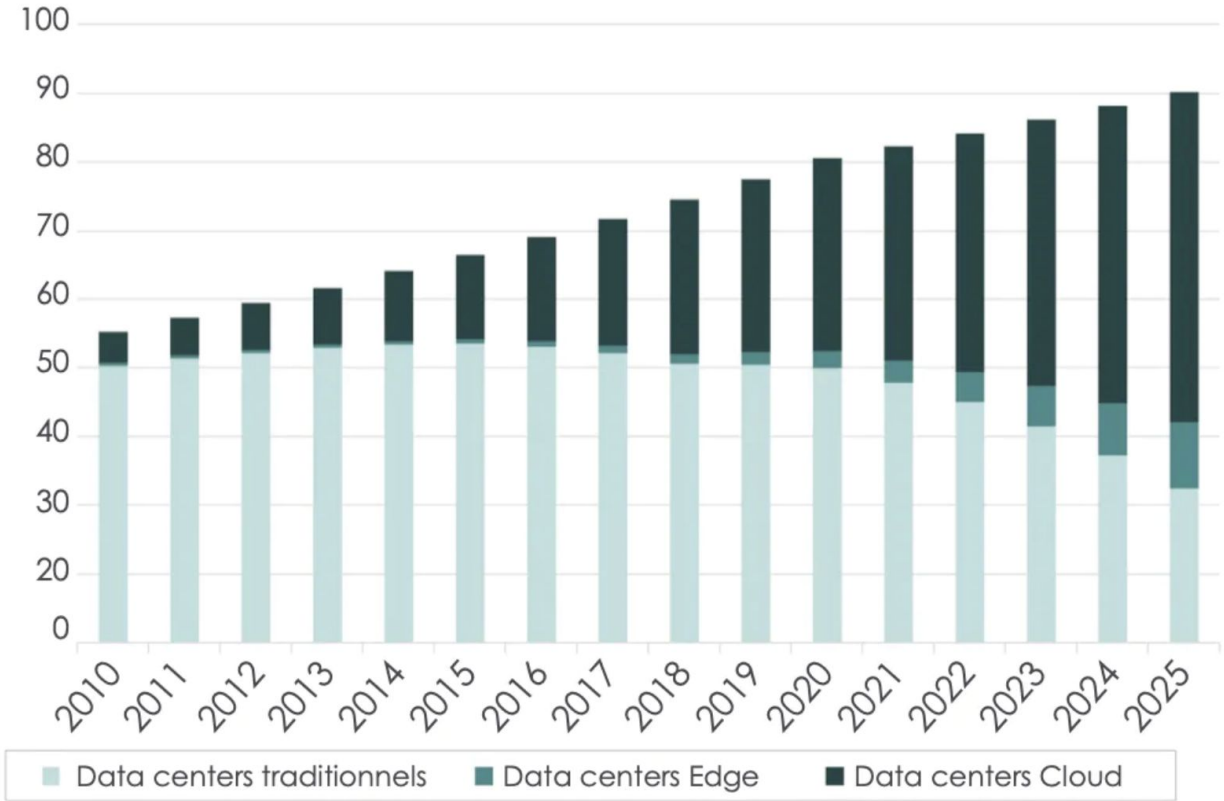

Source : Borderstep Institute

Évolution annuelle de la consommation énergétique des data centers dans l'Union Européenne (projection entre 2019 et 2025)[5] [TWh/an]

Selon le scénario central de l'étude, **les effets négatifs pourraient l'emporter :** les émissions de gaz à effet de serre des centres informatiques passeraient ainsi de 2,1 millions de tCO2eq en 2019 à 2,2 millions de tonnes en 2025, et enfin 3,9 millions de tCO2eq en 2040, soit une **hausse de 86 %, plus importante que celle de l'empreinte carbone du numérique (+ 60 %) sur la même période** . La mission d'information note néanmoins que le scénario bas, le plus optimiste, de l'étude fait apparaître une baisse nette importante des émissions des *data centers* , de près de - 50 % d'ici 2040. Selon les auteurs de l'étude, ce scénario est cependant « *peu plausible* » car il s'appuie sur une conjonction de trois hypothèses très favorables (la baisse rapide et forte de l'intensité carbone de l'électricité en France ; des gains d'efficacité énergétique qui ralentissent peu ; une hausse de la demande plus faible qu'anticipé). **L'hypothèse d'une hausse de l'empreinte carbone des *data centers* semble donc très probable** .

Pour atténuer ces impacts, des efforts sont à réaliser en amont, afin de développer des usages numériques plus vertueux et plus sobres (voir *III*). En outre, **au regard de la faible carbonation de l'électricité française, les politiques mises en oeuvre pour faciliter l'implantation sur le territoire national de centres informatiques doivent être poursuivies** . En particulier, la loi de finances pour 2019 [75] (*) a instauré un tarif réduit de taxe intérieure de consommation finale d'électricité (TICFE) de 12 euros par MWh, contre 22,5 euros pour le tarif de base, pour les consommations des centres informatiques français supérieures à 1 GWh par an lorsque ces consommations sont égales ou supérieures à 1 KWh par euro de valeur ajoutée [76] (*).

L'octroi de cet avantage fiscal pourrait être **conditionné à des critères de performance énergétique,** en fixant un niveau minimal d'efficacité énergétique. Pour stimuler l'installation de *data centers* performants sur le territoire français, **le soutien pourrait également être renforcé pour les centres les moins consommateurs.**

Proposition n° 21 : Favoriser l'installation de *data centers* en France en renforçant l'avantage fiscal existant et en le conditionnant à des critères de performance environnementale.

Our value proposition

Server cooling below 80°C, water heating above 60°C?
We do both at the same time!

A data center cooling system
Google, Oregon, 103 MW

District heating plant facility
Sweden, 30 MW

Our solution

The QBx: our patented technology recycles 95% of energy consumed by IT into hot water @ 65°C

The most energy efficient design for IT infrastructure:

- Designed to embed 12 state-of-the-art **OCP servers**
- Highly scores in all IT expectations & standards:
  - **Data protection** (physical & TPM protection)
  - **High density** (over 6kW/m2)
  - **Silence** (no acoustic constraints)
  - **Modular design** (for scalability & urbanization)
  - **Fire protection** & security (contained & sealed casing)
  - **Maintenance** & ergonomy (for technicians)

With the QBx, Qarnot provides a radical value proposition:

- **PUE = 1.00** (no cooling)
- **WUE = 0.00** (no water consumption)
- **ERE = 0.05** (95% of heat reused)




Client case

SGCIB reduces its I.T. costs by 50% and its carbon footprint by 80% by running servers in a Finnish heating network

Finance

Pascale Moreau
COO, Global Markets

SOCIETE GENERALE

"It's all about recycling the waste heat that is produced by data centers and transforming it into a resource for others. Our latest collaboration was in Finland."

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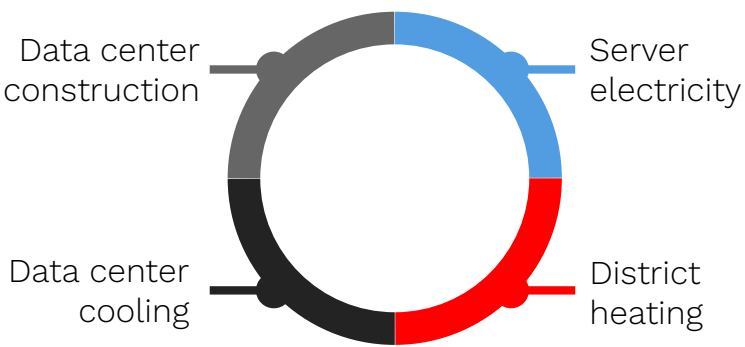
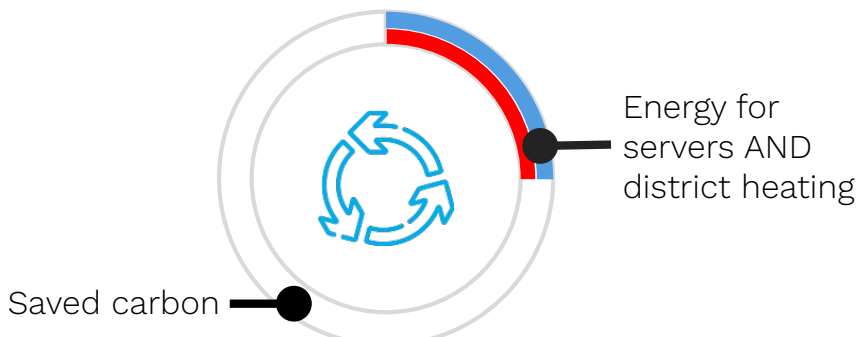
The benefits

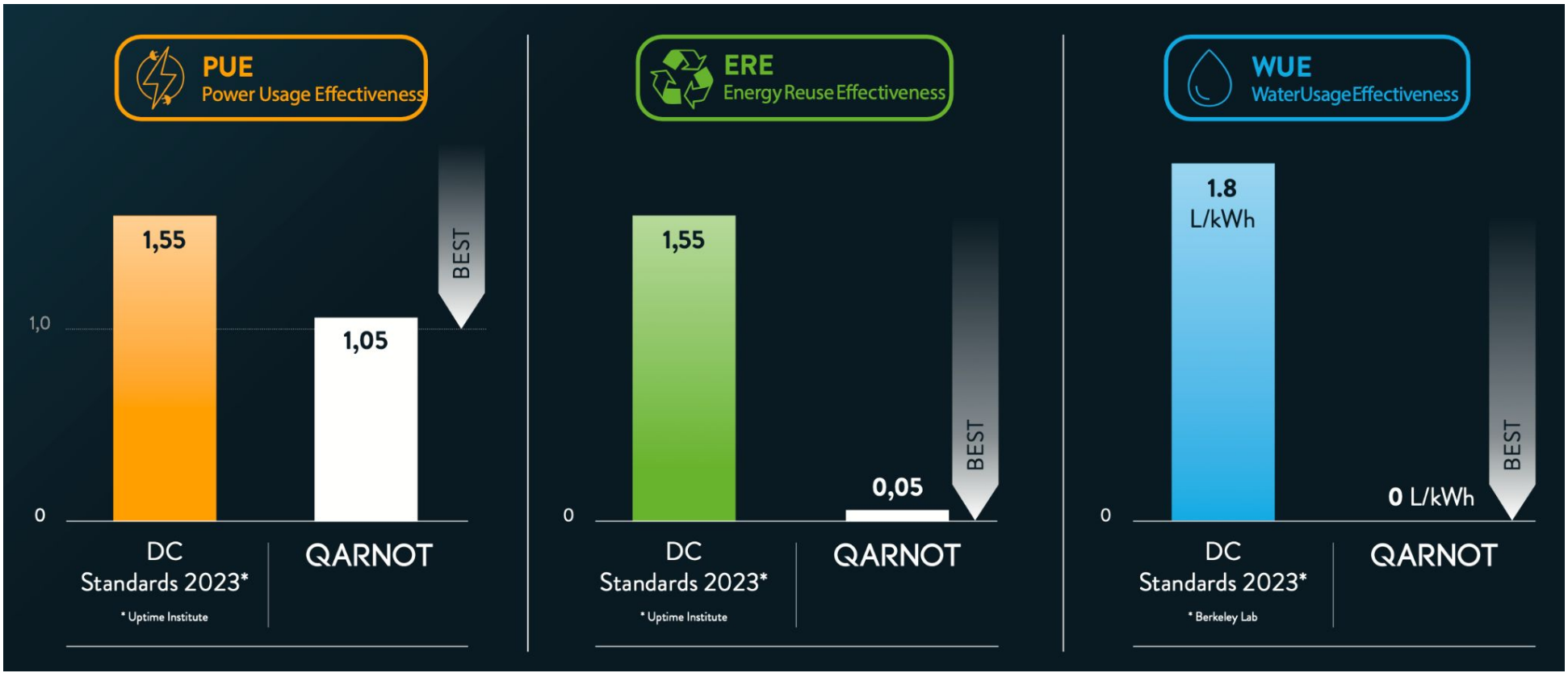
A radical approach to shrink carbon footprint way beyond data center optimizations

Traditional model



Qarnot model




PUE
Power Usage Effectiveness
1,55
1,05
BEST
1,0
0
DC
Standards 2023*
* Uptime Institute
QARNOT
ERE
Energy Reuse Effectiveness
1,55
0,05
BEST
0
DC
Standards 2023*
* Uptime Institute
QARNOT
WUE
WaterUsageEffectiveness
1.8
L/kWh
0 L/kWh
BEST
0
DC
Standards 2023*
* Berkeley Lab
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Testimonies

+12 success stories in 3+ countries

Finance

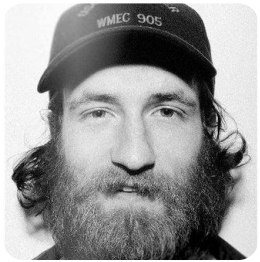
Charles-Emmanuel Musy

Head of IT, Global Markets

"Our benchmarks showed **an impressive service** quality compared to global large cloud providers, along with **an excellent price ratio** and even **better carbon footprint**!"

NATIXIS

3D animation



Philippe Llerena

CTO, Arcane co-prod (#1 Netflix 2022)

"**Lower carbon footprint**, **the platform** and their **team reactivity** are the reasons we work with Qarnot"

FORTICHE

3D animation

Jacques Bled

ILM co-founder, Minions producers

"The lower carbon footprint enabled by their model makes their **offer unique on the market** and definitely a reason to sustainably render our movie with Qarnot"

ILLUMINATION

Research

Jean-Frédéric Gerbeau

Deputy Chief Scientific Officer

"Qarnot is very interesting as it widens and increases the **carbon footprint impact**."

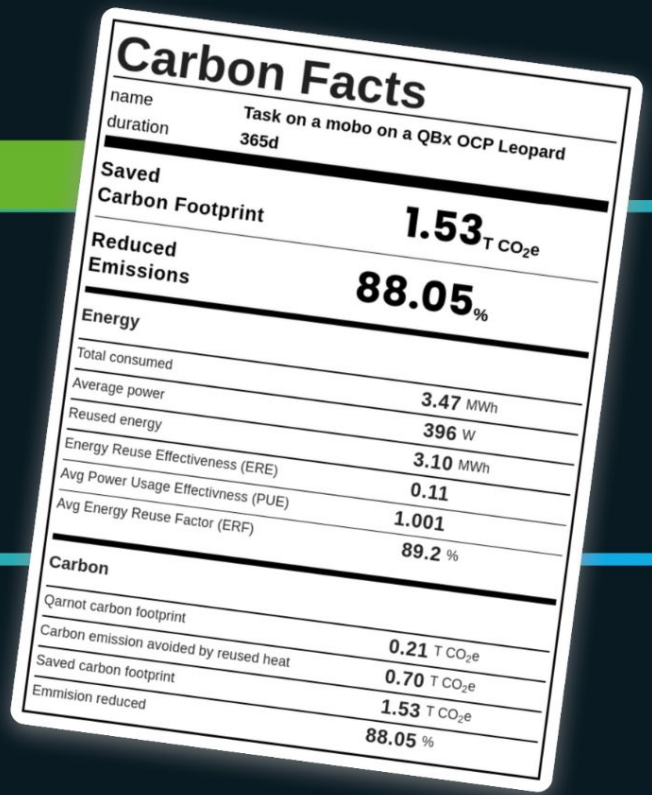
Inria

DES PERFORMANCES ENVIRONNEMENTALES INÉGALÉES

Pilotez votre consommation énergétique avec les Carbon Facts

Qarnot génère un rapport détaillé des postes de dépenses et d'économies d'énergie et de carbone pour chacune de vos tâches de calculs.
Cela vous permet :

- de **piloter en temps réel** la consommation énergétique de vos calculs
- d'intégrer facilement vos résultats à vos bilans
  (GES, Bilan Carbone, subventions CNC ou européennes, etc.)



Carbon Facts

name	Task on a mobo on a QBx OCP Leopard
duration	365d
Saved Carbon Footprint	**1.53** T CO_2e
Reduced Emissions	**88.05** %
Energy	
Total consumed	3.47 MWh
Average power	396 W
Reused energy	3.10 MWh
Energy Reuse Effectiveness (ERE)	0.11
Avg Power Usage Effectivness (PUE)	1.001
Avg Energy Reuse Factor (ERF)	89.2 %
Carbon	
Qarnot carbon footprint	0.21 T CO_2e
Carbon emission avoided by reused heat	0.70 T CO_2e
Saved carbon footprint	1.53 T CO_2e
Emmision reduced	88.05 %

In a nutshell

we aim at becoming the leader of next generation data centers and cloud services by leveraging the best low carbon IT infrastructure solution

Qarnot ENABLES:

- sustainable & sovereign infrastructure
- at scale in EU

Qarnot TRANSFORMS:

● problem	⇨	opportunity
● energy consumer	⇨	energy producer
● cost	⇨	revenue

La FRENCH TECH DEEPNUM20

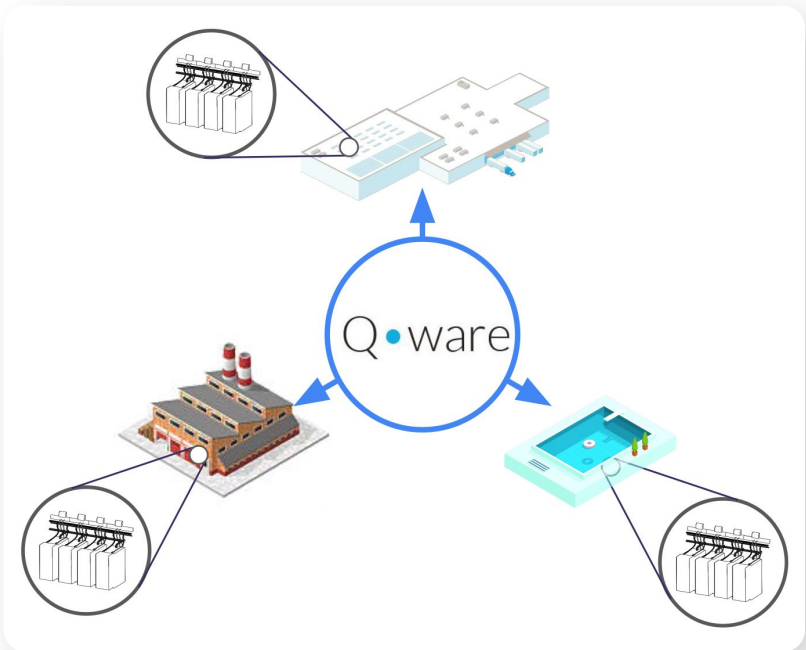
EIC Accelerator

QARNOT

More I.T.
Less Carbon
Appendixes

Our platform

The Qware: our proprietary software platform optimally drives IT infrastructure under energy constraints



Thanks to the Q.ware, our clients can access the IT infrastructure at different levels of service:

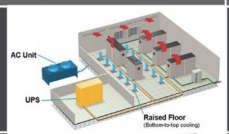
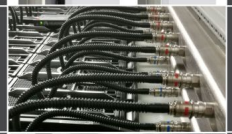
- direct access to QBx servers
- a generic IaaS level
- HPC optimised PaaS or SaaS

It provides:

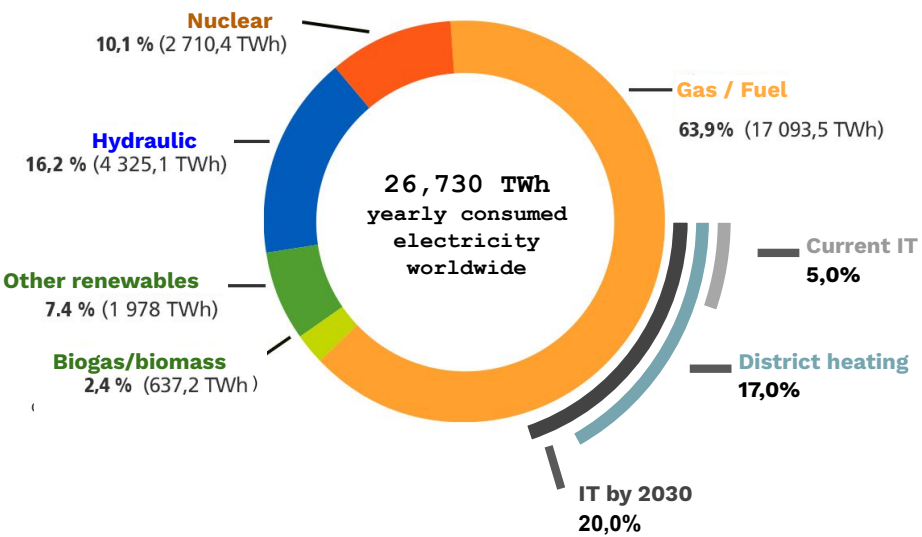
- fine grained energy and carbon load balancing
- automatic control of IT capacity depending on electricity availability and heat demand
- detailed metrics about energy & carbon footprint

Appendix

Qarnot's solution outperforms all other options used by data centers to efficiently cool their IT infrastructure

COOLING SYSTEM		COOLANT	PROS	CONS
COMPUTER ROOM AC (CRAC)			State-of-art	Low efficiency (PUE) Low density
INDIRECT LIQUID COOLING (ILC)			High density	Costs Weight
DIRECT LIQUID COOLING (DLC)			High density Efficiency	Very expensive Maintenance Fragile
TOTAL LIQUID COOLING (TLC)			Silence Efficient	Weight Heat capacity (Fire) Pollution (mineral oil) Maintenance
DIRECT WATER COOLING (DWC)			High density Modularity Cost effective Sustainability Fire protection Maintenance Silence	

Orders of magnitudes worldwide



Nuclear plants
Total power: 400 GW / 2,710 TWh
Typical reactor: 0.9 to 1.3 GW
# of reactor worldwide: 453
Top 5: US(62), FR(56), CN(50), JP(42), RU(37)

Hyperscaler data centers
Typical power: 100 to 500 MW
# of hyperscaler DC worldwide: 600
e.g. Citadel Campus, US (650 MW), Sines4, PT(450 MW)

Wind farms
Total power: 650 GW
Total production: 1,390 TWh
Intermittence: wind load factor 24%

District heating networks
Total power: 4,450 TWh
40% for industry, 60% for buildings
90% fossil: coal (45%), gas (40%), oil (5%)

Processors
Total power: 20 GW (est.)
Typical power: 120 to 400 W
Typical # cores: 8 to 64
Number of cores sold yearly: ~ 2B
AMD + Intel revenues: $100B

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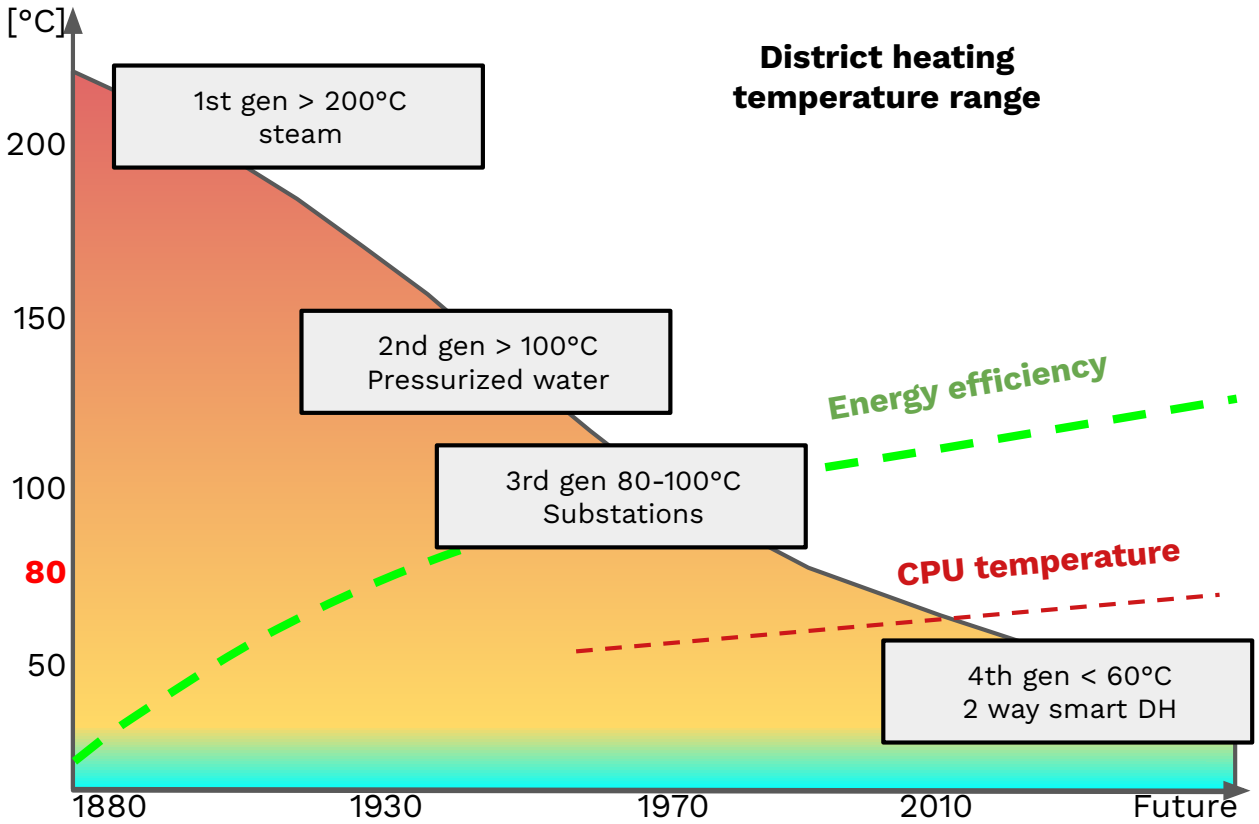
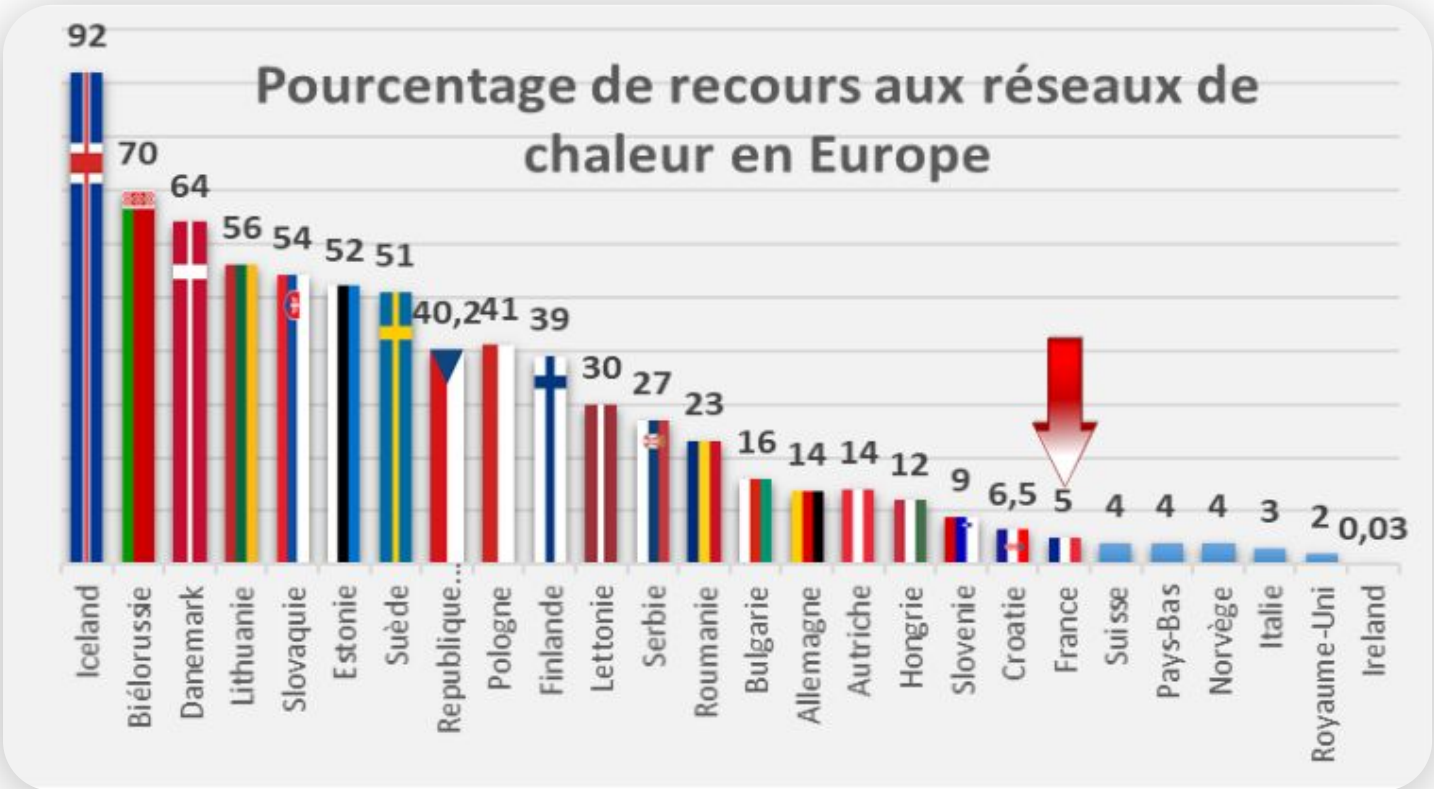
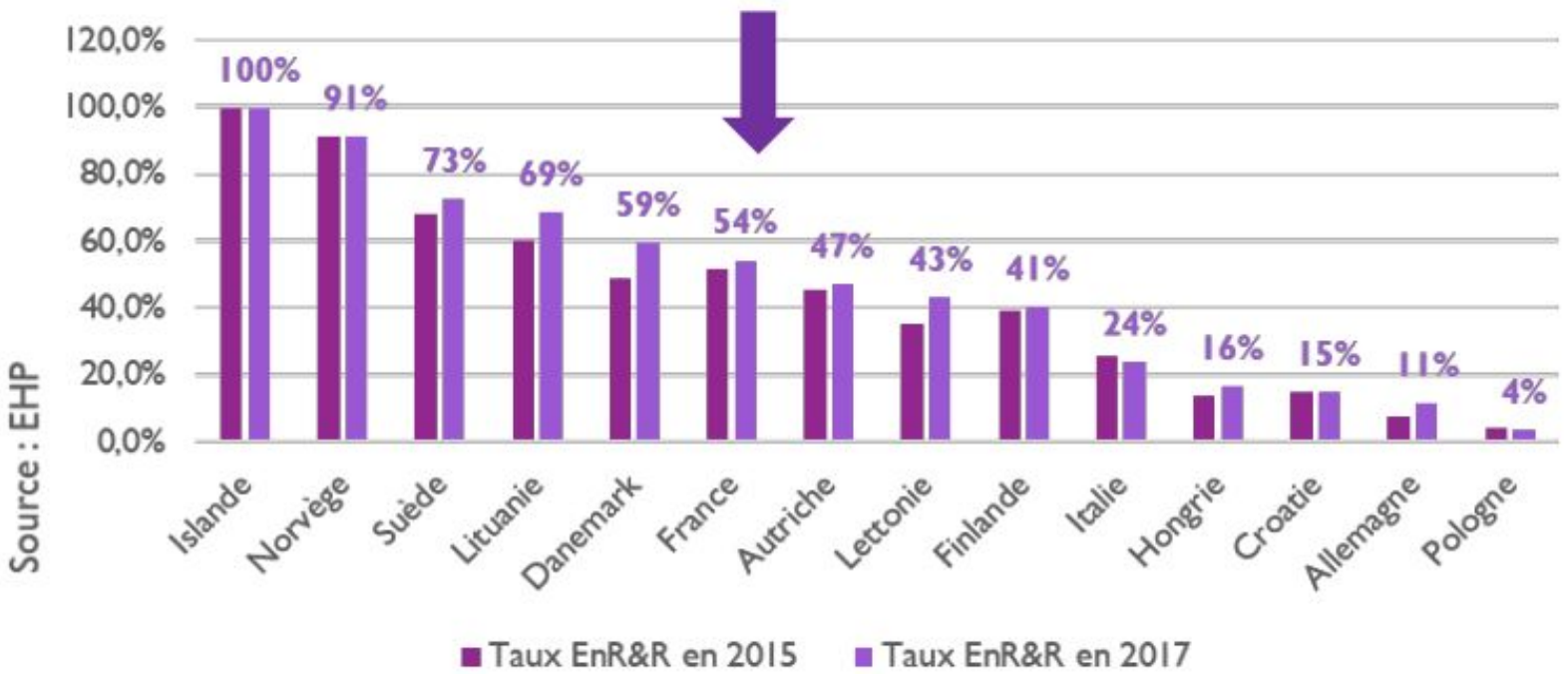
Heat networks



Heat networks in France vs Europe



Heat networks in France vs Europe



Heat networks in France

➔ LEUR DEVELOPPEMENT DOIT ACCELERER RAPIDEMENT POUR ATTEINDRE LES OBJECTIFS